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User-Centric Locomotion Techniques for Virtual Reality Games: A Survey of User Needs and Issues

Daichi Hirobe, Shizuka Shirai, *Member, IEEE,* Jason Orlosky, Mehrasa Alizadeh, Masato Kobayashi, *Member, IEEE,* Yuki Uranishi, *Member, IEEE,* Photchara Ratsamee, *Member, IEEE,* and Haruo Takemura, *Member, IEEE*

***Abstract*—Virtual reality (VR) video games that are played on a VR headset are becoming increasingly common in households, and though many games require players to navigate vast virtual spaces, most homes cannot provide a large enough physical space to encompass the entire virtual space. Thus, VR video games that require locomotion often provide users with alternative locomotion techniques. While teleportation or steering is typically used as a standard, new techniques can overcome remaining problems such as motion sickness. However, a holistic perspective of user needs and issues regarding these techniques in practical situations has not been studied on a broad basis. To address this gap in the literature and contribute to future VR video game development and research, we conducted 16 semi-structured interviews and surveyed 88 participants to help explore issues regarding existing locomotion techniques. Our results revealed preferences related to teleportation versus steering and the postures that users adopt while playing VR video games, along with user needs for locomotion techniques in each posture.**

***Index Terms*—needfinding, empirical study, locomotion, teleportation, steering, virtual reality, games**

I. Introduction

In the last few years, commercial virtual reality (VR) headsets have become increasingly available to the general market at an affordable price, and they have been making their way into consumer households. One major use of VR headsets in households is for video games [1]–[3]. Many of these games provide a virtual space and require users to explore it, such as the popular *Half-life: Alyx* (2020) [4]. In such games, the position tracking functionality enables users to navigate a virtual space by walking around their physical space. However, the virtual spaces provided by these games are often much larger than the size of a typical room in households. Therefore, games often provide users with alternative locomotion techniques [5], such as teleportation or steering [6]. These locomotion techniques enable users to navigate virtual spaces without physically moving around in the real world. As a result, users can explore virtual spaces that exceed the physical limitations of their room size. While alternative locomotion techniques like teleportation or steering are already widely used in VR video games, it has been pointed out that they have several difficulties. For example, it is known that teleportation often causes disorientation [7], while steering is also said to induce motion sickness [8]. Thus, new locomotion techniques have been actively studied to address these issues and enhance user experiences [9]–[11]. Thus, new locomotion techniques have been actively studied to address these issues and enhance user experiences. However, despite the fact that it is essential to consider both subjective evaluations, such as user satisfaction and objective evaluation, including effectiveness and efficiency to improve user experience, most related works focus only on objective evaluation. Even if they investigate subjective satisfaction, they are limited to sample size. Without knowing the issues (i.e. which effects of locomotion techniques are negatively perceived) facing users and their needs (i.e. requirements for a locomotion technique) when they play VR video games, it remains unclear whether a technique is suitable for locomotion in VR video games.

To narrow this research gap, we investigate a wide range of aspects of user needs regarding locomotion techniques in VR video games using subjective measurements, including semi-structured interviews and a large-scale questionnaire survey constructed based on the result of the preceding interviews. This research aims to find issues and user needs for locomotion techniques of VR video games in more practical situations through interviews and a questionnaire survey to contribute future VR video game developments and research.

Note that our study exclusively focuses on VR video games played on a VR headset, rather than video games in general or VR applications in general, because user needs and issues differ by context. For instance, unlike traditional non-VR video games, the view of VR video game players is completely encompassed by the game world. Also, educational or industrial applications are often used in professional settings for non-game VR applications. The size of physical space or acceptable cost for equipment is different, and it can affect the

Daichi Hirobe, Shizuka Shirai, Masato Kobayashi, Yuki Uranishi, and Haruo Takemura are with Osaka University, Osaka, Japan (e-mail: hirobe.daichi@lab.ime.cmc.osaka-u.ac.jp, shizuka.shirai.cmc@osaka-u.ac.jp, kobayashi.masato.cmc@osaka-u.ac.jp, yuki.uranishi.cmc@osaka-u.ac.jp, haruo.takemura.cmc@osaka-u.ac.jp)

Jason Orlosky is with Augusta University, Augusta, Georgia, United States and Osaka University, Toyonaka, Osaka, Japan (e-mail: jorlosky@augusta.edu)

Mehrasa Alizadeh is with Otemon Gakuin University in Ibaraki, Osaka, Japan (e-mail: m-alizadeh@otemon.ac.jp)

Photchara Ratsamee is with Department of Robotics and Design, Osaka Institute of Technology, Osaka, Osaka, Japan (e-mail: photcyber@gmail.com)

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entire user experience, including locomotion.

To understand issues of locomotion techniques in existing VR games and the need of locomotion techniques that users want from future VR games, we pose the following research questions:

RQ1. What needs do users have for VR game locomotion techniques?
RQ2. Which issues do users feel in existing locomotion techniques?
RQ3. How do the postures that users adopt while playing VR video games affect user needs of locomotion techniques? And what issues do these postures have?
RQ4. Do the answers to the above research questions vary depending on user's experience in VR and VR video games?

By examining RQ1, we try to reveal user needs of locomotion techniques in VR video games and contribute to the future works, such as research on new locomotion techniques or development of VR video games. At the same time, it is essential to explore issues related to locomotion techniques already used in VR video games to shed light on the future direction of research on locomotion techniques. Thus, we examine RQ2 to investigate how existing techniques are evaluated in practice. VR video games deviate from traditional video games in that VR games are often played in two different postures: standing and sitting. Thus, we investigate RQ3 to know about postures; standing and sitting. We also investigate intrinsic issues related to postures to contribute to future research about user experience in VR. While researches regarding RQ2 [12], [13] or RQ3 [14], [15] in the VR video game context have been conducted, all of these conducted experiments where participants played specific titles under controlled conditions. On the other hand, in this study, we surveyed users' experiences with a broader range of titles in actual environments. Furthermore, we hypothesized that user needs and issues may vary based on the experience with VR and VR video games. Thus, we set RQ4.

To answer these RQs, we conducted 16 semi-structured interviews and a questionnaire survey of 88 participants. We gathered needs and issues related to locomotion in VR video games, as well as postures adopted during VR gameplay through semi-structured interviews, created a questionnaire based on the results of interviews, and conducted a survey about these needs and issues.

II. Related Work

Many locomotion techniques for VR have been presented and studied so far. First, this section briefly reviews previous research in VR locomotion techniques, such as natural walking, teleportation, and steering. Then, we introduce prior work about VR locomotion evaluation methods and surveys.

A. VR locomotion techniques

1) Natural Walking: While it is known that physically walking in the real world is an outstanding way to navigate a virtual world [16]–[19], such techniques impose limitations on the size of the virtual world. In order to overcome this limitation, a method called Redirected Walking (RDW) has been proposed as shown in the work by Li et al. and Fan et al. [20], [21]. This technique manipulates the virtual space so slightly not to be recognized by a user, and then the user will be guided toward the center of the tracking space unconsciously and can keep walking infinitely, while the user feels like walking on the virtual world freely [22].

