Simulator sickness in non-VR video games

Exploring the visual triggers, players' mitigating strategies, and accessibility solutions

By: Karen Farag & Lina Alm

Supervisor: Sergej Kuzmin

Södertörn university | School of Natural Sciences, Technology and environmental studies

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Simulatorsjuka i icke-VR-videospel

Utforskande av visuella triggers, spelares hanteringsstrategier och tillgänglighetslösningar

Abstract

Simulator sickness affects some players of non-VR video games, causing symptoms similar to motion sickness. This study investigates the primary visual triggers of simulator sickness in non-VR video games and explores the coping strategies players use to mitigate its effects by interviewing 15 participants who have exhibited symptoms of simulator sickness prior to recruitment for the study. Through qualitative research methods, including in-depth interviews and questionnaires, we identify several key factors contributing to simulator sickness. The study findings suggest that while some players adapt by modifying game settings or taking breaks, many remain unaware of potential mitigation techniques. The study also highlights the need for improved accessibility options in game design. By addressing these factors, game developers may create more inclusive gaming experiences for players susceptible to simulator sickness.

Keywords:
Simulator sickness, non-VR gaming, coping strategies, game settings, gaming accessibility, visual effects, camera movement

Abstrakt

Simulatorsjuka påverkar flera spelare i icke-VR-dataspel och orsakar symtom liknande åksjuka. Denna studie ämnar undersöka de främsta visuella orsakerna till simulatorsjuka i icke-VR-dataspel, samt att utforska de strategier spelare använder för att hantera dess effekter genom att intervjua 15 deltagare som uppvisat symptom av simulatorsjuka innan rekrytering till studien. Genom kvalitativa forskningsmetoder, inklusive djupgående intervjuer och onlineformulär identifierar vi flera nyckelfaktorer som bidrar till simulatorsjuka. Studiens resultat tyder på att medan vissa spelare anpassar sig genom att justera spelinställningar eller ta pauser, förblir många omedvetna om möjliga åtgärdsstrategier. Dessutom belyser studien behovet av förbättrade tillgänglighetsalternativ i speldesign. Genom att potentiellt ta hänsyn till dessa faktorer i framtiden kan spelutvecklare skapa mer inkluderande spelupplevelser för spelare som är känsliga för simulatorsjuka.

Nyckelord:
Simulatorsjuka, icke-VR-spel, hanteringsstrategier, spelinställningar, tillgänglighet i videospel, visuella effekter, kamerarörelser

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1. Introduction

Gamers might expect to be able to play the video games they buy without concerns about long-term accessibility, and why shouldn't they? As long as their gaming system meets the requirements of the game and no bugs during playing occur everything is fine, no? Not so much for the unfortunate players that get their gaming disrupted by *simulator sickness*, experiencing symptoms of motion sickness without actually moving. This is a phenomenon that has been described as early as the late fifties (Zaychik and Cardullo 2003, 1) when researchers of the US air force first coined the term. Since, it has also been referred to as *VIMS* (video-induced motion sickness), gaming sickness, cyber sickness, VR (*virtual reality*) sickness and other less common names. For the purposes of this paper we will primarily be using simulator sickness.

The phenomenon of simulator sickness is well-known in *HMD-VR*-based (head mounted display virtual reality) video games where between 40-70% of players (Kerner and Brush 2023) begin experiencing some form of symptom within fifteen minutes of playtime. It might therefore come as a surprise that simulator sickness is also prevalent in non-VR video games where studies of non-VR video games have shown that over a longer period, up to 50 minutes, some 67% of adults and 56% of children report some form of symptoms of motion sickness when playing (Chang et al. 2012). Despite these numbers, simulator sickness in non-VR video games is thought to be rare by the general gaming community, which indicates to us that the phenomenon is rarely discussed.

Prior studies, that are covered more thoroughly in the related research section, have explored gaming simulator sickness from broader or different angles, such as through a quantitative approach focused on symptoms and coping strategies (Chen et al. 2024), VR-specific environments and hardware-induced discomfort (Merhi et al. 2007; Christensen et al. 2018), or perceptual sensitivity to motion illusions (Pöhlmann et al. 2022). Others have examined the physiological effects of game-induced motion through postural activity and eye movement (Chang et al. 2012; Stoffregen et al. 2008; Wibirama et al. 2020).

This study distinguishes itself from previous research by focusing specifically on visual triggers of simulator sickness, specifically in non-VR video games, as the primary factor under investigation. We are using qualitative insights gathered through semi-structured in-depth interviews and questionnaires with previously affected players, and thematic

analysis to analyse our data. In addition, we are not limiting our study to a specific game genre, allowing for a broader understanding of how visual elements across various gaming contexts contribute to simulator sickness. By narrowing the focus to visual elements and exploring how individuals recognize, cope with, and mitigate sickness in everyday gaming experiences we also aim to identify common visual triggers and players' strategies to manage their symptoms. We hope that these insights will encourage developers to consider more customizable and inclusive visual settings during the game development process and inspire more accessible game design.

2. Purpose and Research Question

The object of this study is to explore what some of the most common visual causes of simulator sickness in non-VR video games are, and find the ways in which players handle or attempt to mitigate them. Our reason for this study is to help improve accessibility in video game design for players susceptible to simulator sickness. By offering developers further information of what visual causes triggers symptoms, we hope that more expansive settings will be considered and implemented during the development cycle of game design.

To be able to offer some suggestions of what settings, visual effects, and camera movements are useful and relevant to be able to affect from an accessibility standpoint to alleviate or outright remove the onset of symptoms of simulator sickness we are focusing on answering these questions:

- *What visual factors do players find contributes most to simulation sickness in non-VR video games?*
- *What mitigation strategies do players employ to deal with the onset of simulator sickness?*

3. Related research

3.1. Simulator sickness

Simulator sickness, also known as gaming sickness or video-induced motion sickness (VIMS), refers to a set of uncomfortable physical symptoms experienced by some individuals while playing digital games, even in non-virtual reality (non-VR) settings (Chen, Burtscher, and Gerling 2024, 582). Simulator sickness is a well-documented and discussed phenomenon in VR-based video games (Kerner and Brush, 2023). In contrast, although some studies have addressed motion sickness in non-VR video games such as Chang et al. (2012), this area remains significantly less explored compared to the extensive research available on VR. Christensen et al. (2018, 1) describe simulator sickness as a response to specific types of motion stimuli present in digital environments, while Pöhlmann et al. (2022, 3-4) explains that unlike physical movement, these stimuli can create a "motion illusion" tricking the brain into perceiving motion even though the body remains still. Importantly, the experience of simulator sickness can differ widely from one individual to another (Chen, Burtscher, and Gerling 2024, 583). (For a visual representation of the related literatures, see appendix figures 1 and 2.)

3.2. Symptoms of simulator sickness

Players experiencing simulator sickness from non-VR, console-based, video games often report a range of uncomfortable symptoms (Christensen et al. 2018, 1). Many researchers, including Merhi et al. (2007, 920), Wibirama et al. (2020, 1), and Christensen et al. (2018, 2), have noted common symptoms, such as nausea, dizziness, eye strain, and disorientation, which are similar to those experienced in traditional simulator sickness. When these symptoms arise, they lead to sensations of discomfort (Pöhlmann et al. 2022, 6) and the intensity, duration, and type of symptoms can vary greatly between players. Chen, Burtscher, and Gerling (2024, 583) explain that some players may feel only mild discomfort, while others experience more intense and prolonged effects, such as persistent headaches, severe nausea, or pronounced disorientation.

3.3. Causes of simulator sickness

Simulator sickness in non-VR video games is likely caused by several factors that disrupt the body's sensory expectations. One suggested central cause is *sensory conflict* (Wibirama et al. 2020, 2; Chang et al. 2012), which occurs when there's a mismatch between what the eyes see and what the body feels. Stoffregen et al. (2008, 323) explain that in non-VR games, rapid in-game movement or intense visual stimuli create the illusion of motion, while the player remains physically still. This discrepancy between visual and physical cues confuses the brain's sensory systems, ultimately triggering symptoms of simulator sickness such as nausea and dizziness (Wibirama et al. 2020, 2; Himmels et al. 2022, 151).

Another suggested explanation, known as the *Postural Instability Theory* (Chang et al. 2012), emphasizes the role of balance in simulator sickness. According to this theory, simulator sickness occurs when a person experiences prolonged difficulty in maintaining a steady posture, even before symptoms appear (Merhi et al. 2007, 921). Chang et al. (2012) and Dong and Stoffregen (2010, 1340) demonstrate that when the players have many subtle changes in how the head, torso, or balance shifts, this can signal that sickness is likely to develop. The longer players feel unsteady, the more likely they are to experience nausea or dizziness, which will make their discomfort worse (Merhi et al. 2007, 932). This issue is particularly relevant in gaming scenarios where analog sticks or quick in-game movements further disrupt postural stability, heightening the risk of sickness (Christensen et al. 2018, 2).

