Exploring Situated Empathy through a Metaverse Campus

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ABSTRACT

Virtual Reality (VR) is promising in communicating people's hardship experiences in simulated situations. This can help foster empathy among people. In this paper, we present a VR experience designed to showcase the hardship experiences of an international higher education community concerning their studies and lives in an unfamiliar neighborhood. We collected hardship stories and data from 40 members of the community through an online questionnaire. The questionnaire analysis led to understanding critical issues, such as social problems, language barriers, issues with bureaucracy, and racism. We then turned the issues into interactive stories in VR. We recruited 18 participants to experience the hardship stories through interactions with avatars in a VR version of the campus where the community is located. Our preliminary results from the questionnaires suggest that the participants' knowledge and tendency to willingness to discuss the hardships improved due to participating in the experience. Further, our semi-structured interviews reflect positively on the VR experience's memorability, the stories' plausibility and participants' increased situated empathy and awareness regarding the hardships of the local international community. This early exploration informs future studies focusing on situated empathy.

CCS CONCEPTS

• **Human-centered computing** → **Virtual reality**; **Empirical studies in HCI**.

KEYWORDS

empathy, virtual reality, social issues, community engagement

1 INTRODUCTION

Equality is one of the most critical topics in social life and modern civilization [68]. Communities, governments, and companies leading industries are becoming more global and working around issues such as borders and discrimination [51]. As such, equality among domestic and international people in a society is a key factor [14]. Although equality is an essential topic in all cultures and communities, it has more significant importance and effect in countries becoming prominent immigrants destinations. In these countries, if society does not accept immigrants as one of its parts, social isolation, anxiety, and post-traumatic stress affect their Quality of Life (QoL), employment, and social status [47, 53]. More importantly, the necessity of equality and inclusive society [38] can impact long-term social development, especially when significant numbers of countries encounter an ageing population and rely on immigrants [35, 38, 73].

Nowadays, technology can promote inclusive societies and bring attention to related issues such as equality and immigrants' hardships [33]. Virtual Reality (VR), in particular, has been suggested as a promising technology to enhance people's empathy [62, 64, 74]. VR can serve as an effective tool in raising people's situated empathy [20, 42] and building long-term effects [42]. Due to these developments, some researchers dubbed VR as the *"empathy machine"* [40].

In this paper, we first investigate the hardships of an international community in a university campus in Oulu, Finland. We designed a survey to collect harrowing experiences, such as the language and cultural barriers of the international community. The community includes international students, staff, and other related persons to higher education during their lives or studies in Oulu, Finland. As a result, we collected a set of stories from 40 non-local participants that can be summarized into five types of hardship and inconveniences that the international members encountered.

Accordingly, to promote an inclusive community through VR, we implemented a metaverse campus (i.e., an immersive environment), namely *We Are Oulu*, to enhance the local society's awareness. As such, we recruited 18 participants and allowed them to have interactive dialogue in VR with a non-playable avatar of a storyteller. We conducted pre- and post-experiment questionnaires as well as a follow-up semi-structured interview with the participants.

Our paper serves as a tangible case study to employ VR for bridging the communication between international and local communities to promote an inclusive community and motivates future work for further studies. Our work contributes to (1) collecting information (i.e., stories) on the hardships the international community encounters and (2) developing an immersive application to reinforce the empathy-arousing utility to the local community. In particular, our work aims to shed light on the following research questions.

(1) What kind of hardships are experienced by the international community?
(2) What empathy-oriented effects does VR-driven communication regarding the hardships of the international community have on the local participants?
(3) How suitable is VR as technology in sharing the hardship experiences of the international community with the local participants?

2 RELATED WORK

This section introduces the fundamental concepts of empathy and further highlights the ways empathy can be measured. Accordingly, we depict the connection between empathy and VR as a relevant medium to elicit empathy.

2.1 Empathy and Measurements

Empathy – the human trait to understand and feel the experiences of others – has been in the academic focus since the early 20th century [70]. The advances in neurosciences have rekindled interest in empathy in the past decades. Even though the concept of empathy has seen ongoing scientific debates in various contexts (e.g., psychology, history, medicine) [66, 79, 81], definitions are still varied. For instance, we can see behavioural responses as an observable consequence of empathy, leading to multiple perspectives to the definition [27, 65, 84]. However, most often, empathy is understood through two dimensions: cognitive empathy, mentally processing the experiences of others, and affective empathy, responding to others' experiences physiologically [70].