For instance, Matsumoto et al. [23] proposed the RDW method, which utilizes visuo-haptic feedback. In this method, users put their hands on a curved wall and walk along the wall while seeing a straight wall in the virtual world. The system rotates the virtual world to compensate for the difference between the real and virtual walls, so users can keep walking the virtual world infinitely while walking in a circle in the real world. Sun et al. [24] proposed the RDW method which utilizes saccadic suppression for a room scale physical space with obstacles, including dynamic ones. But even though these techniques enable users to walk in a larger virtual world with a smaller physical space, they still require a certain size of the physical space.

Using treadmills has been proposed as a method that enable users to explore a virtual world on foot without moving around a physical space. Souman et al. [25] developed the omnidirectional treadmill (ODT) which aims to enable a user to walk as naturally as s/he does in the real world. ODTs like this have been evolving [26], [27] and a method that combines RDW and an ODT was also proposed [28]. However, these treadmills, including ones commercially available, are too expensive and bulky to use in general households. In addition, the locomotion methods that require physical walking, like RDW or ODT are not available for people with motor disability.

2) Teleportation: Many VR video games provide not only natural walking, but also alternative locomotion methods for exploring a virtual world. One of the most used locomotion techniques is teleportation [29]. In this method, a user points where s/he wants to go, then the method instantaneously moves the user to the destination. The idea of using the teleportation for exploring a virtual environment has already existed in immersive virtual environments [30]–[32] like CAVE [33].

In VR with HMDs, Bozgeyikli et al. [34] proposed "Point & Teleport", which teleports a user to where s/he points. The original "Point & Teleport" tracks a user's hand to detect where s/he is pointing, and the teleportation is triggered by pointing the same place for a certain amount of time. Recently, controller-based "Point & Teleport" is often regarded as the most basic teleportation [9], [35]–[38]. This variant uses VR controllers, such as Oculus Touch or HTC Vive Controller, to detect where a user pointing, and the teleportation is triggered by pushing a button or pulling a trigger on a controller. A lot of locomotion techniques have been proposed based on "Point & Teleport". For example, the original "Point & Teleport" has the weak point that a user has to teleport a couple of times to detour an obstacle. To address this, Funk et al. [39] proposed methods which utilize a curved trajectory for pointing the destination and manipulating the orientation after the teleportation. In this study, they confirmed that need for correcting the orientation after the teleportation was decreased by their proposed methods. Müller et al. [10] also proposed a

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method derived from “Point & Teleport” called “UndoPort”. This method has an additional functionality which allows users to return to where they were before the teleport. They confirmed that this functionality enhance users’ exploration efficiency.

Furthermore, locomotion techniques which use the teleportation in a different manner from “Point & Teleport” have been proposed. Liu et al. [40] combined the teleportation and RDW in order to encourage users to use a tracking space more effectively and walk more. They named the method “Redirected Teleportation”, and confirmed its efficacy. Another example is a locomotion technique which utilizes “World in Miniature” (WIM) [41], a miniature representation of the virtual world. Pausch et al. [42] proposed a method where a user deploys a doll representing the user on the miniature, then the user goes into the doll and teleports to the destination. Truman et al. [43] proposed a WIM locomotion method integrated with recent research progresses and implemented it on a modern VR setup.

Teleportation is not only for research, but it has already been adopted in many video games, such as *Robo Recall* (2017) [44] or *Half-Life: Alyx* (2020) [4].

3) Steering: Another one of the most used locomotion techniques is steering [6], [45]. Like teleportation, this technique has been already used in immersive virtual environments [46]. It is also a commonly used technique for non-VR video games. Steering uses joysticks [47]–[49], touchpads [50], or a keyboard [49], [51] as an input device and moves a user continuously towards the direction pointed by the device. Unlike teleportation, this technique has a maximum speed limitation. Prior studies used velocities that were close to human walking or running speed, such as 1.4m/s [51] or 5m/s [52].

Also, a lot of variants of steering which use a user’s body as the input instead of external controllers have been proposed. Hashemian et al. [53] proposed leaning-based steering methods, and confirmed that they can mitigate motion sickness compared with joystick-based steering. Pai et al. [54] proposed a locomotion technique, “ArmSwing”, which activates steering locomotion by swinging arms. It was compared with walking-in-place method, and its effectiveness was confirmed in various aspects. The study by Thinh et al. [55] suggested that these techniques are equally effective as natural walking. Another merit of this kind of locomotion techniques is that users can use their hands for other purposes like shooting guns [13].

In addition, integrating the “field-of-view (FOV) restriction” [56] technique has been actively studied, which restricts a user’s FOV while moving into steering to mitigate motion sickness. Teixeira et al. [57] used a commercially available video game and confirmed that a FOV restriction is effective in mitigating motion sickness. In a normal FOV restriction, user’s peripheral vision is filled in black, but Lugrin et al. [58] proposed a method which utilizes a portal and drone-metaphor instead of filling the peripheral vision in black. Atkins el al. [59] also proposed a method which integrates FOV restriction with a portal into joystick-based steering.

Along with teleportation, steering has already been adopted in many video games, such as *Resident Evil 4* (2021) [60] or *Myst* (2021) [61].

B. User Studies of VR Experience

1) Characteristics of Locomotion Techniques: To investigate characteristics of each locomotion technique, numerous comparative studies have been conducted [62]. These studies have investigated various aspects of locomotion techniques, such as performance [63]–[66], sense of direction [67]–[69], motion sickness [63], [65], [66], [69], immersion [63], [65], [66], [70], or usability [63]–[66]. Boletsis [71] proposed a metric specialized for evaluating locomotion techniques in VR by merging System Usability Scale (SUS) [72] and Game Experience Questionnaire (GEQ) [73]. However, VR is used for broad purposes [12], [74], [75], and demanded characteristics of locomotion techniques should vary depending on the use case. In addition, to investigate whether a locomotion technique is suitable for a certain context, not only characteristics of the technique, but also demanded characteristics for the specified context must be known. Nevertheless, we could not find a research which investigated demanded characteristics for VR video games, so we decided to conduct this survey.

Moreover, each comparison study reports slightly different results. For example, Clifton et al. [12] compared teleportation and steering in motion sickness and immersion aspects using a commercially available video game. They confirmed that steering produces more motion sickness than teleportation, while the latter also produces some motion sickness, and steering can produce better presence than teleportation. Habgood et al. [52] also reported that steering produces more motion sickness than teleportation. On the contrary, Bozgeyikli et al. [65] reported there was no significant difference between teleportation and steering in motion sickness. Also, regarding immersion, teleportation got a higher score than steering in their study. They also reported that the task completion time of teleportation is as long as or longer than steering, depending on the task condition. Drogemuller et al. [76] also reported that teleportation is slower and causes more disorientation than steering in a task of 3D graph exploration. However, in the study by Buttussi et al. [63], teleportation was much faster than other techniques including steering. The study environments used by Bozgeykli et al. and Buttussi et al. are similar; both involve moderate sized fields containing a certain amount of obstacles. Therefore, it is still unknown which technique is suitable for the video game context, and it is also worthwhile to study them from a different approach than prior studies.