Vection (Pöhlmann et al. 2022, 4), the sensation of movement when a player is actually stationary, also likely plays a significant role in simulator sickness. It occurs due to visual cues that create a strong illusion of motion, often experienced in games with fast-moving visuals, such as racing games or first-person shooters (Wibirama et al. 2020, 2; Pöhlmann et al. 2022, 4). Wibirama et al. (2020, 2) emphasize that this sensation can confuse the player's sensory systems, intensifying the likelihood of sickness symptoms as the brain struggles to reconcile the illusion of motion with physical stillness.

Technical factors and in-game design further contribute to simulator sickness, as visual and gameplay elements influence how players perceive motion (Himmels et al. 2022). According to Himmels et al. (2022, 150), factors like the field of view, movement speed, and specific

camera angles, such as high visual angles (Chang et al. 2012), have been found to increase discomfort. Himmels et al. (2022, 151) also suggests that games with wider fields of view or faster movement speeds often create stronger motion illusions, amplifying the risk of simulator sickness. Additionally, environmental factors such as display settings, lighting, and room temperature can interact with these design features to influence susceptibility (Chen, Burtscher, and Gerling, 2024, 583).

Individual differences also play a critical role in determining how some players are more vulnerable to simulator sickness than others (Chang et al. 2013). Factors such as age, gender, and gaming experience shape how players respond to intense visual stimuli (Himmels et al. 2022, 149; Chang et al. 2013), with some individuals being more likely to experience symptoms than others. Chang et al. (2012) also found that sometimes girls report higher rates of simulator sickness compared to boys, suggesting potential gender-related differences in sensitivity.

Wibirama et al. (2020, 1) discuss how the use of *Stereo 3D technology*, which creates the perception of depth in games, can further increase the risk of simulator sickness. They (2020, 1-2) argue that while this technology is designed to enhance immersion by improving the sense of presence compared to 2D visuals, enabling users to learn 3D environments faster and understand complex scenes more effectively, it often leads to physical discomfort as the brain struggles to process the three-dimensional imagery. They (2020, 10) also explain that in fast-paced games, like first-person shooters, stereo 3D technology requires rapid eye movements to track the action. This can intensify sensory conflicts, making simulator sickness more likely.

3.4. Predicting simulator sickness in players

Merhi et al. (2007, 933) show that watching how players move during gameplay can help identify those who might be more likely to get simulator sickness. Dong and Stoffregen (2010, 1341) meanwhile emphasize that the key sign is how variable their movements are, rather than how big the movements are. They explain that players with more erratic or inconsistent motion patterns, including shifts in head and torso movement (body sway), often struggle to adapt to the game and are more likely to feel sick. Similarly, Chang et al. (2013)

suggest that simulator sickness may occur when the body struggles to adapt to the game environment. Predictable and repetitive movement patterns often indicate this difficulty, serving as an early warning sign of potential sickness.

3.5. Mitigation and coping strategies for simulator sickness

To help players prevent or adapt to simulator sickness in non-VR games, several strategies have been identified. Merhi et al. (2007, 933) suggests that when recognizing early signs of discomfort, such as increased postural instability or specific movement patterns, players should take timely preventive actions, like pausing gameplay, taking breaks, or stopping entirely if symptoms worsen.

According to Pöhlmann et al. (2022, 6), improving focus and attention can help players handle motion effects more comfortably. They explain that the gradual practice or exposure to visually complex games might make it easier for the players to adjust and reduce discomfort over time. Himmels et al. (2202, 151) emphasize this theory, as they found that experienced gamers, for instance, are less likely to experience simulator sickness compared to non-gamers, likely because they are more accustomed to processing the visual and sensory cues of virtual environments.

Many researchers like Chen, Burtscher, and Gerling (2024), Himmels et al. (2022) and Chang et al. (2012) emphasize that game settings and design adjustments play a crucial role in mitigating sickness as well. Chen, Burtscher, and Gerling (2024, 584-585) explain that players can reduce discomfort by adjusting field of view settings, minimizing motion blur, or slowing down camera movements. They even suggest that developers can support this further by designing games with customizable visual settings and features like pause functionality and flexible save points, allowing players to exit the game without penalty, particularly in multiplayer scenarios. Meanwhile, Himmels et al. (2022, 151) and Wibirama et al. (2020, 9) suggest that reducing optic flow (the illusion of rapid visual motion) by simplifying scenes or enabling players to adjust the game's visual complexity can also help improve comfort.

There are also environmental factors and external stimuli that can provide additional relief. Chen, Burtscher, and Gerling (2024, 584) suggests that simple measures like ensuring good ventilation, taking fresh air breaks, or adjusting the gaming environment’s lighting and temperature may help mitigate the symptoms.

Guo et al. (2013, 52) and Wibirama et al. (2020, 11) encourage players to manage their eye fixation points by focusing on stable and central areas of the screen, especially in fast-paced games. This can help reduce eye strain and decrease the chances of sensory confusion. Meanwhile, Wibirama et al. (2020, 2), Dong and Stoffregen (2010, 1342) and Chang et al. (2013) found that when players highly engage and feel in control within the game, this significantly influences simulator sickness. They explain that a sense of active control, such as being able to direct movements or interact meaningfully with the environment, can sometimes reduce discomfort by increasing the player's sense of agency.

4. Method

For our method we have opted to use in-depth interviews (Lankoski and Bjork 2015, 93-94) with an additional, complimentary, questionnaire, to reach out to more people and get information from people who didn't want to participate in interviews but were willing to help in some other way, to gain as much data as possible. Thematic analysis (Lankoski and Bjork 2015, 123) was our tool of choice as we analyse and examine our data to reveal what may be the possible causes of simulator sickness in our participants, what steps they have taken to mitigate the onset of simulator sickness by changing the settings of the games, what their environment looked like and if there was a relation between that and the onset of symptoms of simulator sickness, and what changes simulator sickness have caused in their gaming habits. Due to the private nature, such as asking about if the participant has experienced symptoms of simulator sickness outside of gaming, gaming habits and changes in behaviour we believe that our choice of in-depth interviews as our primary choice of data collection would be helpful in maintaining our participants' comfort and allow for their open and honest responses (Lankoski and Bjork 2015, 96).

4.1 Data collection

4.1.1. Recruitment

Due to the fact that the topic of our research deals with people experiencing symptoms of illness we had to take this into account when recruiting participants. As such we used a targeted sampling strategy (Lankoski and Bjork 2015, 99) to recruit participants who have at one or more times experienced simulator sickness through online forums such as the Södertörn university study portal (Instructure 2025), Facebook (Meta Platforms, Inc. 2025), Reddit (Reddit, Inc. 2025), Quora (Quora, Inc. 2025), and Discord (Discord, Inc. 2025). This let us reach as large a pool of potential participants as possible. This means that while our participants met this first criterion, any other commonalities between their habits, gender, age and gaming experience were not explicitly sought out during the recruitment process.

Eight vocal interviews were performed. The questionnaire also received eight responses, one of which were discarded due to not being filled out in full. In total of fifteen responses were gathered (see appendix figure 3 for participants list).

4.1.2. Data security

Informed consent was sought before any data was shared, and participants were asked not to share any data that might identify them in both the interview and questionnaire. Any incidental data was anonymised as soon as feasible. While names were shared with the researchers during the vocal interviews, they were not recorded and the files associated with the participants had their names anonymised as well. Any gathered data has been stored either locally on devices belonging to the researchers or on Google Drives (Google 2012) owned by them.

In accordance with GDPR principles (Swedish Authority for Privacy Protection 2021) we have sought to minimise any and all personal data gathered in relation to our research and have established a strict deadline as to when any data pertaining to or that includes personal data will be deleted. Relevant in this case: recordings containing the voices of our participants. This deadline is when this thesis receives a passing grade, but no later than July 1, 2025.

4.1.3. Interview protocol

We designed our interview protocol of 30-33 questions keeping in mind our choice of semi-structured interviews to allow for both guided exploration and flexibility in our aim to gather in-depth responses about our participants' experiences with simulator sickness. To do this we drew inspiration from Chen, Burtscher, and Gerling (2024, 583)’s interview protocol.

Our interview protocol begins with a paragraph welcoming the participant, thanking them for their participation, outlining the interview’s purpose and their role in the study. In addition, the participant is thoroughly informed about our data confidentiality and management, and their rights with regards to participation and their withdrawal of consent (Lankoski and Bjork 2015, 97 & 108). This was then followed by asking the participant for their explicit consent to participate. We then start the interview portion with a section to get to know the participant and establish base information about them.

These were followed by several parts of questions, the first section focusing on the participants experiences with simulator sickness during non-VR gaming, if they recall a specific game where this occurs and if so, what was happening on the screen/in the game at the time, and how long it takes for simulator sickness to set in. The second part covered what

the settings in use in the game were and what the environment around the participant was like at the time. The third section covers the participants' attempts at coping with the onset of simulator sickness and whether these coping strategies were successful or not, and the fourth and final section covers the participants' change in gaming habits due to simulator sickness, if any and whether they have any recommendations on how to mitigate the onset of simulator sickness.

At the end of the interview protocol, we had a rounding-off question prepared to provide participants the opportunity to share additional thoughts or insights that may not have been covered during the interview. (See appendix, text 1 for the full protocol.)