Furthermore, different methods to measure empathy have been proposed in different research domains, such as Human-Computer Interaction (HCI), neurology, social psychology, etc., [13, 31, 70]. The measurements range between qualitative and quantitative. For instance, asking about the participants' feelings after the empathy experiences [80], self-report questionnaires [11, 43, 57, 65], studying *"facial, gestural, and vocal indices of empathy-related responding"* [87], and analyzing physiological measurements (e.g., heart rate) [80]. Among these tools, self-report questionnaires such as the Interpersonal Reactivity Index (IRI) and the Questionnaire of Cognitive and Affective Empathy (QCAE) are seen as easy-to-apply measurements for understanding a person's empathic traits [70].

For instance, the QCAE consists of 31 items with a 4-point Likert scale to measure the cognitive and affective components of empathy [65].

2.2 When Virtual Reality Meets Empathy

The core features of VR, including *Immersion*, *Imagination*, and *Interaction* [7] (also known as *3Is*), support simulating various scenarios. More importantly, the rise of these features on mobile VR devices facilitates interaction experiences ubiquitously [29] due to the recent advancement of VR devices [1, 39]. As such, VR is a widely adopted technology in multitudinous applications in people's lives and different industries, such as entertainment, creativity and gaming, space and military, online meetings, social studies, and so on [15, 18, 24, 45, 46, 67, 77]. Moreover, VR has demonstrated its potential through various types of game-based education scenarios [61]. For instance, Bracq et al. [8] assessed a VR simulator's usability and accessibility in training scrub nurses, while Lu et al. [52] also proposed a VR environment assisting the learning of children with autism. Nonetheless, Boletsis et al. [6] mentioned that VR design in professional educational scenarios is still in the exploration stage.

As supported by the embodied simulations, VR has been recognized for its potential for perspective-taking [19]. Multiple studies suggest that it is this immersive quality of VR that supports its perspective-taking capabilities [16, 49, 56, 62, 72]. Louie et al. [50] discussed that enhancing empathy is a new role for VR, and people can understand another's suffering or hardship through VR experiences. The audience can explore perspective-taking and acquire an understanding of another individual's situation through role-play in virtual environments. Bujić et al. [12] proposed that people's attitudes regarding human rights can be changed via media content through an immersive experience with VR. VR can also be used to support a person's emotion recognition to mitigate aggressive behaviors [71]. Additionally, VR also has been used to improve parents' understanding regarding their children with sensorineural hearing loss by enhancing empathy [28]. Also, a study by Martingano et al. suggests that VR can significantly improve affective empathy (i.e., feeling another person's emotions), but the aspects relating to cognitive empathy (i.e., knowing how other people think and feel) are more challenging to elicit [54]. Moreover, Herrera et al. [42] indicated that people who experienced homelessness in VR had a more empathic and longer-lasting attitude than those with traditional perspective-taking.

However, the findings on virtual perspective-taking are not unanimous. For instance, a study with an embodied perspective-taking task relating to sexual harassment with a Milgram obedience test led to treating the victim worse [58]. The research on virtually mediated empathy also suggests a "depoliticized hyperreality" [86] that focuses on the spectacle of someone's pain. In this light, the notion of the "empathy machine" suggests a technocratic solution to a complex systemic issue. Still, VR has been found relevant in immersive journalism to communicate human realities in a new way [23, 36]. As such, various research contributions help to mature using VR for empathic purposes.

2.3 Hardships Based on Otherness

To motivate our work, we highlight a few pieces in which research has shown the impact of hardships that stem from various biases and (non-)acceptances. A study by Jarrell et al. [44] found that diverse media representations affected participants' behavior, reducing gender and racial bias. Gender bias was also explored by Gonzalez-Liencres et al. [34], who found that embodying a female avatar in an intimate partner violence situation led to increased physiological reactions and less prejudice towards women. Likewise, Gabbiadini et al. [32] found that video games with male-typed violent and sexist content decreased empathic feelings towards women. Similar results were found by [59] in terms of intergenerational attitudes, where VR perspective-taking scenarios decreased ageism. The virtual embodiment has also been shown to reduce racial bias and support pro-social connections [37, 41, 48]. On a more general level, Farmer and Maister [30] found that VR simulations can support the malleable perception of self, which helps to change attitudes and reduce prejudice towards people different from oneself. As such, research suggests that exposure and representations can indeed affect a person's attitudes and behavior, which supports the goal of our study: to promote a more inclusive campus for international students.