One of reasons of this inconsistency is that these studies used different tasks for their user studies. Thus, Cannavò et al. [77] proposed the testbed for evaluating locomotion techniques in various situations. In this study, we focused on assessing actual VR gameplay to evaluate them in more practical situations. However, it’s difficult to engage in a general discussion using the objective results of a specific title. Thus, we opted for subjective assessments targeting people with experience in VR video games.

2) Postures: The postures also have some impact on VR experiences and gameplay. Merhi et al. [78] conducted experiments in which users played video games through a HMD while standing or sitting and they compared motion sickness across these two postures. The result showed that standing users were more prone to getting motion sickness. Hu et al. [79] conducted experiments in which participants rated qualities of 360° VR videos while standing or sitting. As a result, they confirmed that sitting users could rate qualities more accurately and with more confidence, while standing users experienced higher emotional arousal. As for the sense of direction, Coomer et al. [80] tested participants to determine how precisely they could remember the positions of objects in a virtual environment while standing and sitting. However, they found no significant difference between the two postures. Koeshandika et al. [14] studied the usability and task performance of three commercially available VR applications, including VR video games, in three different postures: standing, sitting, and supine. Consequently, they confirmed that postures do not have any significant impact on performance if video games do not require frequent locomotion in virtual environments. Regarding the supine posture, Thomas et al. [15] also investigated the user experience of playing VR video games in this posture. They found that some movements, such as leaning or crouching, took more effort when in the laying-down posture. In a VR medical training study, Shewaga et al. [81] compared "seated" condition and "room-scale" condition, which utilizes more larger physical space than "seated" condition. They found that "room-scale" condition could provide better results, such as higher immersion and shorter task completion time. On the other hand, Tehreem et al. [82] could not find any significant difference between the seated posture and standing posture in VR chemical experiment training.

Among studies about postures, the most relevant one to our study is a study conducted by Zielasko et al [83]. They listed some aspects of VR experiences affected by postures and degree of embodiment, such as motion sickness or locomotion precision [84], and they discussed these aspects with other VR researchers. Then, they conducted an online survey targeting experienced VR users, researchers, and practitioners. As a result, they reported how postures and degree of embodiment have an impact to these aspects. They also discussed about this topic in another paper [85] and proposed a couple of guidelines and future work directions. One of the differences between their study [83] and ours is the focus; we are specifically investigating video games, whereas they considered overall VR experiences. Also, our participants include many less experienced individuals, so we expect that our results can reflect a broader range of opinions from typical VR users rather than just those of professionals.

As we have seen so far, while studies related to postures of VR users have been conducted, we could find only a few investigations which focused on postures within the context of VR video games [14], [15]. However, we hypothesized that postures also have an impact on gameplay and user needs for locomotion techniques. Therefore, we also decided to investigate issues related to postures that users specifically experienced while playing VR video games.

C. Locomotion in VR Video Games

The locomotion techniques in VR video games and those that are designed for gaming in general have also been actively studied. Guidelines for locomotion techniques exist to ensure a positive user experience. For example, a technique should not induce motion sickness and should be easy to learn. These characteristics are important in a gaming context as well, but we believe there are unique demands in this context that extend beyond locomotion in general.

In a gaming context, end users often pick up or manipulate objects while moving. Griffin et al. [13] compared hands-free locomotion techniques and hands-busy locomotion techniques (i.e., controller-based techniques) using a VR shooter game task. They conducted an experiment in which participants played a VR shooter game using hands-free techniques and hands-busy ones. Results showed no difference in task performance between these two groups, even though they had initially expected the former to outperform the latter in situations requiring both locomotion and item collection.

Also, unlike a surgical simulator or virtual city design, VR video games often require a wide range of distances for locomotion. Zhao et al. [86] proposed "TeleSteer", which is a combination of teleportation and steering. This technique allows users to switch teleportation and steering anytime they want. Zhao et al. proposed it as a versatile technique effective in various situations, including gaming.

Cmentowski et al. [87] proposed a unique locomotion technique called "Outstanding", specifically for gaming. When a user moves using this technique, their viewpoint rises high above their avatar. They can point to where they want to go while looking down at their avatar, and if they point to the destination, the avatar moves there. Once the avatar reaches the destination, the user's viewpoint returns to the avatar. Cmentowski et al. confirmed that their proposed technique can improve spatial awareness and mitigate VR sickness without impairing presence. On the other hand, they also reported that their technique can reduce immersion in the avatar and impose some limitations on the level design. Although this is not a problem in non-entertainment applications, if a VR video game player could freely see the entire level, it would spoil and disrupt the gaming experience. Additionally, the sense of unity between the player and their avatar is very important for narrative games, like *Déraciné*.

Even though a gaming contexts have unique requirements for locomotion, to the best of our knowledge, little research focuses on this specific class of techniques. Of course, while VR video game industry has been evolving and best practices [88] have been established, we believe it is essential to study the requirements and issues that players currently experience to enhance future research and development of VR video games.

III. Semi-Structured Interview

A. Overview of the Survey

We first conducted semi-structured interviews with a small group of individuals to gain a preliminary understanding of

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issues and user needs. Subsequently, we created a questionnaire based on the results of these interviews and collected responses from a larger number of people to investigate issues and user needs more precisely. This kind of two-phase survey was already adopted in similar research in other fields [89]. Therefore, we also decided to use this approach.

Both of the interviews and the questionnaire were approved by our university's ethical review committee and were conducted with the participants' informed consent. All participants were informed that they could withdraw their consent and decline the use of their results.

B. Target Scene for the Survey

The locomotion scenes targeted in this study are those that do not have a significant impact on the main gameplay. For example, locomotion in most scenes of visual novels or puzzle games, such as *Déraciné* (2020) [90], *Myst*, or *A Fisherman's Tale* (2019) [91], falls within to our research scope. However, a combat scene in a shooter game does not fall into our research scope, whereas a scene in which a user explores a field while collecting items does.

The reason why we are targeting these scenes is because the scenes with a significant impact on the main gameplay often include some aspects unique to a specific title, so it is difficult to discuss issues or user needs in such scenes for a wide range of games. In addition, several studies focused on scenes involving the main gameplay [46], [92], but most studies about locomotion techniques used a one-size-fits-all scene [87], [93], [94]. Hence, we selected these scenes to enable comparison of the results of our study with these locomotion studies. To describe our target locomotion to participants, we prepared a couple of YouTube videos of locomotion that we are targetting[1234] and those that we are not[56].

C. Methods

1) Participants: We gathered 16 interviewees. All of them are males in their twenties. Ten of them are our lab members, four are another university's lab members, and two are working adults. Some students have been using VR for their research, but none of working adults were involved in the video game industry or the VR industry.