4.1.4. Data gathering - interviews

Our data gathering was conducted in several stages, starting with a series of pilot interviews - expected to last some 20 minutes - to test our interview protocol. When the initial set of three pilot interviews were completed, we analysed the answers and questions and found that the results were in line with our expectations of depth of information. Once we had established that our results were sufficiently rich in data, we proceeded to perform several more vocal interviews. These were conducted either online via Discord (2025) direct calls and recorded through OBS Studio (2012), Zoom (2013) or using the native recording app of one researcher's cell phone when conducting the interviews in person. The interviews were held in either Swedish or English based on the participants' preference.

In addition, following the initial set of pilot interviews and confirmation of data, we then went on to create an online questionnaire through Google Forms (Google 2008) based on our established interview protocol, suitably altered for the change in medium as detailed below.

4.1.5. Questionnaire protocol

The questions for the questionnaire protocol were derived from the interview protocol following three pilot interviews to establish that we were gathering a satisfactory amount of data. The questionnaire began with a starting page where the potential respondent receives the same information as in the vocal interview with regards to data confidentiality and management, their rights with regards to participation and their withdrawal of consent. In addition, the questionnaire did not require the participant to share their name or email to ensure anonymity.

To access the rest of the questionnaire the participant had to answer an obligatory question granting their informed consent to participate in the study. The questionnaire then followed the same system as the interview protocol. Section one focused on their experiences with simulator sickness during non-VR gaming. Section two on the settings in use at the time and the participants' gaming environment at the time. Section three the coping strategies for the onset of simulator sickness and whether said strategies were successful or not. The fourth and final section covers potential changes in the participant's gaming habits due to simulator sickness and if they have any recommendations on how to mitigate the onset of simulator sickness.

Like the interview protocol, participants were given the opportunity to share any additional thoughts or insights that might not have been asked about in the questionnaire in the prior sections. This form was then advertised on various online forums, like Reddit, and through Discord servers that we, the researchers, are members of.

4.2. Data analysis

The interviews were transcribed by using Maestra (2020) to do the bulk of the initial transcription before each interview was manually reviewed while the interview recordings was listened to at the same time, to ensure that the transcription was accurate to the audio files, and if not edits were made to ensure that such accuracy was reached and maintained. Once all data was properly transcribed it was further prepared for analysis. The questionnaire responses were inspected and found to be formatted in an easily analysed state and as such deemed ready.

Both sets of data then went through a first stage of analysis where a combined pre-existing idea of what themes would potentially be found, and an emergent set of general themes were developed (Creswell and Creswell 2018, 308–12). These overarching themes were then discussed by us and deemed to be related and relevant to our research. During the second phase of coding, the interview data was broken down further into more niched themes under the umbrellas of the more generalised ones, to be further presented in the results section (see appendix figure 4).

5. Results

These following sections present the key findings of our research on simulator sickness in non-VR video games. Our research results highlight:

1. The various triggers and contributing factors to simulator sickness
2. The impact of simulator sickness on players' gaming habits and behaviors
3. The strategies players use to mitigate their symptoms
4. Players' recommendations for creating more accessible and comfortable gaming experiences.

5.1. Simulator sickness triggers and causes in non-VR video games

Our research suggests that simulator sickness in non-VR video games can be caused by a mix of game design, how players interact with the game, and individual sensitivity (see figure 1). Several key factors contribute to this, including game settings, excessive movements on the screen, unstable camera controls, and certain game genres. Additionally, we have found that when the game does not respond as players expect, it can make symptoms worse. Apart from game design, physical factors such as sitting still for long periods, playing for too long, and being sensitive to visual effects also play a role, as reported by participants. The following sections discuss these triggers in more detail, based on what participants shared about their experiences.

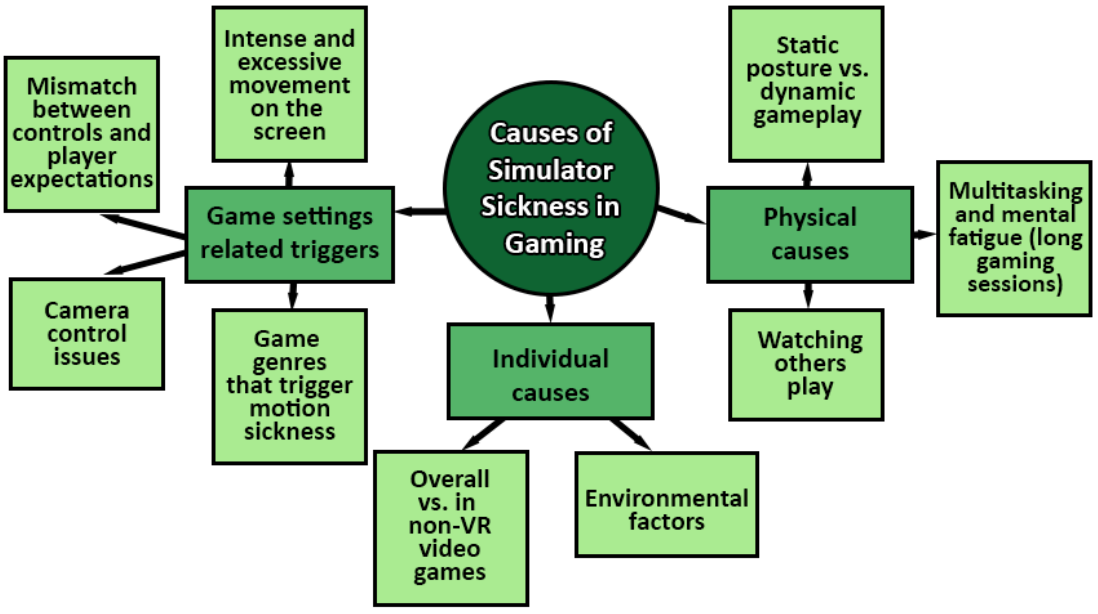

Figure 1: Theme map over the causes of simulator sickness in non-VR video games

5.1.1. Game settings-related triggers of simulator sickness

During our research we found that certain design choices and in-game settings, such as excessive movement, inconsistent camera controls, genre-specific triggers and mismatched player expectations, have been identified by participants as key contributors to simulator sickness in non-VR video games. Participants explained that these factors not only disrupt their sense of control and spatial orientation but also increase the likelihood of experiencing nausea and disorientation. The following sections explore the four primary game settings-related triggers found that were most frequently cited by participants.

5.1.1.1. Intense and excessive movement on screens

Based on the participants' responses, it becomes clear to us that the most frequently reported trigger for simulator sickness in non-VR video games is; intense and excessive movement on the screen, like rapid camera shifts, character swaying, and high-speed visual changes. Sudden or continuous camera movement was also frequently cited as a major cause of simulator sickness. P4 noted that developers often incorporate camera sways to match character movement, which they found to be unpleasant:

> When a model of a character moves and, like, sways, the camera should do that as well. I disagree that it was a good idea. (P4)

Similarly, P14 shared that *'wild camera movements out of my control while sitting closer to the TV'* triggered their motion sickness, particularly during fast-paced sequences such as combat in *God of War* (Santa Monica Studio 2005).

Several participants pointed out that games with high-speed gameplay and quick camera transitions exacerbate their symptoms. For instance, P1, P2 and P3 reported experiencing motion sickness when rapidly turning their point of view and exploring open-world environments. P2 explained *'When turning and looking around while running, that's when it happens.'* (own translation). Additionally, P2, P3 and P7 highlighted that games with slower camera movement, such as *Mario Kart 8* (Nintendo 2014), do not trigger their symptoms, unlike fast-paced games.

Many participants also reported that a high volume of visual stimuli, such as rapid flashes, environmental effects, and frequent screen transitions, contributed to their discomfort. They experienced significant discomfort due to fast camera shifts, rapid gameplay transitions, and visual overload.

These findings suggest that excessive camera and screen movement, whether voluntary (player-controlled) or involuntary (game-driven), is a primary factor contributing to motion sickness in non-VR video games.

5.1.1.2. Camera control issues

Many participants experienced discomfort due to inconsistencies and unexpected movements in camera control. P2 highlighted the challenges of third-person games where the camera is tied to the character, especially when the game rotates the camera independently. P14 also mentioned that the camera zoom during running caused simulator sickness, noting the disorienting effect of the dolly effect used to simulate speed. Furthermore, several participants pointed out that unreliable mouse movement in PC games, where on-screen movement does not precisely match the input, can lead to discomfort.

> Mouse movement tied to an unreliable frame rate causes overshooting and input latency, which makes it appear you're moving 'drunk' through the game. (P14)

In addition, P10 noted that frequent changes in camera angles and perspective can worsen their simulator sickness symptoms.

5.1.1.3. Game genres that trigger simulator sickness

Based on participant responses, certain genres consistently stood out as being highly likely to contain problematic triggers.

First-person games: A common theme among participants was the discomfort caused by first-person games, particularly in FPS games (*first-person shooters)*. P4 mentioned that first-person games usually trigger their simulator sickness, while P6 elaborated that the issue arises from trying to look through someone else's eyes:

> where you are trying to look through the eyes of someone else and they're running around of moving and a lot of jerking motions. Any game like that is going to cause that problem for me. (P6)

Third-person games: Interestingly in our data, third-person games also emerged as a significant cause of simulator sickness for some players, particularly when the camera is overly dynamic. P7 described that it adds to their mental stress when the game forces the player to believe that they are that body they are seeing on the screen.