Compared to the literature above, this paper serves as a groundwork for promoting an inclusive society of international members of new arrivals (i.e., immigrants) and the residents. Our paper is the first to attempt to establish a VR environment to facilitate the communication of hardship stories and thus provoke empathy among community members in a university setting.

3 DATA COLLECTION AND HARDSHIP STORIES

This section first describes collecting the hardship stories through a preliminary survey on a website. Accordingly, we collected several stories that led to the design of empathy topics and, thus, the implementation of virtual environments.

3.1 Method and Survey Design

Our first step was to collect the true stories of the hardships reported by the international members of a university campus, such as students and staff. We employed a website to capture what international people experience during their inhabitance in Oulu. *Carrd*, a cross-platform solution, was used due to its low cost, easy-to-use, and fast publishment features. We created a one-page website with links to the survey page and the researchers' contact information. Before starting the survey, the participants' consent was asked to use their stories for academic purposes in an anonymized manner.

The survey asked several demographic and background questions. Along with age, gender, nationality, and ethnicity, we asked about the participants' number of years they had studied or lived in Finland, current status regarding Finland's higher education system, their consideration about being judged by their nationality in the community, and their experience living in other countries.

Finally, our participants were asked to compare their quality of life (QoL) in Finland with their home country or other countries they studied or lived in before, on a scale from 1 (*Extremely Unsatisfied*) to 5 (*Extremely Satisfied*).

Next, the survey invited participants to describe any hardship they experienced during their inhabitance in Oulu or studies at a local university from the perspective of a non-native member of this community. We also clarified that the hardship included, but was not limited to, cultural barriers, language problems, issues with immigration, residence permits, bureaucracy, daily interaction with other community members or social problems, racism, etc.

Finally, we invited the participants to use their wording and tone to describe their stories: *"Change your earlier hardship description into a 'speech bubble,' i.e., how would you tell shortly about your experience to someone in just a few sentences or even less?"* By converting hardship experiences into stories, we could use them in our final evaluation (Section 5) to elicit empathy about hardship experiences.

We promoted our survey through our social media channels (e.g., *LinkedIn* and *Twitter*) and other direct contact approaches (e.g., emails and onsite recruitments). Our survey resulted in 40 valid responses, with the survey results: (1) preliminary and demographic questions and (2) hardship stories and experiences.

3.2 Participants

Among the 40 participants, 67.5% were male, 30% female, and 2.5% preferred not to say, with ages between 20 and 52 years old ($M = 30.1$, $SD = 6.8$). In total, we had participants from 20 nationalities, representing a highly diversified population of immigrants: Iran (40%), Sri Lanka (7.5%), Ghana (5%), Greece (5%), Spain (5%), and each with 2.5% from these countries: Australia, Belgium, China, Ecuador, France, Germany, Honduras, India, Kashmir, Luxembourg, Pakistan, Portugal, Turkey, Ukraine, and the United States of America. Additionally, our participants' ethnicities were from the following ethnicity categories: Asian (45%), White (37.5%), Hispanic or Latino (12.5%), and Black or African American (5%).

Regarding their current status in the higher education system in Finland, our participants are 10.0% BSc students, 50.0% MSc students, 27.5% PhD students, 5% graduated, and 7.5% staff. Also, we had participants who lived in Finland between less than one year and about 25 years ($M = 3.1$, $SD = 4.2$). Notably, 57.5% participants have stayed in Finland for two years or less.

Comparing the participants' life in Finland with their home countries or other countries they studied or lived in; the responses are positive in general ($M = 3.8$ and $SD = 0.8$). Finally, the participants' self-declarations of whether they had been judged by their nationalities in the community were quite mixed, as distributed between "yes" (37.5%), "no" (32.5%), and "maybe" (30.0%).