2) Procedure: The interviews were conducted through either face-to-face meetings or online calls. Most interviews lasted about 30 minutes, with the longest one lasting about 90 minutes. Firstly, we explained to the participants the study purpose at the beginning of their interview. Next, we explained our research target locomotion scene in VR games using a web page that contains the definition of targeted locomotion and YouTube videos of VR video games, which we mentioned earlier. Although we explained the definition of locomotion which we are targeting, we asked interviewees not to limit their responses to this definition. It was because we wanted to gather as many opinions as we could, and we thought that we could filter out irrelevant ones later.

In the first question, we inquired about experience with non-VR video games, and asked them to recall the positive and negative aspects of locomotion in non-VR video games. After that, we asked some questions about VR. We inquired about experiences with VR itself and VR video games, including which locomotion techniques are used in these games, and positive and negative aspects of locomotion in these games. Also, we inquired about postures they took while playing. We asked whether they were standing or sitting while playing each game, and inquired about advantages and challenges associated with these two postures. Finally, we asked the interviewees to mention as many aspects as possible that they thought were important for locomotion techniques in VR video games. If an interviewee mentioned unfamiliar aspects, we asked follow-up questions about them. When all of the questions were finished, if the interviewee had any topics they wanted to share or any questions they wanted to ask from the interviewer, the interviewer addressed them.

D. Results

After finishing all the interviews, we extracted information from notes taken during interviews and recordings of interviews to formulate questions for the questionnaire.

First, we checked the interviews about the non-VR video games and locomotion in these video games, we could not find anything regarding the main scope of this survey, so we decided not to include themes about non-VR video games in the questionnaire.

Next, we listed locomotion techniques which interviewees have used from their responses. While listing, we omitted locomotion techniques used in scenes outside our research scope. Most interviewees have responded that they have used teleportation and steering. Fourteen of the sixteen interviewees have used teleportation, and ten have used steering. Some interviewees reported using other techniques different from both teleportation and steering. One respondent reported piloting a combat plane in *ACE COMBAT 7: SKIES UNKNOWN* (2019) [95]. Another interviewee reported playing a video game while physically walking on his own feet in an amusement facility. Three interviewees have used special devices, such as a treadmill, for locomotion in games. However, only a minority of interviewees have used these techniques, so we decided to inquire only about teleportation and steering, which many respondents are expected to have experiences with. In addition, these two are often used for baselines when comparing locomotion techniques [63], [87], [92].

Then, we extracted issues and user needs from responses. During the extraction process, we comprehended issues not only as issues, but also as user needs. It is because we thought that users are likely to have needs which are in line with the issues they mentioned. As a result, we found five issues listed in Table I from responses. They were extracted from responses regarding various locomotion techniques. However, in a questionnaire, we inquired about all of these issues

[1]https://www.youtube.com/embed/Rqo-oZ4kB2w?start=18753&end=18792
[2]https://www.youtube.com/embed/L-qtmSIH3nM?start=242&end=259
[3]https://www.youtube.com/embed/LTLotwKpLgk?start=103&end=126
[4]https://www.youtube.com/embed/rmMAGpO6hc8?start=130&end=167
[5]https://www.youtube.com/embed/r2W4yaQQhkQ?start=1584&end=1601
[6]https://www.youtube.com/embed/qsWn9ttdqbA?start=2760&end=2783

TABLE I
LOCOMOTION TECHNIQUE ISSUES AND NEEDS MENTIONED IN INTERVIEWS ($N = 16$).

No.	Found Issues	Count
I1	Causing motion sickness	9
I2	Compromising immersion	5
I3	Difficult to use	3
I4	Losing the sense of direction	3
I5	Hard to move precisely	3
No.	**Found User Needs**	**Count**
N1	Not causing motion sickness	13
N2	Not lowering immersion	12
N3	Easy to use	9
N4	Fun to use	10
N5	Not losing your sense of direction	4
N6	Ability to move precisely	7
N7	Ability to move hands freely while moving around	2

"Count" means the number of interviewees who mentioned an issue.

TABLE II
POSTURE ISSUES MENTIONED IN INTERVIEWS ($N = 16$).

No.	Found Issues	Count
PI1	Annoyed by cables	8
PI2	Physically tired	9
PI3	Limited body movements	9
PI4	Causing motion sickness	2
PI5	Low immersion	8
PI6	Trouble clearing play space	2
PI7	Bumping into objects in the environment	5
PI8	Stumbling	1

for both of teleportation and steering to compare the results between the techniques. Also, as mentioned above, these five issues are also user needs, such as "Not causing motion sickness" or "Easy to use". In addition to them, we found there were two more user needs, "Fun to use" and "Ability to move hands freely while moving around". Every user need and the number of respondents who mentioned each need are shown in I. Therefore, we inquired about these five issues and seven user needs in the questionnaire. We also extracted issues regarding postures from responses. We identified eight issues listed in Table II. Along with issues of locomotion techniques, issues related to standing and ones with sitting are mixed here.

IV. QUESTIONNAIRE

Following the semi-structured interviews, we proceeded with a questionnaire to quantitatively analyze locomotion techniques issues and user needs in VR video games.

A. Methods

1) Participants: We restricted participants to people who have experience playing VR video games. The anonymous online survey was distributed to VR research laboratories, VR researchers' communities, and VR companies using Microsoft Forms. Note that some of the participants of the interviews also responded to the questionnaire.

We gathered 100 participants but excluded 12 due to invalid data. The Eighty-eight valid participants consisted of 79 males and nine females. The age distribution of participants was as follows; six participants were in their teens, fifty nine participants were in their twenties, fourteen participants were in their thirties, eight participants were in their forties, and one participant was in their fifties.

We also inquired about the frequency of Using VR, application experience, and posture experience, for data analysis. With regard to the frequency of Using VR, we divided respondents into beginners and experienced users based on their answers to "Frequency of playing VR video games". No respondents have answered "Never" to this question, and we can get 44 beginners and 44 experienced users by dividing respondents by whether they play VR video games that include locomotion more than a few times a month or not. We used this category for data analysis.

Regarding the application experience about teleportation and steering, 68 participants (77.27%) had used teleportation, and 75 participants (85.22%) had used steering, of which 59 participants had experience using both interfaces.

As for the posture, 82 participants (93.18%) have played VR video games while standing, and 76 participants (86.36%) have played while sitting, of which 70 participants have experience using both postures.

2) Procedure: At the beginning of the questionnaire, we shared a URL to a web page which is similar to the one we used in the interviews and asked the participants to see the page before responding to the questionnaire. In addition, because there are some questions regarding teleportation and steering in a questionnaire, we also put explanation of these locomotion techniques and YouTube videos as examples.

The survey comprises twenty-eight questions (see Appendix), grouped into five categories.

A. Demographic information
B. Experience with VR equipment and VR video games
C. Experience, level of satisfaction, and issues of certain locomotion techniques
D. Experience, issues, and user needs for locomotion techniques while in certain postures
E. Preferred posture

Questions in category C are for RQ2, and ones in categories D and E are for RQ1 and RQ3. Regarding investigation for RQ1, we hypothesized that user needs may vary depending on posture. Therefore, we decided to ask the same question about user needs for each posture. Also, we divided respondents into beginners and experienced users based on their answers to questions in category B for RQ4. In the questions related to issues, we included an option for "No problem" into issues acquired from the interview results.