> having a body move in front of you and that you have to believe that you're that body. It basically puts more like mental stress, stress. Plus, it adds another moving element to the game. (P7)

Our participants report that this feeling of being detached from the character's movements can lead to discomfort, especially when the screen does not stabilize. According to P16 third-person games with excessive camera movement, especially those that cannot be switched to first-person view, are a problem for them for this reason.

Driving and vehicle-based games: Another genre mentioned by participants that caused simulator sickness involved games where players control vehicles, such as cars, boats, or spacecraft. For instance, P12 noted that any game that involves driving a vehicle would trigger simulator sickness for them.

5.1.1.4. Mismatch between controls and player expectations

According to some participants, a factor that contributes to simulator sickness in video games is the mismatch between the player's expectations of controls and the actual in-game responses. Participants explained the situation by saying that when the input they make does not result in the anticipated movement or action, it creates a disconnect that can lead to discomfort and nausea. P2 expressed this issue clearly, stating:

> So if I am accustomed to some input that produces that specific movement, and if in-game something else happens that I'm not expecting, that could cause motion sickness. (P2)

This indicates that players grow used to and rely on consistency in how their inputs are translated into actions. When the game behaves unpredictably, such as moving the character in an unexpected direction or causing the camera to rotate unexpectedly, it disrupts the player's sense of control and orientation, which can lead to discomfort.

> Like if I'm moving forward and I expect to move forward, but then the game decides that I'm moving aside or something like that. (P2)

Participants also described how this mismatch becomes more noticeable the longer they play a game:

> It requires some time playing the game. So when I'm starting playing, I don't expect anything. So it doesn't work like that. But if I'm playing for longer, then I'm starting to expect certain inputs to produce that exact result. (P2)

This demonstrates that as players become familiar with the game, their expectations solidify. When these expectations are violated, it becomes annoying and can trigger simulator sickness.

5.1.2. Physiological factors contributing to simulator sickness

Based on our data, we have found that simulator sickness in non-VR video games is not solely triggered by visual stimuli but is also influenced by several physiological factors. Our findings suggest that the interplay between physical stillness, cognitive demands, and prolonged exposure to gameplay can significantly contribute to discomfort. The following sections explore these factors in detail.

5.1.2.1. Static posture vs. Dynamic gameplay

A key factor that we have found contributing to simulator sickness in non-VR video games, as highlighted by several participants, is the contrast between a player's static posture and the dynamic movement within the game. Unlike VR experiences, where players may physically move their heads and bodies in sync with in-game actions, non-VR games require players to remain seated and motionless while the content on the screen moves rapidly. Wibirama et al. (2020, 2) and Chang et al. (2012) suggests that this causes a disconnect between visual input and physical stillness which creates sensory conflicts, which many of our participants identified as a major trigger for their discomfort.

P4 explained that their simulator sickness is exacerbated by focusing intensely on the screen, leading to a form of tunnel vision, as they stated: *‘The only thing that my brain registers is the screen in front of me.’* (P4). They also described how remaining physically still while the game world moves creates a sensory mismatch

> When everything moves on the screen and I sit on my chair without moving, there becomes a little bit of dissonance between what I actually see and what my body experiences. (P4)

Interestingly, some participants reported that VR gaming alleviates their simulator sickness symptoms because it allows for synchronized movement between their bodies and the in-game environment.

> In VR, I was moving my body and head at the same time, so it felt more real. (P1)
> VR works very well because I'm moving with the camera. (P4)

This suggests that the ability to physically align with visual movement helps reduce the sensory conflict experienced in traditional gaming setups.

5.1.2.2. Watching others play

Another significant factor that emerged from our data is the experience of simulator sickness while watching others play non-VR video games. Many participants indicated that they experience similar or even heightened symptoms when observing gameplay, where they highlighted that visual factors such as screen movement, graphics speed, and camera settings play a crucial role in triggering discomfort.

Some participants, like P4, explained that their tendency to develop tunnel vision while focusing on the screen remains the same whether they are actively playing or merely watching*: 'It doesn't really matter if I play or someone else plays, then I can get motion sickness'*. (P4)

This suggests that visual input alone, without the added control element, is often sufficient to induce symptoms. Similarly, P6, shared that they tend to avoid watching others play to prevent symptoms from arising.

Certain participants pointed out that specific types of visual stimuli exacerbate their symptoms. P7 reported that fast-paced games with high-speed graphics, such as *Fortnite* (Epic Games 2017*)*, were particularly problematic: *'The graphics were way too quick, and I just couldn't watch more than 15 minutes'*. (P7) This highlights how rapid motion and visual overload can quickly induce simulator sickness, even as a passive viewer.

However, not all participants experienced simulator sickness while watching others play. P14 mentioned that watching gameplay in a smaller video window helped mitigate symptoms, while P16 and P13 noted that the experience depends largely on the game's settings and how the recorded player has configured them. On the other hand, P15 stated that watching others play made their simulator sickness even worse.

5.1.2.3. Multitasking and mental fatigue in gaming

A few participants reported that multitasking within games and prolonged gaming sessions can significantly contribute to simulator sickness in non-VR video games. Participants highlighted how the cognitive and visual demands of modern games can lead to mental fatigue, which in turn exacerbates feelings of discomfort and nausea. For instance, P5 explained that simulator sickness often arises when the game requires intense focus on multiple elements simultaneously:

> I think it’s because you have to stay focused all the time on ten things at once. There's a lot of rapid eye movement, talking to others, checking the map, and so much happening at the same time, which can be very exhausting for the brain and eyes. (P5) (own translation)

5.1.3. Individual simulator sickness triggers

In our research, we aimed to explore whether individual factors, such as general susceptibility to simulator sickness and the gaming environment, contribute to differences in simulator sickness experiences among players of non-VR video games. The results were mixed. Some participants reported no simulator sickness in daily life but experienced it exclusively during gaming, while others had a history of simulator sickness in other contexts, suggesting a potential predisposition.

When examining the gaming environment, factors like lighting and screen distance yielded varied responses. While some participants found bright lighting or sitting close to the screen increased their symptoms, others reported no impact. These findings suggest that individual factors may influence simulator sickness for some, but they do not serve as consistent triggers across all participants.

5.2. Players' mitigation and coping techniques for simulator sickness

Interestingly, we noted that many of our participants didn't really recognise that they are facing an issue when getting motion sick in gaming, as several of them assumed they are the only ones affected. The following section explores how players handle simulator sickness, focusing on their lack of awareness about the issue, the adjustments they make to game settings, and the physical strategies they employ to alleviate symptoms (see figure 2).

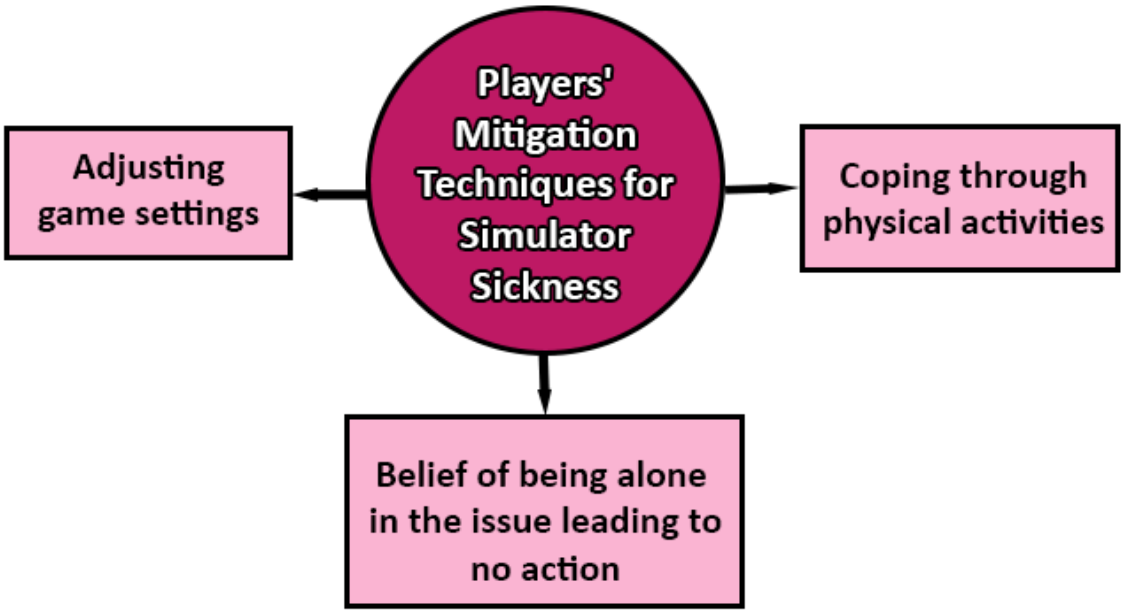

Figure 2: Theme map over how players mitigate with simulator sickness in non-VR video games

5.2.1. Belief of being alone in the struggle leading to no action

Surprisingly, the participants' responses reveal that many of them were unaware that simulator sickness in non-VR video games can be a common issue.