3.3 Topics Reflected by the Participants

The topics of the stories covered various aspects of an international person in Finland. Answers included aspects such as: *"Opening a bank account was really hard and late. Finding Finland friends was also hard. It's really cold here."*, *"Financial concerns exacerbated by the pandemic had a detrimental effect on my motivation and ability to concentrate on my studies."*, and *"People are looking friendly sometimes but not always :)."*

After reviewing all the responses' stories, the authors performed an initial categorization of the responses by applying a thematic analysis [9], which was validated by another colleague. We used a standard approach to perform the thematic analysis with six

primary steps: familiarization, coding, generating themes, reviewing themes, defining and naming themes, and writing up [17]. We named a code for each problem discussed in each story and then put stories with similar codes in a category. This resulted in ten categories: Social, Language Barriers, Bureaucracy, Racism, Job Seeking, Financial, Weather, Cultural Barriers, Immigration, and Daily Interactions. Anecdotally, we found many participants mentioning issues relating to the Social and Language Barrier categories.

3.4 Selected Stories for the Experiment

Many valuable stories were available for the VR study that covered multiple possible issues and difficulties in a non-native member's life. Therefore, the authors examined all stories and selected five to cover most of the mentioned issues. Then, the selected stories were validated by two colleagues. We chose longer stories to provide participants with a better storyline featured with reasonable duration and detail. Some of the stories we used combined several relevant stories. Additionally, the tone and wording of the stories remained the same, and we only corrected the typos and grammatical errors in the stories. The five selected stories are as follows:

Story 1 combines two participants' stories and refers to three critical issues: Social, Language Barriers, and Racism, as follows:

> *Connecting to Finnish people is hard, especially since they switch back to Finnish even with having non-Finnish speakers around. However, hobbies might help in the end to get closer to them. Only once did I have an experience when a bit older Finland person called me a Nazi behind my back for being from Germany. He refused to talk to me in English during all future meetings after hearing me say that I was from Germany. After talking to the other teammates, they told me that he has strong prejudices toward me for my origin.*

Story 2: This story reflects both the positive and negative sides of being in the community as a non-native member. It covers issues of Social, Language Barriers and Cultural Barriers.

> *Overall, the whole, I felt like Finnish people were very helpful towards me. However, I know this is not true for many of my mates. Whilst I cannot speak on their account, I did witness many occasions when we were out in public, at the pub, for example, where locals would treat my friends differently than they would treat me. This I derived was based on their ethnicity. This happened to my friend from Iran, my friend from Greece, and my friend from Finland, who is of Sudanese descent. In regard to the latter, there was one instance when we were together at a bar talking English, and he was abused for not talking Finnish in Finland. Unbeknownst to this woman, Finnish is his mother language, so she was shocked when he replied in Finnish. Unfortunately, this was just one example of many.*

Story 3: This story describes a detailed personal story that mentions many vital topics such as Financial, Job Seeking, Language Barriers, and Immigration difficulties, as follows:

> *My biggest hardship was financial. While I could find work at a strawberry farm, a chocolate factory, online*

> *tutoring, and several other odd jobs, money was always a concern. The pandemic made it especially difficult to find an internship, which is a core part of our program and a primary reason why I chose the program in the first place. Originally I had planned to go to India in June 2020. This would have been paid as it was overseas. But being unable to go overseas meant that I needed to find an online one or one within Finland. The problem with needing to find an education internship within Finland is that mastery of the Finnish language is often a prerequisite. Another problem is that, mostly, they are unpaid. This was a massive problem for me as I had factored into my finances pre-application that I would be getting paid for my internship. Ultimately I was left to complete my internship online and unpaid. At the same time, I was writing my thesis and working part-time. A further complication was the fact that I needed to complete it before the July 31 deadline. This period was tumultuous for me. I could not complete my thesis the way I wanted to; instead, I just submitted it for the sake of submitting it. By the end, I was completely run down, and my mental health had suffered severely. I was in a foreign country without any financial or familial support, unable to return to my own country due to border closures. However, I was very grateful that my faculty permitted me a 3-months exception to resubmit my thesis.*

Story 4: This story describes an individual's experiences of getting a resident permit (i.e., Immigration issues). It was selected since the volunteer uttered the hardship story with a university.

> *While my husband was a university staff member, I was waiting so long for the final decision on my resident permit, which lasted two years! The university did not support my husband and me in this matter. They even did not bother to contact the immigration service and follow up on the permit application. At the same time, we were under severe mental pressure while seeing others can enter Finland without any problem, and their decisions were made in less than a month. My husband could not focus on his studies and tasks because he had to focus on writing requests to the immigration service. In the end, my decision was released without any interference from the university. So there's no support for their employees.*

Story 5: This story primarily describes Social and Cultural Barriers.