3) Data Analysis: All the data analyses were carried out using IBM SPSS version 29.0.0.0. In order to investigate RQ2, we counted the number of responses in which they felt issues and not felt issues (Q11 and 15) for 59 participants who had experience using both interfaces and investigated whether the numbers of responses significantly differed in each category of issues between teleportation and steering using the MacNemar test. Also, we investigated differences between beginners and experienced users for each issue in teleportation and steering using the chi-square tests to answer RQ4. Furthermore, we investigated whether there was a significant difference in

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TABLE III
THE NUMBERS OF RESPONDENTS AND THEIR RATINGS FOR EACH LOCOMOTION TECHNIQUE AND EXPERIENCE LEVEL (Q11. 15).

		I1	I2	I3	I4	I5	No Problem
Teleportation	Beginner	4 (12.90%)	17 (54.84%)	9 (29.03%)	15 (48.39%)	9 (29.03%)	3 (9.68%)
	Experienced	4 (10.81%)	25 (67.57%)	11 (29.73%)	17 (45.95%)	19 (51.35%)	0 (0.00%)
	Total	8 (11.76%)	42 (61.76%)	20(29.41%)	32 (47.06%)	28 (41.18%)	3 (4.41%)
Steering	Beginner	22 (64.71%)	8 (23.53%)	7 (20.59%)	5 (14.71%)	5 (14.71%)	3 (8.82%)
	Experienced	21 (51.22%)	6 (14.63%)	2 (4.88%)	4 (9.76%)	9 (21.95%)	12 (29.27%)
	Total	43 (57.33%)	14 (18.67%)	9 (12.00%)	9 (12.00%)	14 (18.67%)	15 (20.00%)

I1: Causing Motion Sickness, I2: Compromising Immersion, I3: Difficult to Use, I4: Losing Sense of Direction, I5: Hard to Move Precisely

satisfaction (Q10 and 14) between teleportation and steering and whether there were any significant differences between beginners and experienced users for each technique using the Wilcoxon signed-rank test and the Mann-Whitney tests, respectively.

To answer RQ3, we inquired about issues related to postures while playing VR video games (Q18 and 23). First, we conducted McNemar tests to investigate whether there is a significant difference between standing and sitting for each issue. Then, we examine whether there were any significant differences in issues between beginners and experienced users for each posture using the chi-square tests to answer RQ4.

To answer RQ1, we asked respondents to rate user needs in a specific posture using a six-grade scale for both standing and sitting and examine whether there were significant differences in user needs across standing and sitting postures using the Wilcoxon signed rank. We also examined whether there were significant differences in user needs between beginners and experienced users for each posture using the chi-square tests to answer RQ4. Furthermore, we conducted Friedman tests to investigate if there were any significant differences among scores of user needs for each posture.

B. Results

1) Issues Related to Locomotion Techniques: The result of multiple-choice questions about issues with each locomotion technique is shown in Table III.As a result of the McNemar test, regarding "Causing motion sickness" ($p < .001$) and "No problem"($p < .05$), there were more people who experienced them while using steering than those who experienced them while using teleportation. For all other four issues, teleportation was perceived as more problematic ("Compromising immersion" and "Losing the sense of direction" ($p < .001$), "Difficult to use" and "Hard to move precisely" ($p < .05$)).

In addition to these five issues, we also included an "Others" option where respondents could freely provide their opinions about issues related to each technique. For teleportation, four respondents provided responses to this option, and two of them mentioned that teleportation is tiresome. Similar to teleportation, four respondents provided responses to this option for steering. All of them provided different opinions. For example, exploring a large map with steering is time consuming compared to using teleportation. Another respondent mentioned that steering feels strange because different games have different speed and acceleration.

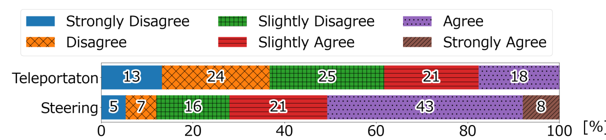

Fig. 1. Distributions of satisfaction scores (Q10 and 14) for teleportation ($N = 68$) and steering ($N = 75$).

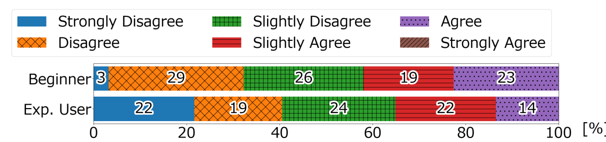

Fig. 2. Distributions of satisfaction scores (Q10 and 14) of teleportation for beginners ($N = 31$) and experienced users ($N = 37$).

2) Issues of Locomotion Techniques Between Beginners and Experienced Users: Table III shows the entire distribution of responses to issues regarding locomotion techniques. As a result of the chi-square tests, we could not find any significant differences between beginners and experienced users for each issue in teleportation. On the other hand, in steering, more beginners answered that steering is difficult, while more experienceds users answered that there is no problem in steering ("Difficult to use" ($\chi^2 = 4.344,\ p < .05$) and "No problem" ($\chi^2 = 4.856,\ p < .05$).)

3) Satisfaction Scores of Locomotion Techniques: Figure 1 shows distributions of satisfaction scores for teleportation and steering. We conducted the Wilcoxon signed-rank test and found that steering received a higher satisfaction score ($p < .001$).

Figure 2 and Figure 3 display satisfaction score distributions for teleportation and steering among both beginners and experienced users. As a result of the Mann-Whitney U tests, we could not find a significant difference for teleportation ($p = .210$), but for steering, experienced users have significantly higher satisfaction than beginners ($p < .001$).

4) Issues Related to Postures: Figure 4 shows the number of respondents who have experienced each issue in a certain posture. The results of McNemar tests showed that there were significant differences for all the issues, including "No problem". The issues which more respondents have experienced while standing compared to sitting are "Annoyed by cables" ($p < .001$), "Physically tired" ($p < .001$), "Trouble clearing play space" ($p < .001$), "Bumping into objects in

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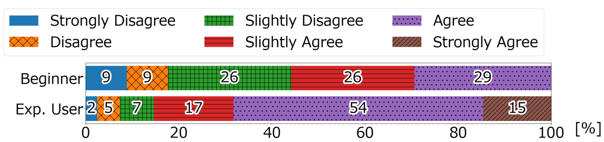

Fig. 3. Distributions of satisfaction scores (Q10 and 14) of steering for beginners ($N = 34$) and experienced users ($N = 41$).

the environment" ($p < .001$), and "Stumbling" ($p < .001$). The issues which more respondents have experienced while sitting compared to standing are "Limited body movements" ($p < .001$), "Causing motion sickness" ($p < .05$), "Low immersion" ($p < .001$), and "No problem" ($p < .05$). Similar to issues related to teleportation and steering, we also included "Others" option here. For standing, three participants provided their opinions on this option. All of them mentioned that they lose themselves in the real world rather than virtual worlds. Regarding sitting, three participants provided varying opinions on this option. One mentioned that he loses his sense of direction in the real world. Another one mentioned that certain body movements are difficult, such as crouching or rotating his body. The last one mentioned that he experiences lower back pain.