> Is it common for people to feel unwell? Especially with these kinds of motion or shooting games? (P1) (own translation)

This question and other questions we received reflect genuine surprise and curiosity about the prevalence of the issue. This lack of knowledge contributes to their belief that they are uniquely affected. For some participants, learning that others shared their experiences was even surprising and validating, for instance, P6 stated in a surprised voice:

> I started feeling very nauseous and I just thought I was sick, and um and then started playing it again and had the same problem, and when I talked to my younger brother he was having the same issue. And my dad said he had the same issue! (P6)

Some participants normalized their discomfort, perceiving it as a natural limitation rather than something that could be addressed. P1 compared their experience to people feeling sick on rides:

> Some just accept feeling nauseous on rides, just as I accept feeling sick when playing games. (P1) (own translation)

This acceptance led them to take no action to mitigate the problem, as they assumed it was unchangeable. Similarly, P6 shared that they thought the issue stemmed from themselves rather than the games:

> I never thought about it... mostly I just figured it wasn't a way to fix it because it was a problem with me. (P6)

This belief further entrenched the idea that seeking solutions was futile. This indicates a cycle where the absence of awareness and resources discouraged proactive behavior from our participants.

5.2.2. Adjusting game settings as a coping mechanism for simulator sickness

Several responses from participants indicate that adjusting game settings is a common strategy for dealing with simulator sickness, though awareness and effectiveness of such adjustments vary greatly among individual participants as some were unaware of the potential of adjusting settings to alleviate simulator sickness. In contrast several other participants demonstrated some awareness of settings that could potentially help, mentioning motion blur and frame rate adjustments as possible solutions.

However, while some participants were aware of some potential solutions their knowledge was limited to these specific settings. They were unsure about what other settings might help with simulator sickness, indicating a lack of broader awareness about all available options within the game settings.

Participants who experimented with game settings reported making several common adjustments to alleviate simulator sickness. Many players found that increasing the field of view (FOV) and adjusting brightness helped. Turning off visual effects such as motion blur and screen shake was another frequently mentioned strategy, as P2 and P4 highlighted that disabling these effects improved their experience. Frame rate adjustments were also considered important for a few participants. P2 and P14 mentioned lowering graphical settings to achieve a smoother experience. Though, P7 highlighted the difficulty of balancing frame rate and visual quality.

> Usually I try to lower the frame rate but then unfortunately it kind of makes the game go a bit framey if that makes sense. It doesn't go as smoothly. So it bothers me. So it's like a lose-lose situation. (P7)

This creates a situation where improving one aspect may worsen another, making it challenging to find an optimal balance.

While many participants found some relief through adjusting settings, these changes were not always sufficient to eliminate simulator sickness entirely. A few participants noted that adjustments allowed them to play longer but did not completely resolve the issue.

5.2.3. Coping through physical activities

In addition to adjusting game settings, many participants employed physical coping strategies to mitigate simulator sickness symptoms. A common approach among participants was to lie down and rest when symptoms become severe

> When it was at its worst, I had to go to bed because I felt really bad and sick. (P3) (own translation)

Others also emphasized rest combined with hydration and eating to help alleviate discomfort.

Taking breaks was frequently mentioned as an effective way to cope. P10 stated that breaks were the only solution that consistently worked, while P12 highlighted the importance of frequent breaks, particularly during the first few days of playing a new game. P7 found that stepping away from the game and taking a walk was the only reliable solution, as medication often had undesirable sedative effects. Similarly, P6 noted that getting up to drink water or walking around helped alleviate symptoms temporarily.

A few participants used other unique coping strategies like closing their eyes during specific game actions, as described by P4, or using visual techniques to focus on the surroundings rather than the screen itself.

> So what I'm doing is trying to not focus so much on what actually happens on the screen and try to see everything around me, like in full vision of that my eye allowed me to and when I do that then it kind of feels like I'm not shaking I'm just sitting there is something that shakes in front of me but I see that everything around me is not shaking I'm not shaking then it feels better. (P4)

5.3. Simulator sickness effects on players' gaming behavior and habits

This section covers the impact of simulator sickness on our participants' gaming behaviors and habits. Based on their responses, three key themes emerged: Limiting and reducing desired playtime, inability to play desired games, and avoiding games that cause simulator sickness (see figure 3).

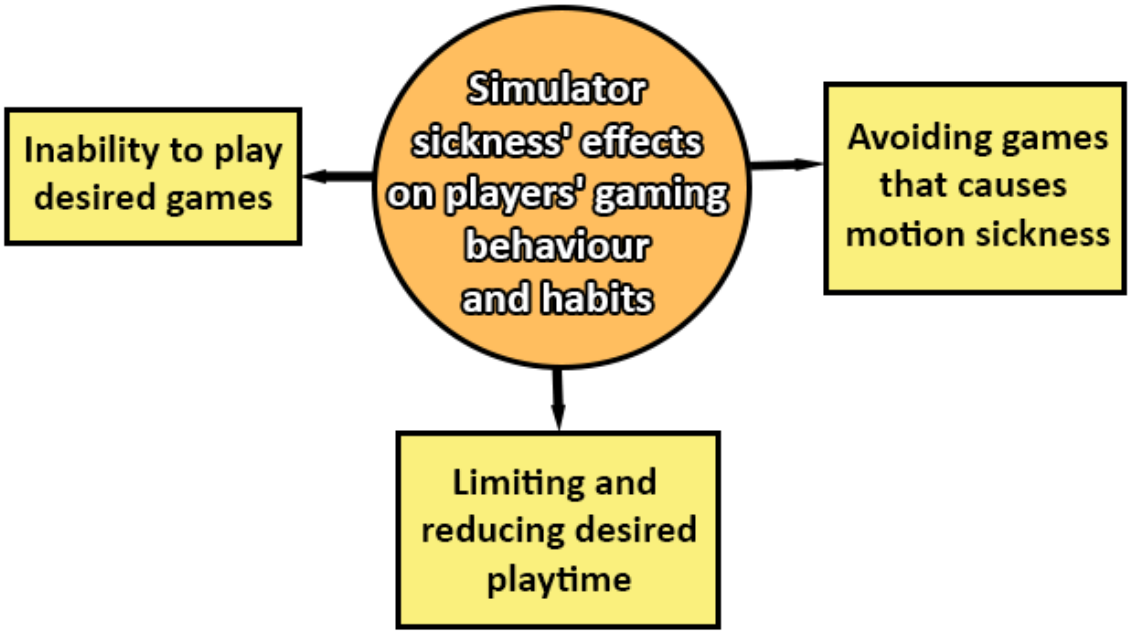

Figure 3: Theme map over the effects of simulator sickness in non-VR video games on players

5.3.1. Limiting and reducing desired playtime

One of the most common consequences of simulator sickness, among our participants, is the need to reduce overall gaming time. Participants expressed frustration over being unable to play as much as they would like due to the discomfort caused by simulator sickness. Some of them even needed to gradually reduce their gaming time.

> I can't play as much as I want and can't play all the games I wanted to play. (P1) (own translation)
> I played less instead. I started playing less and also reduced the time I spent on that game. (P5) (own translation)

Several participants reported that they tried limiting session lengths and taking frequent breaks to manage their symptoms. However, despite these efforts, many found their total playtime significantly decreased. For example, P3 initially tried to control their symptoms of simulator sickness by playing in short ten-minute intervals but ultimately decided it wasn't worth the discomfort and stopped playing the game causing them altogether.

5.3.2. Inability to play desired games

Many participants expressed disappointment over their inability to play the games they were most interested in due to simulator sickness.

> What I want to say is that I have not been able to play all the games I had wished for. Instead, I have to choose certain games. (P1) (own translation)

P6 echoed P1's sentiment, stating that their gaming opportunities were greatly reduced, and they found themselves seeking alternative hobbies like board games that did not involve playing on a screen. For some players, such as P2, simulator sickness has become a deciding factor in whether they even attempt certain games. Yet, it's difficult to determine beforehand whether a game will cause issues.

> If it causes sickness, I don't want to play it. (P2)
> If I know that the game is causing massive problems for me, I am very unlikely to play it. But it is difficult to know beforehand. (P2)

5.3.3. Avoiding games that cause simulator sickness

To handle simulator sickness, many participants reported actively avoiding specific games or entire genres known to trigger their symptoms. Avoidance strategies varied, with some participants, like P15 and P16, completely giving up on particular types of games, others, like P4, selectively engaged with them under specific conditions, while others, such as P7, mentioned avoiding visually intense games like *Fortnite* (Epic Games 2017), which were found to exacerbate their symptoms.

5.4. Players' recommendations for better and simulator sickness-free experiences

As part of the study, participants were asked to share their suggestions for how to better accommodate the part of the video game player base that experience simulator sickness from an accessibility viewpoint (see figure 4). This section covers these suggestions.