> *Cultural barriers are very big for non-natives. Becoming friends with Finnish people is very difficult unless you are willing to make an effort and have a lot of patience. There have been times in which people have treated me differently because I am a foreigner. Sometimes it happens that the bus is crowded, and people sit next to each other, but no one tries to sit close to me. Even when I can not find two empty seats next to each other, I prefer to stand up and not sit next to other. I have been actively excluded from work conversations by having*

people in a group suddenly switch to Finland. This has caused a lot of anxiety to me that I have had to cope with through psychotherapy.

The topics of Daily Interactions and Weather were not selected as part of the presented stories, as the provided stories in these topics were not deemed that serious in nature, at least compared to the ones selected. A total of eight out of ten story categories are covered by the five selected stories.

4 IMPLEMENTATION OF A METAVERSE CAMPUS

This section details the technical implementation of the campus VR environment where the experiment takes place.

Hardware: The experiment was developed for Oculus Quest 2 HMD using the Unity game engine. The VR application was streamed to the HMD with AirLink for improved performance. The application was run on a Lenovo ThinkPad T15G Gen 1 with a 2.60 GHz Intel(R) 6-Core(TM) i7-10750H CPU, 32 GB RAM, and an NVIDIA GeForce RTX 2080.

Virtual Environment: We used an open-source 3D model of a local university with a prepackaged Unity scene. We selected the university's central corridor and one of the main lecture halls for the location of the experiment. We selected the central locations at the campus to ensure they are familiar places to our participants. We implemented invisible blocking objects in the campus area to force the participants to stay within the study area. Figure 1 depicts the full virtual model of the university, in which the experiment takes place in one lecture hall (left) and a section of open spaces (right).

Atmosphere: The virtual university model is adjusted to have a sufficiently realistic atmosphere through lighting, the presence of other people, and sound design. Directional light is created outside window spaces. Lobbies, corridors, and the lecture hall have interior lighting in the ceiling. Shadows are created automatically by the engine and are configured to be soft shadows. The environment also contains the ambient sound of a crowd talking quietly, recorded at a real-life location.

Interactable Characters: The virtual characters can tell the collected hardship stories to the participant through VR headsets. Each interactable character is highlighted by a circle beneath them and a large interactable button on top of them (Figure 1). Pointing and clicking the talk button opens a dialogue window, where the participant can read the character's story (Figure 2) by pressing the 'continue' button. Each story is divided into short sections. The character goes through a simple animation loop while the participants read their story.

Two considerations were given for the characters in the context of our study. First, the visual appearance could influence the empathic response of the participants, so we opted to vary the skin color and gender of the characters. However, with five stories and five characters, we were unable to fully balance the appearance. Second, some consideration was given to creating an audio recording of each story, but the decision was made to include a text-only

story, as voice tone and style can also influence how participants react to the stories.

Besides the interactable characters, the environment also has non-playable characters (NPCs) with walking and talking animations. NPCs form either small groups or walk around the area following natural paths in that part of the campus.

Movement and Interaction: In the virtual university environment, we provided movement and rotation for the application instead of teleportation. Participants can move freely in the virtual environment using the joysticks for directional controls. The movement is blocked outside the area with interactable characters, and the lecture hall stairs are a slope rather than steps to prevent unnecessary motion sickness. All characters and environmental objects in the environment have collision enabled. When approaching the NPCs, the player can initiate the dialogue by pointing and clicking the corresponding buttons (see Figure 2) with the joystick triggers.

5 EXPERIMENT DESIGN

We designed a lab study to understand how international students' hardships could elicit empathy. The VR experiment had three main stages. In the first stage (15 min), after consenting to the study, the participant first completed a pre-experiment questionnaire on Google Forms.

In the second stage, the participant read a brief instruction on using the VR experiment that explained the task: (A) finding and visiting five virtual avatars in the university's virtual environment and (B) containing information on the VR headset and controllers, e.g., how to move in the virtual environment, and how to initiate a conversation with the avatars. After the briefing, the participants with HMDs completed the virtual experiment within 15 minutes in an XR lab (Figure 3). Finally, the participants were asked to complete the post-experiment questionnaire as previously. Subsequently, the researchers conducted a follow-up semi-structured interview (15 – 30 min). Every participant was compensated with a 10-euro gift card.