Furthermore, we also conducted the chi-square tests to examine whether there were any significant differences in issues between beginners and experienced users for each posture. However, we could not find any significant differences for either of the postures.

5) Preference of Postures: Regarding the preference for postures, we first inquired about whether respondents have played VR video games which are available for both standing and sitting. We inquired respondents who answered "Yes" to this question which posture they mainly took while playing such games. The preferences of posture given from participants who answered "Yes" to the previous question are distributed as shown in Figure 5. The result shows that sitting is preferable to standing.

We also inquired about the reason for their preference through an open-ended question. 7 out of 15 respondents who answered "Mostly Standing" or "Always Standing" mentioned higher immersion as the reason for their preference. Four respondents mentioned that they suffered from motion sickness less while standing. In addition, three respondents cited having fun and three being able to move their bodies freely as reasons. Meanwhile, 13 out of 20 respondents who answered "Mostly Sitting" or "Always Sitting" mentioned that a sitting posture is less tiring than a standing posture. Although only 1 respondent cited higher immersion as the reason, all other respondents also provided more practical reasons, such as the ease of securing the play space.

6) User Needs between Postures: Figure 6 shows the average scores of user needs for each posture. The results of the Wilcoxon signed-rank test show that standing had significantly higher average scores than sitting ("Not lowering immersion" : $p < .001$, "Fun to use" : $p < .001$, "Not losing your sense of direction" : $p < .05$, "Ability to move precisely" : $p < .05$, and "Ability to move hands freely while moving around" : $p < .05$.)

Table IV shows the average scores of each user need between beginners and experienced users. Regarding standing, there was only one user need with a significant difference, which is "Not losing your sense of direction" ($p < .05$). The average score for beginners was higher than that for experienced respondents. Regarding sitting, there was also only one user need with a significant difference, which is "Ability to move hands freely while moving around" ($p < .05$). The average score for experienced respondents was higher than that for beginners.

7) Comparison among User Needs: We found significant differences in scores of user needs for both standing ($p < .001$) and sitting ($p < .001$). Therefore, we consecutively conducted multiple comparisons with Bonferroni correction to identify which pairs of user needs had a significant difference between them. Regarding standing, we found significant differences between "Not lowering immersion" and "Fun to use" ($p < .001$), as well as between "Not lowering immersion" and "Not losing your sense of direction" ($p < .05$). "Not lowering immersion" had a higher average score in both pairs. Regarding sitting, we found significant differences between "Fun to use" and three user needs, which are "Not lowering immersion" ($p < .05$), "Not causing motion sickness" ($p < .05$), and "Easy to use" ($p < .001$), as well as between "Easy to use" and two user needs, which are "Not losing your sense of direction" ($p < .05$) and "Ability to move hands freely while moving around" ($p < .05$). Among these user needs, "Easy to use" has the highest average score and "Fun to use" has the lowest average score.

8) User Comments: At the end of questionnaire, we prepared a form where respondents could write their opinions freely. Three respondents answered that they also played video games in a lying-down posture. Even though there have been some studies [14], [15], [96] about VR experiences in a lying-down posture, most of commercially available VR video games are designed only for standing and sitting postures. Offering the option to play in a lying-down posture might be necessary to further popularize VR video games.

V. Discussion

A. User Needs

Figure 6 shows that there are two needs that exhibit significant differences between the results of standing users and sitting users; "Not lowering immersion" and "Fun to use". While these two needs are related to entertainment, these differences suggest that standing users and sitting users have different demands regarding the entertainment aspects of locomotion techniques. In Section IV-B6, "Not lowering immersion" was significantly highly demanded by standing users compared to "Not losing your sense of direction" and "Fun to use". The fact that immersion is much more demanded than "Fun to use" suggests that standing users prioritize specific aspects of entertainment, particularly immersion. For sitting, "Easy to use" has the highest average and "Fun to use" has the lowest average. This difference suggests that sitting users prioritize practicality over entertainment. Looking

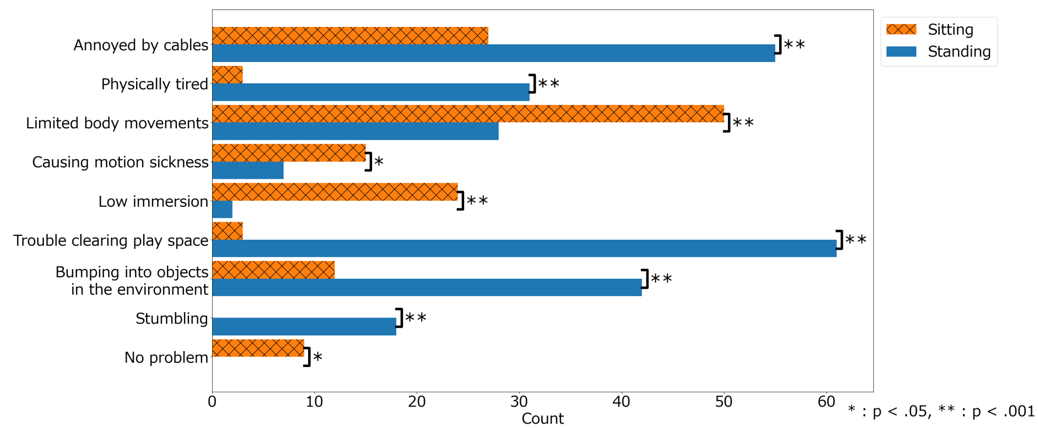

Fig. 4. The number of respondents who have experienced each issue (Q18 and 23) in standing posture ($N = 82$) and sitting posture ($N = 76$). The numbers of respondents who have experienced "Stumbling" while sitting and "No problem" while standing are 0.

TABLE IV
THE AVERAGE SCORES OF USER NEEDS AND THEIR STANDARD DEVIATIONS FOR EACH POSTURE AND EXPERIENCE LEVEL (Q19, 24). THE NUMBERS IN PARENTHESES REPRESENT STANDARD DEVIATIONS. PAIRS HIGHLIGHTED IN BOLD (STANDING N5 AND SITTING N7) SHOW SIGNIFICANT DIFFERENCES BETWEEN BEGINNERS AND EXPERIENCED USERS.