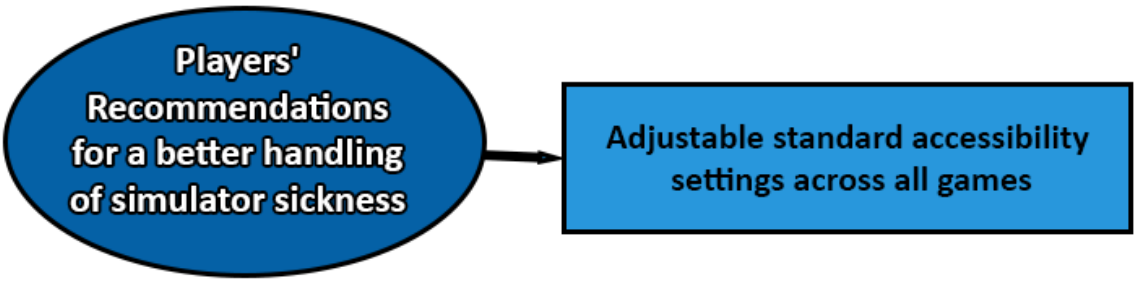

Figure 4: Theme map over the players' recommendation for a better handling of simulator sickness in non-VR video games

A recurring recommendation was the ability to disable motion blur:

> Well, as I said, make motion blur disableable. That's basics. Some games don't allow to disable it, and this is awful. (P2)

Similarly, unnecessary camera movements and blur effects were highlighted as triggers for discomfort, with P14 stressing the importance of turning them off entirely.

Another major point of concern that was discussed by several participants is camera movement and stability. Participants expressed a need for better control over camera shake, with adjustable sliders that fully eliminate unwanted movement. P4 noted that while some

games offer sliders to reduce camera motion, they don't always work effectively, citing *Bioshock* (2K 2007) as an example. Additionally, P13 wished for settings that would stop the camera from moving along with the character's animations, emphasizing that this kind of forced movement often leads to simulator sickness. More fine-tuned control over camera transitions and movement speed was also suggested:

> Much higher FOV max, more granular visual settings for camera transitions. like not having to take down cursor speed to regulate speed of transitions. (P15)

Field of View (FOV) adjustments were another crucial recommendation by participants. P14 highlighted the delicate balance of FOV settings, as they explain that an extremely high FOV can create a warped, fisheye effect, while a low FOV results in fast camera movements that can be disorienting. Some participants also called for games to allow even higher maximum FOV settings, ensuring players can tailor their experience to their comfort level.

Regarding graphics and display settings, P7 suggested that games should allow for reduced frame rates without sacrificing visual quality, as lowering FPS can sometimes help alleviate nausea. Another practical suggestion by P14 was increasing font size, which allows players to sit farther from the screen and reduce discomfort caused by a constricted FOV. P14 also suggested that more games should offer an option to zoom out for a more stable viewing experience. Similarly, P16 wished for standardized settings that allow players to adjust their point of view freely across all games.

Overall, players emphasized the need for more flexible and detailed settings that allow them to adjust camera behavior, FOV, visual effects, and display options to their comfort level.

6. Discussion

Our research sheds further light on visual causes of simulator sickness in non-VR video games by both pointing to and extending findings from existing literature on the topic. Participants in this study identified various in-game triggers, personal experiences, and coping mechanisms that contribute to or alleviate discomfort, aligning with key theories on sensory conflict, postural instability, and vection, which have been discussed by previous related studies and literature. The discussion below explores how these findings relate to previous research and what they imply for game developers and players.

6.1. The role of sensory conflict and postural instability

One of the explanations for simulator sickness in digital environments is *Sensory conflict theory* (Chang et al. 2012; Stoffregen et al. 2008), which occurs when the brain receives mismatched signals from visual and proprioceptive systems (Wibirama et al. 2020, 2). Participants in our study supported this theory by reporting discomfort when in-game motion did not match their physical stability. This aligns with Pöhlmann et al.'s study (2022), which identified vection, which as mentioned previously is the sensation of movement when a player is actually stationary, as a major factor in simulator sickness. It can also be seen in those of our participants who reported a preference for VR games because they allow for full-body movement, enabling them to stay physically in sync with their in-game character, which they found more comfortable. This finding suggests that the ability to physically move in response to in-game motion may help reduce sensory conflict.

Furthermore, our participants identified specific visual effects, including, but not exclusive to, motion blur, excessive camera shake, and abrupt perspective changes, as major contributors to simulator sickness. This aligns with Himmels et al. (2022) and Christensen et al. (2018) who explain that high-speed visual stimuli and environmental effects increase sensory conflict. The need for an option to disable motion blur, as mentioned by P2 and P14, supports recommendations by Chen, Burtscher, and Gerling (2024) that reducing unnecessary visual effects can help mitigate simulator sickness.

Chang et al. (2012) and Merhi et al. (2007) highlight *postural instability* as another key factor in simulator sickness. This theory (Chang et al. 2012) suggests that maintaining balance in a

virtual space without corresponding physical movement can cause discomfort. Some of our participants' experiences supported this idea, particularly those who mentioned that games with unpredictable camera movement disrupted their sense of control. These findings also align with Christensen et al.'s research (2018), which suggests that fast camera rotations and forced movements contribute to postural instability and discomfort, as well as Dong and Stoffregen (2010, 1342)'s findings that a sense of lacking control may affect the development of simulator sickness. Himmels et al. (2022, 150) also identified poorly optimized camera angles and forced movements as a significant contributor to discomfort.

6.2. The role of field of view (FOV)

The role of FOV settings in simulator sickness was also reinforced by findings in our study. Participants emphasized that FOV values set too high or too low could create distorted perception or excessive motion effects, reinforcing earlier findings, by Himmels et al. (2022, 151), that explains that games with wider fields of view often induce simulator sickness. However, our findings suggest that different players require a broader range of customization options to suit their comfort levels. One participant (P15) even suggested higher maximum FOV settings.

6.3. Genre-specific triggers and individual differences

Our study aligns with studies by Wibirama et al. (2020) and Pöhlmann et al. (2022) who found that racing games and FPS titles tend to induce stronger vection effects due to their high-speed motion and optic flow. Participants consistently cited first-person shooters (FPS), driving simulations, and games with frequent perspective shifts as the worst offenders. However, our findings also revealed individual variability, as some of our participants stated that third-person games with dynamic camera angles were equally problematic.

Another individual variability we observed was that some players experienced simulator sickness only in specific conditions, such as playing for long periods, multitasking, or watching others play, while other participants experienced simulator sickness every time they played non-VR video games.

This suggests that simulator sickness in gaming is not solely dependent on game design factors but also on individual player sensitivities.

6.4. Coping strategies: What worked and what did not

Adjusting game settings, such as disabling motion blur, increasing FOV, or lowering frame rates, was a common method used by participants. These strategies are consistent with previous suggestions by Chen, Burtscher, and Gerling (2024), who emphasize the importance of customizable settings for reducing simulator sickness.

However, our results also highlight that there are limitations to current mitigation methods. Some participants noted that reducing frame rates helped alleviate sickness but that this negatively impacted visual quality, making the game feel “choppy”. This trade-off suggests that more optimized frame rate options are needed to balance performance and comfort.

Several participants found that frequent breaks, hydration, and movement helped reduce symptoms. These solutions are in line with recommendations by Pöhlmann et al. (2022) and Merhi et al. (2007) that periodic breaks and posture changes can help mitigate symptoms. However, our findings indicate that this is not always a sufficient solution for everyone. A few participants found that even limiting play sessions to short intervals did not help prevent simulator sickness. It could help them play slightly longer but did not solve the problem.

Chen, Burtscher, and Gerling (2024, 584) suggest that adjusting display settings (like FOV) and gaming environments can play a crucial role in reducing discomfort. Some participants mentioned adjusting lighting or sitting farther from the screen to reduce simulator sickness.

6.5. The impact of simulator sickness on player behavior

We have found that simulator sickness has a direct influence on gaming habits, with many participants reporting that they avoid certain games or limit their playtime. This supports Wibirama et al. 's (2020) findings, who found that simulator sickness significantly affects how players engage with digital experiences, and with Himmels et al. (2022) who also argues that simulator sickness can lead to lower gaming engagement and enjoyment. Additionally, several of our participants actively avoided FPS and third-person genres completely due to simulator sickness concerns.

6.6. What we could not observe/ Shortcomings of our study

While our data aligned with many theories, there were areas where our findings were inconclusive or did not fully support existing research.

Gender differences: While Chang et al. (2013) suggested that women report higher simulator sickness rates than men, our study could not find clear evidence to support or refute this claim due to the use of targeted recruitment of participants not taking into account gender when recruiting. This resulted in a majority of female participants.

Experience-based adaptation: Himmels et al. (2022) suggested that experienced gamers are less likely to experience simulator sickness due to adaptation. While some participants (P10) mentioned that they built tolerance over time, others (P5) found that simulator sickness persisted regardless of experience level, suggesting that adaptation may not occur for all players.

Environmental Factors: Chen, Burtscher, and Gerling (2024) have indicated that room lighting, ventilation, and screen distance can influence simulator sickness susceptibility. While some participants (P14) mentioned that sitting farther from the screen helped, others reported no noticeable effect, making it difficult to generalize these findings.