Questionnaires: Our pre- and post-experiment questionnaires aim to understand how the participants understand international students' hardships and how the dialogue featured with empathy affected the participants. To assess the effectiveness of the VR experiment, we used the same questions in the pre- and post-questionnaires: *How much do you know about the hardships faced by the international community in Finland?*, and *How do you evaluate the international community's QoL compared to yourself?* The first question rated the participants' knowledge and experience in discussing the international community's hardships on a 5-point Likert scale of 1 (Not at all much) to 5 (Extremely much). The second question inquired about the participants' awareness of the international community's QoL on a 7-point Likert scale of 1 (their QoL is much worse) to 7 (their QoL is much better).

Also, after the post-experiment questionnaire, we administered the Questionnaire of Cognitive and Affective Empathy (QCAE) [65] to measure the participants' empathic traits. The QCAE has 31 statements rated on a 4-point Likert scale of 1 (Strongly Disagree) to 4 (Strongly Agree). The responses for the different items are summed together to produce scores for the cognitive and affective
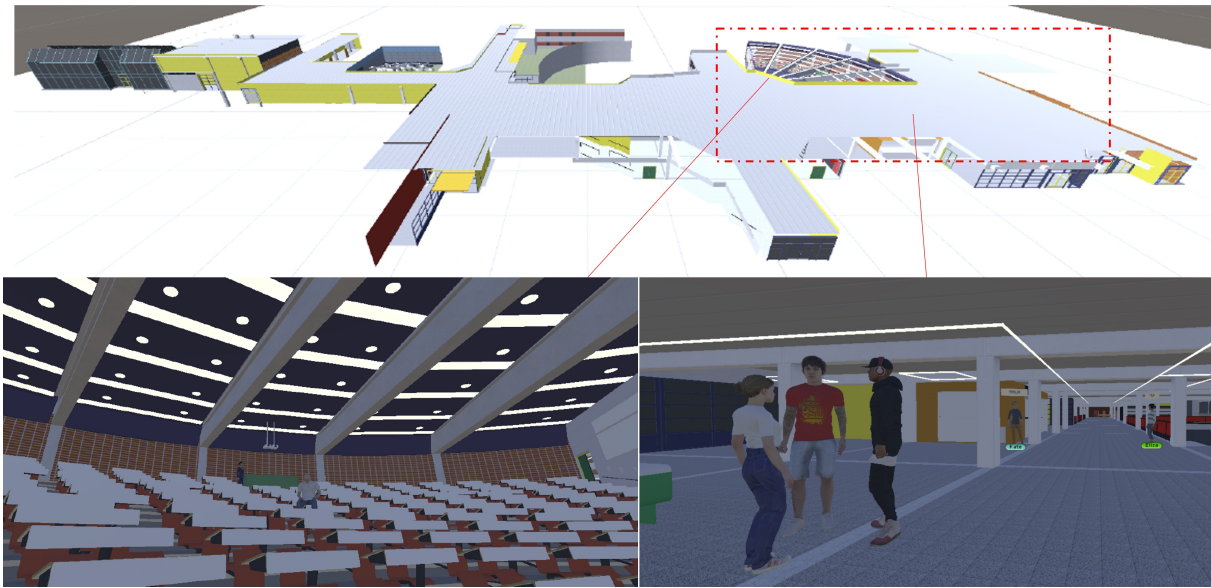
Figure 1: An overview of the university model focusing on the eastern end of the campus, next to a lobby area and a lecture hall, and NPCs interact with users in the lower area of the lecture hall (within the red square of dotted line).

Figure 2: The participants go through the hardship stories (story five shown) through a VR dialogue system.

Figure 3: The experiment setup with a participant exploring the VR experiment.

components and the total empathy score (items #1, #2, #17, and #29 were reverse-scored).