		N1	N2	N3	N4	N5	N6	N7
Standing	Beginner	4.39 (1.61)	4.80 (1.10)	4.61 (0.89)	4.17 (1.22)	**4.56 (1.05)**	4.37 (1.09)	4.46 (1.25)
	Experienced	4.39 (1.58)	5.17 (1.09)	4.85 (1.11)	4.29 (1.25)	**3.93 (1.40)**	4.73 (1.23)	4.68 (1.29)
Sitting	Beginner	4.31 (1.68)	4.11 (1.43)	4.63 (1.11)	3.26 (1.34)	3.97 (1.10)	3.91 (1.38)	**3.66 (1.37)**
	Experienced	4.10 (1.53)	4.27 (1.50)	4.66 (1.26)	3.61 (1.36)	3.95 (1.30)	4.37 (1.30)	**4.39 (1.34)**

N1: Not causing motion sickness, N2: Not lowering immersion, N3: Easy to use, N4: Fun to use,
N5: Not losing your sense of direction, N6: Ability to move precisely, N7: Ability to move hands freely while moving around

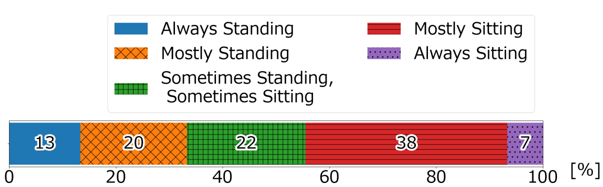

Fig. 5. Distributions of preference of posture (Q27) ($N = 45$).

at prior research, immersion has been treated differently. For example, while the study by Cmentowski et al. [87] and the one by Griffin et al. [13] are dealing with standing video game context, the former surveyed the immersion aspect of techniques using the iGroup Presence Questionnaire, whereas the latter used only a single Likert scale to rate presence. Our result suggests that if a study is targeting the standing gaming context, the immersion aspect is important and worth surveying thoroughly. As Figure 4 suggests, standing users are feeling a higher level of immersion than sitting users, whereas sitting users are less likely to feel tired compared to standing users. Therefore, differences in user needs across postures may reflect the preference for different postures, such as choosing standing when seeking immersion in video games and opting for sitting during extended game play. If so, it is recommended to avoid adopting locomotion techniques based on body movements, such as arm swinging or foot steps, for games played in sitting. Considering these differences will be important for future research in VR video game locomotion. For example, if one technique is immersive but easily disrupts player's sense of direction, the down side of the technique could be acceptable when it is used in a standing position. Additionally, when a technique is designed to be used in a sitting position, the entertainment aspect of the technique might not be a as important, even if the technique is for VR video games.

There were also differences in needs caused by expertise for both postures. For standing, the only user need which has a significant difference between beginners and experienced users is "Not losing your sense of direction". Especially, beginners in standing have higher average than experienced users in standing and both beginners and experienced users in sitting for this user need. This difference may arise because while a chair works as a guide of the forward direction for sitting users, standing users often lose track of the initial direction they were facing. For sitting, the only user need which has a significant difference between beginners and experienced users is the one related to moving hands freely. This user need is more strongly demanded by experienced users than beginners. We hypothesized that it was because while standing users can walk on their own foot, sitting users mostly rely on their controllers for locomotion. When users do other tasks while moving, this difference could present additional challenges for sitting users. Therefore, we thought that experienced users who have more demands to do other tasks while in motion would demand the freedom to move their hands freely while moving.

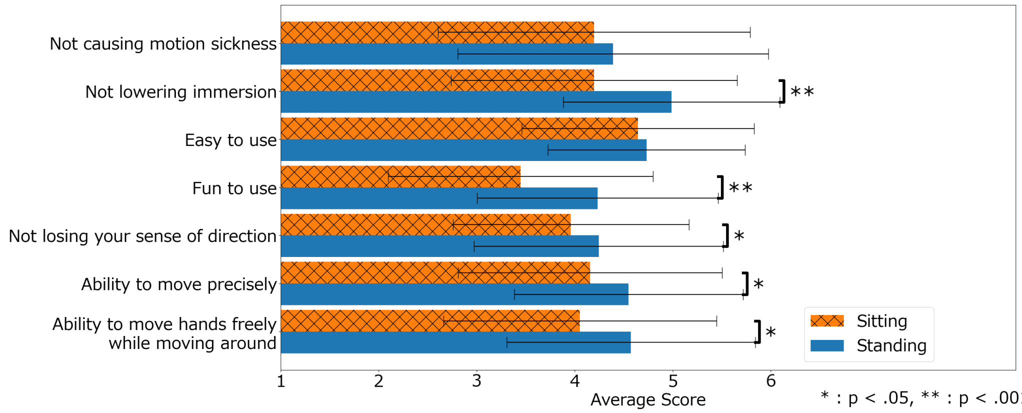

Fig. 6. The average scores of user needs for each posture (Q19 and 24)

B. Existing Locomotion Techniques

We confirmed that teleportation is more challenging for usage and precise movement, while more people feel that steering is "No problem". Given that the control of steering is quite similar to that of non-VR video games, it's possible that more people are familiar with steering. However, in the semi-structured interviews, two interviewees, who frequently play video games, mentioned problems in steering locomotion in VR video games. One participant answered that it is sometimes confusing which direction he moves when he tilts a stick forward: either the direction he looks or the forward of the playspace. Another participant, who often plays first-person-shooter non-VR games, answered that it is annoying that the moving direction unexpectedly changes when he looks sideways even a little. Considering that both interviewees frequently play video games, it is implied that players do not necessarily expect steering locomotion in VR video games and its counterpart in non-VR video games to behave identically. We conducted a brief survey on this topic and found that Meta [97] mentions it in their guidelines. However, we could not find any researches specifically investigating this aspect. However, we believe that it is impossible to address this issue solely by defining the best approach for steering locomotion because each player must have different preferenes. Meta recommends implementing a couple of these approaches and allowing users to switch between them.

Regarding satisfaction scores, We found a significant difference between teleportation and steering, with more people rating a higher score for steering. While the rate of positive responses for teleportation is about 40%, that for steering is more than 70%. This aligns with the observation above that teleportation is more problematic than steering in many aspects. We guess it is because steering uses thumbsticks, in the same way that traditional non-VR video games do. Therefore, teleportation might be easier to use if it utilizes thumsticks rather than pointing with the controller.

In Section IV-B2, we confirmed significant differences only for "Difficult to use" and "No problem" in steering. More beginners feel that steering is "Difficult to use", while more experienced users perceive steering to be "No problem". In addition, when the rate of beginners who think steering is "Difficult to use" is compared to that of teleportation, Table III shows that the former was 20.59%, while the latter was 29.03%. Thus, it can be said that steering is easy to use for experienced users rather than being difficult to use for beginners. The result that more experienced users feel steering is "No problem" also implies it. On the other hand, there are no significant differences in all issues for teleportation. Therefore, this result also suggests that teleportation is more difficult to master than steering. The study by Habgood et al. [52] also reported a similar trend. Considering that the main control of the currently dominant Point&Teleport technique is pointing, it may not be recommended to use pointing as the primary action for locomotion.

The reason of this might be physical issues, such as the difficulty in suppressing hand shake even for experienced players or inevitable fatigue from long gaming sessions. Another possible explanation is due to hardware problems. Point&Teleport technique requires hand tracking, and jitter or stuttering of a tracking system can impact the usability of the technique. If these errors are the main cause of the problem, it is natural that the technique is difficult to master even for experienced users. To mitigate this effect, implementing something like a low-pass filter may be effective.

C. Influence and Issues by Postures

We confirmed that there were significant differences for all issues between standing and sitting. More people experienced difficulties related to cables while playing VR video games in standing. It may be because while standing users can rotate their body 360 degrees, sitting players mainly look to the forward direction of their chair. However, Figure 4 shows that "Annoyed by cables" is the second largest issue for sitting users. This infers that the cable problem is not only for standing users. Thus, if a game is played on a tethered HMD, it is desirable for users to be able to play the game without rotating their head frequently no matter which posture they adopt.