6.7. Recommendations for better experiences

As Chen, Burtscher, and Gerling (2024) highlight the importance of minimizing unnecessary visual motion to reduce simulator sickness, our participants also emphasized the need for more customizable settings to help players reduce motion-induced discomfort. A key recommendation is to provide options to disable motion blur and reduce camera shake, as uncontrolled visual effects were frequently cited as a trigger.

It is our suggestion that game developers should provide adjustable FOV settings, with options to increase the maximum for individual preferences. Additional settings to fine-tuning camera speed and transitions could also be a worthwhile setting to add so as to also enhance player accessibility, as unexpected shifts contribute to simulator sickness (Christensen et al. 2018). Guo et al. (2013, 52) also discusses the possible improvement to

simulator sickness symptoms that comes from having a fixed or stable point on the screen for the player to focus on. Our suggestion in relation to this is that game developers could offer an optional target reticule - if their game doesn't already have such - setting to provide such a fixed point.

Additionally, developers should consider providing options for independent camera movement adjustments and settings that allows players to stabilize the screen when needed. Participants reported that tying camera motion directly to character animations worsened their symptoms, reinforcing findings by Stoffregen et al. (2008), who suggest that disrupting a player's sense of control increases discomfort. This also aligns with Christensen et al. (2018), who argue that greater control over camera motion can reduce sickness triggers.

As suggested by participants, adding accessibility features for motion sensitivity, like: zoom-out functions, font size adjustments, and *UI* (user interface) modifications could help players sit further from the screen, which may reduce visual strain.

7. Conclusions

This study set out to explore the causes of simulator sickness in non-VR video games and investigate how players handle its effects. Through qualitative data collection, including interviews and questionnaires, we identified key triggers of simulator sickness and the strategies players use to mitigate symptoms (appendix fig.4).

The central questions for this research were as follows:

1. *What visual factors do players find contributes most to simulation sickness in non-VR video games?*
2. *What mitigation strategies do players employ to deal with the onset of simulator sickness?*

Our findings reveal that sensory conflicts, excessive camera movement, high-speed visual changes, and mismatched player expectations are the primary contributors to simulator sickness. While individual susceptibility varies, first-person perspectives, rapid motion effects, and unstable camera controls emerged as the most common triggers.

To handle these challenges, some players employ adaptive in-game settings or environmental adjustments, and behavioral physical strategies. Many rely on adjusting field of view (FOV), reducing motion blur, or taking breaks to manage symptoms. However, a notable gap in awareness was observed, as many players either assumed they were alone in their experience or were unaware of available solutions, which prevented them from taking proactive steps. This highlights the need for greater accessibility considerations in game design and better awareness of simulator sickness mitigation strategies.

Beyond identifying triggers and coping mechanisms, this study also aims to provide game developers with insights into how design choices can impact the player's comfort. Our findings suggest that developers should consider implementing more customizable accessibility options, such as adjustable motion blur, camera shake, and FOV settings, as well as the ability to disable involuntary camera movements. Increased transparency in game descriptions regarding potential simulator sickness triggers would also help players make informed choices.

The research methodology could capture a wide range of player experiences, but limitations remain. The relatively small sample size means that broader generalizations require further study. Additionally, while our research focused on self-reported player experiences, future studies could incorporate physiological measurements or experimental settings to deepen the understanding of simulator sickness triggers and mitigation strategies.

Despite these limitations, this study highlights the real impact of simulator sickness in non-VR gaming on players and offers valuable insights into how both players and developers can work toward more accessible gaming experiences. Further research is needed to develop standardized design guidelines that minimize discomfort while maintaining an immersive experience. By addressing these issues, both researchers and developers can contribute to making gaming more inclusive and enjoyable for all players.

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Appendix

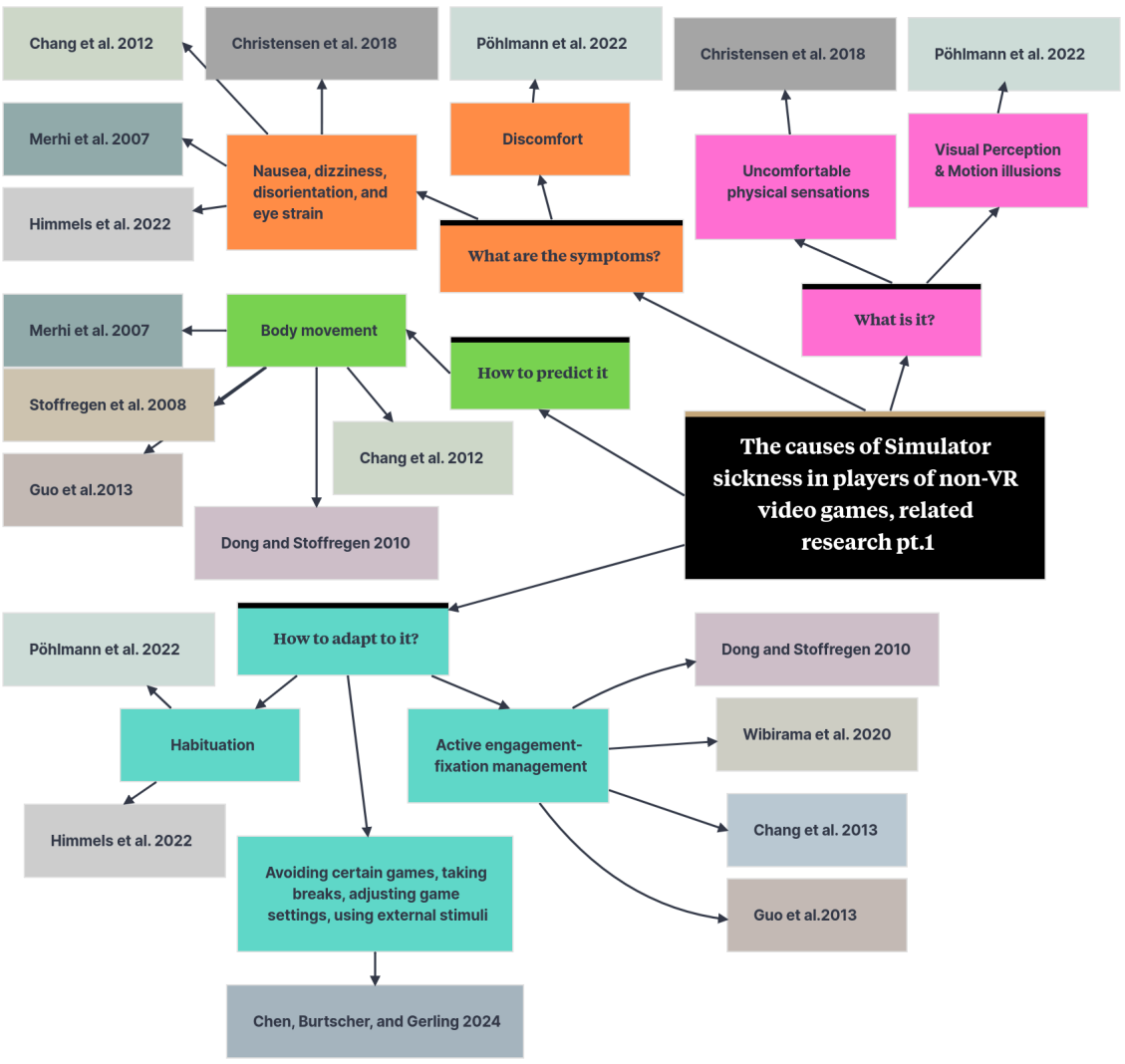

Figure 1: part 1 of the thematic literature map over the causes of simulator sickness in non-VR video games, discussing what Simulator sickness is, how to predict when it is going to happen and how players can adapt with it.

Figure 2: part 2 of the thematic literature map over the causes of simulator sickness in non-VR video games, discussing what may cause it in players and how to prevent it from happening.

ID	Age	Gender	Gaming frequency	Hours per week	Preferred Genre	Session duration	Motion Sickness Frequency
P01	32	Female	A few times per week	3 hours	Shooting games	1-2 hours	All games except The Sims
P02	36	No preferred	A few times per week	n/a	RPG	Multiple hours	Most games
P03	28	Female	A few times per week	2-3 hours	Adventure	30-45 minutes	Only one game
P04	32	No preferred	Daily	n/a	RPG	Longer sessions	Most first person shooters
P05	21	Female	A few times per week	ca 20 hours	MMO	Longer sessions	Only one game
P06	56	Female	Less frequently	n/a	Strategy	Short sessions	Most first person shooters
P07	27	Female	Weekly	n/a	Horror	Longer sessions	Recent development, Call of Duty, Outlast Whistleblower, fast paced videos
P08	26	Female	Daily	7 hours	No preferred	Shorter sessions	Only during longer play sessions, no particular game
P09	17	Male	A few times per week	10-20 hours	Action/adventure	Longer sessions	Only in Overwatch and Dying Light
P10	45	Female	Daily	5-10 hours	Puzzle	Shorter sessions	Only in Portal, Human Fall Flat and Antichamber
P11	29	Male	Daily	10-20 hours	Action/adventure	Longer sessions	Doesn't get motion sick
P12	35	Female	Daily	10-20 hours	RPG	Longer sessions	Multiple games (#1)
P13	35	Not shared	Daily	10-20 hours	Simulation	Longer sessions	Supermarket Simulator, Clothing Store Simulator
P14	50	Male	Daily	10-20 hours	Action/adventure	Longer sessions	Multiple games (#2)
P15	33	Female	A few times per week	<5 hours	Simulation	Shorter sessions	Multiple games (#3)
P16	26	Non-binary	A few times per week	10-20 hours	Action/adventure	Longer sessions	Hellblade: Senua's Sacrifice, generally any third person games

Figure 3: A table of the participants list including their number, age, gender, how often do they play, their preferred game genre, for how long do they usually play in one playing session and how frequently they get simulator sickness during gaming.

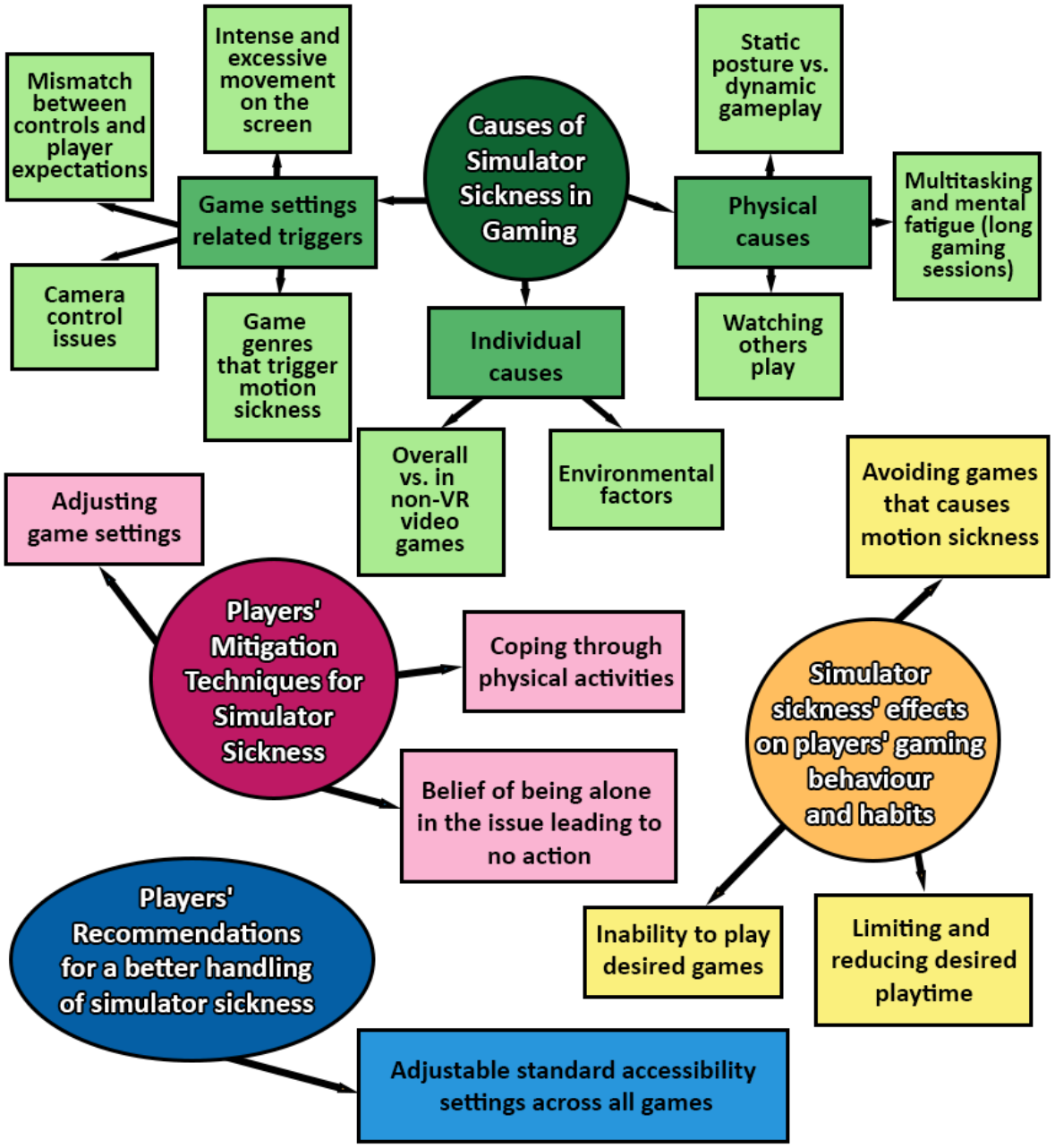

Figure 4: Combined thematic map over the causes of simulator sickness in non-VR video games, how players mitigate and handle it, its effects on players and players recommendations for better experiences.

Text 1:

Interview Protocol

INTRODUCTION

Hello, and thank you for your interest in taking part in this study! My name is <name> and I'm part of a duo with my classmate and we're performing this interview as part of a study that will be the basis for our bachelor's thesis about what visual causes might lead players to become motion sick in non-VR video games, and how they as players deal with it.

Your participation in this study and interview is highly appreciated, and of course completely voluntary. You're under no obligation to answer any question for any reason and, if you so choose, to end the interview and withdraw your consent for us to use the gathered material, you just need to say so.

The interview is going to be conducted and recorded as voice-only and we estimate that it will take around 20 minutes, but that's all that it is, an estimate, so don't worry if we run shorter or longer than that.

Your privacy is very important to us, and as such any gathered data will be anonymised and kept confidential. Any non-anonymised data will be deleted when we receive a passing grade, and any anonymised data will be kept until June 2025, or when the writers' graduate.

Do you have any questions before we begin about what I've said so far?

<answer potential questions, if no, continue!>

Alright! Then may I have your consent to participate in this interview?

QUESTIONS

Warm up questions:

First, I'd like to ask you a little bit about yourself, to get to know you and a little bit about your history, if that's okay? It's totally fine if you prefer not to answer any of these questions, just say so and we'll move on!

- How old are you?
- Do you have a preferred gender?
- What system do you usually game on? (PC, console, switch, mobile? Etc.)
- How often do you play video games?
  Follow up: On average, how many hours would you say you spend gaming per week?
- Do you have a favourite game genre?

- When you play video games, do you usually play for long stretches or time or in short sessions?
- Also, when you play, do you play solo or with friends?
- Do you usually get motion sickness in general?

MAIN PART OF INTERVIEW

1. Experiencing motion sickness in gaming questions

- Do you recall a time when you experienced motion sickness while playing a non-VR video game?
- What was that game?
  Or multiple games, if it's happened more than once?
- In your estimate, approximately how long did it take for the symptoms of motion sickness to kick in?
- Was anything in particular happening at the time? Such as a cutscene, a lot of movement, intense combat, change in camera angles?

  Ask any necessary follow-up questions. In particular, what games and how long before motion sickness set in should be considered important.

2. Game settings, software, hardware, and context

- To the best of your abilities, can you recall what settings you were using in the game when you experienced symptoms of motion sickness? For example, camera angles, field of view, motion blur, frame rate, and so on?
- What gaming system were you playing on at the time? Such as PC, console or another one? We're also interested in what monitor or monitors you were using.
- If you remember, could you tell me what the environment around you was like? Was the room you were playing in brightly lit, were you close to the screen? What time of day was it?
- Do you also experience motion sickness while watching other people play?

3. Coping Strategies

- When you realised that you were experiencing symptoms of motion sickness, did you try to attempt to mitigate this by changing the settings in the game causing the issues? Or make changes to your hardware or environment?
- If so, what worked and what didn't?
- How did you cope with the motion sickness during or after that gaming session, or was it severe enough that you immediately ended playing to deal with it?
- Based on your experiences, do you have any ideas about what might help reduce gaming sickness for you?

4. Impact on gaming behavior

- How has gaming sickness influenced your gaming habits?

- After the first time when you got sick:
  - have you started avoiding certain games?
  - Have you tried limiting session length OR stopping gameplay completely for a period?
  - Are there specific games or genres you actively avoid because of this?

5. Ideas

- Are there any particular features, tools, or resources you wish games or hardwares had to help with this issue?

GENERAL ROUNDING OFF

1. Summarizing:

Thank you for sharing your experiences and insights today.
Just to summarize, we've talked about your gaming habits, your experiences with motion sickness, the scenarios and settings involved, how you cope with it, its impact on your gaming, and any ideas you have for reducing it.

2. Clarifying:

- Is there anything we discussed that you'd like to revisit or clarify?
- Do you feel there's anything important about your experiences with gaming sickness that we didn't cover but you'd like to share?
- Do you have any questions for me about this study or anything we've talked about today?

CLOSING INTERVIEW STATEMENTS

Thank you again for your time and for contributing to this research. Your input is incredibly valuable and will help us better understand and address gaming sickness in the future. If you at any time feel like withdrawing your participation, simply contact us and we'll remove your data immediately.