"Limited body movements" is perceived to be more problematic by sitting users than standing users and more than half of the sitting users have experienced this issue. This implies that locomotion techniques that utilize body movements, such as arm swinging, leaning, or footstep, are difficult to use while sitting. Therefore, as we discussed above, it is recommended to avoid adopting locomotion techniques based on body movements for games played in sitting. "Causing motion sickness" is also perceived to be more problematic by sitting users than standing users, despite a prior study [78] showing the opposite result. This may be because while standing users can walk a short distance, sitting users have to use alternative locomotion techniques every time they move. Merhi et al. [78] used non-VR video games with a HMD for experiments. That might be the reason why their results were different from ours.

"Low immersion" is another issue which is perceived to be more problematic while sitting. There are some possible explanations for this. The first one is because sitting users have to use alternative locomotion techniques every time they move. The second one is the inconsistency between the actual user's posture and an in-game avatar's posture, which may lower immersion since in-game avatars are standing in many games. Three interviewees and five questionnaire respondents mentioned a decline in immersion caused by the inconsistency between their physical posture and the posture in game. For example, one participant stated that "(the reason they prefer to play VR games in standing is that) *it's usually more immersive because sitting while walking in VR is immersion-breaking.*". On the other hand, two interviewee mentioned that they were deeply immersed in the game *Last Labyrinth* (2019) [98] because a player is bound to a wheel chair in this game. Thus, if developers want to make their game immersive when played in a sitting position, it is better to come up with a reason that players in the game are also sitting, such as riding on some vehicles. One of the two interviewees who had played *Last Labyrinth* stated that when he played *TOKYO CHRONOS* (2019) [99], he initially felt discomfort due to the inconsistency between his sitting posture and his avatar's standing posture. However, he also stated that once he adjusted the eye height in the game, the discomfort disappeared. Therefore, immersion may not be broken if only eye height is consistent, even though the player's posture and their avatar's posture are inconsistent. While we were able to find some studies about the inconsistency between physical and virtual eye height [100] [101], it seems to be unknown which is more problematic: inconsistency in postures or inconsistency in eye height. A similar future work proposal was also made by Zielasko et al. [85]

We also compared all the issues between beginners and experienced users, however we could not find any significant differences for neither standing nor sitting. This result suggests that the issues related to postures are not overcome by experience.

VI. Conclusion

In this study, we conducted semi-structured interviews with 16 interviewees and an online questionnaire survey to 88 respondents. Through these surveys, we investigated issues and user needs for locomotion techniques, as well as issues related to postures while playing VR video games. As a result of semi-structured interviews, we found five issues and seven user needs related to locomotion techniques, along with eight issues associated with postures. Subsequently, we designed a questionnaire based on the results of the interviews, and our findings can be summarized as follows;

- There was a difference in tendencies of user needs for locomotion techniques between standing users and sitting users; Standing users are primarily demanding immersion, whereas sitting users are prioritizing practicality, such as ease of use.
- Teleportation was perceived to be more problematic than steering for all the identified issues, except for motion sickness. Steering also received higher satisfaction scores, and experienced users expressed greater satisfaction with steering compared to beginners.
- There were significant differences between standing and sitting for every issue, and also it is suggested that these issues can not be overcome by experience. However, it is suggested that certain issues, such as lowering immersion, can be mitigated through thoughtful game design.

This study focused on locomotion conducted in scenes that do not have any significant impact on the main gameplay, such as one in visual novels or puzzle games. This means that our results are limited in that they cannot be applied to more intensive locomotion scenes or locomotion involving other important actions. Thus, one direction for future research is to investigate the issues and user needs for other scenes, such as shooting or melee combat scenes. Another potential direction for future research is to conduct a similar investigation for other locomotion techniques. In this paper, we examined the issues of teleportation and steering since the results of the interviews suggested that these two techniques are dominant in VR video games. However, there are some subtypes [34], [43], [53], [102] within these locomotion techniques, as well as other types of locomotion techniques [86], [103]. Therefore, investigating the issues related to these could contribute to future studies and the development of VR video games.

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APPENDIX A
LIST OF QUESTIONNAIRE ITEMS

Please refer to supplementary material for more details on the questionnaire.

A. Demographic information

Q1. Age
Q2. Sex

B. Experience with VR equipment and VR video games

Q3. Please select the total duration of time you have continuously used VR equipment from the options below.
Q4. How often do you usually use VR equipment?
Q5. What do you mainly use VR equipment for? If you use it for multiple purposes equally, please inform us in the "Other" option.
Q6. How often do you play VR games that include locomotion?
Q7. Please select the total duration of time you have continuously played VR games that involve locomotion from the options below

C. Experience, level of satisfaction, and issues of certain locomotion techniques

Q8. Regarding locomotion techniques in VR games, have you ever used the Teleportation technique?
Q9. How often do you use Teleportation as a locomotion technique when you play VR games?
Q10. You are satisfied with Teleportation as a locomotion technique in VR games. (1. Strongly Disagree - 6. Strongly Agree)
Q11. Please select any of the following problems that you feel when you use Teleportation as a locomotion technique in VR games.
Q12. Regarding locomotion techniques in VR games, have you ever used the Steering technique?
Q13. How often do you use Steering as a locomotion technique when you play VR games?
Q14. You are satisfied with Steering as a locomotion technique in VR games. (1. Strongly Disagree - 6. Strongly Agree)
Q15. Please select any of the following problems that you feel when you use Steering as a locomotion technique in VR games.

D. Experience, issues, and user needs for locomotion techniques while in certain postures

Q16. Regarding your posture when playing VR games, have you ever played VR games while standing?
Q17. Please select all the HMDs that you have used while standing and playing games.
Q18. Please select each of the following problems that you feel when you play VR games while standing.
Q19. Each of the following options describes a desirable aspect of locomotion techniques while standing and playing VR games. Please read them carefully, judge how well they match with your opinion, and rate them.
Q20. If you have other desirable aspects of locomotion techniques while standing and playing VR games, please describe them in the form below.
Q21. This item asks you about your posture when playing VR games. Have you ever played VR games while sitting?
Q22. Please select all the HMDs that you have used while sitting and playing games.
Q23. Please select each of the following problems that you feel when you play VR games while sitting.
Q24. Each of the following options describes a desirable aspect of locomotion techniques while sitting and playing VR games. Please read them carefully, judge how well they match with your opinion, and rate them.
Q25. If you have other desirable aspects of locomotion techniques while sitting and playing VR games other than those above, please describe them in the form below.

E. Preferred posture

Q26. There are VR games that are available for both standing and sitting. Have you ever played such VR games?
Q27. This question is directed to those who have played VR games available for play while standing and sitting. Which posture(s) do you choose for such kind of VR games?
Q28. Please describe the reason why you chose that posture(s).

F. Overall Opinion

Q29. If you have any feedback about this survey or other thoughts, please feel free to share them here.