Interview: As the last step of the experiment, we conducted a semi-structured interview to inquire about our participants' in-depth reflections on several questions. Two authors conducted the interviews. One focused on taking notes, and another on the questions. The interviews were in English or Finnish, depending on the participant's choice. At the beginning of the interviews, we gave the participants a short explanation of the study and its purpose. We interviewed the participants with questions relating to four main themes: 1) their reactions to the VR experiment, 2) what they thought about the avatars' stories, 3) how they were affected by the VR experience, and 4) what they think about the technology being used in this way.
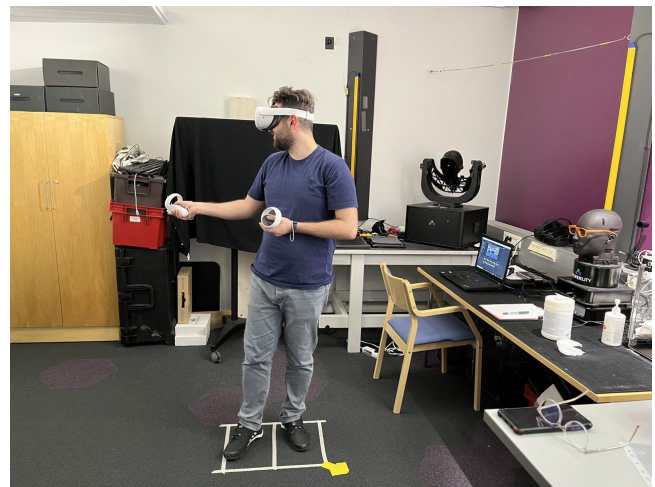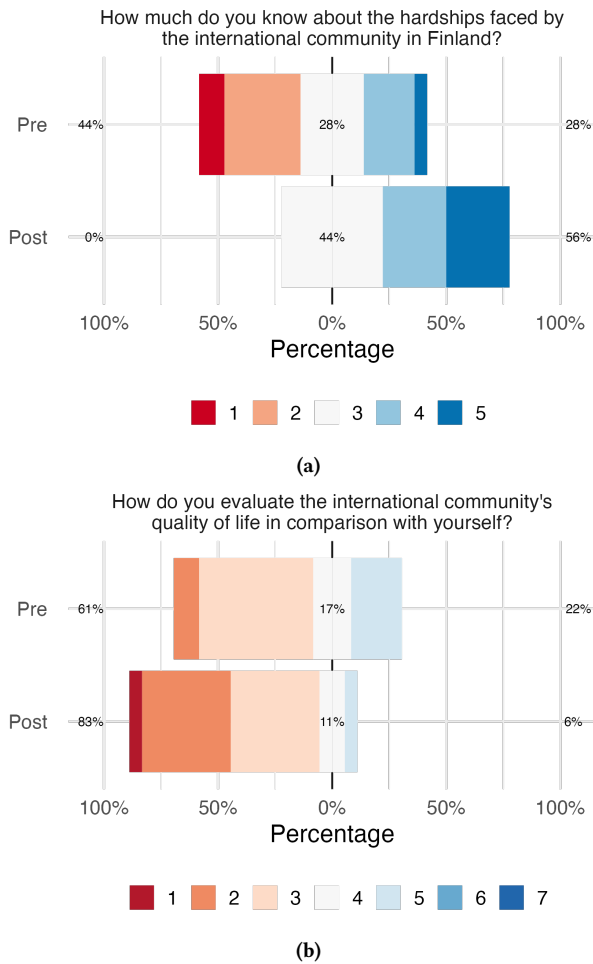
6 EXPERIMENT RESULTS

This section reports the participants' demographics, their responses during the experiments (e.g., pre- and post-experiment questionnaires), and their reflection based on the semi-structured interview.

6.1 Participants

From April to May 2022, we recruited 18 participants (11 females, 6 males, and 1 non-binary) from our university campus and their ages ($M = 23.3$, $SD = 3.7$) ranged from 19 to 35 years old. Also, 12 and 6 of our participants are BSc and MSc students, respectively. 11 of them are Finnish natives, while 6 are not. One participant

How much do you know about the hardships faced by the international community in Finland?

(a)

How do you evaluate the international community's quality of life in comparison with yourself?

(b)

Figure 4: Participants' ratings for the two questions pre- and post-experiment.

reports being half Finnish (i.e., either mother or father is a Finnish native). The participants' total QCAE scores ($M = 88.0$, $SD = 12.4$) ranged between 66 and 106. It is important to note that 31 and 124 are the lowest and highest possible scores in the QCAE. In addition, the cognitive component had a mean value of 52.6 ($SD = 8.6$), and the affective component had a mean value of 35.4 ($SD = 5.2$).

6.2 Questionnaire Results

Our participants answered two questions (Section 5) before and after the VR experiment regarding the hardships. As shown by the graphs in Figure 4, the experiment helped the participants to learn more about the international community's hardships (pre $M = 3.8$, $SD = 1.1$; $post$ $M = 2.8$, $SD = 0.86$; Figure 4a). Additionally, the experiment decreased the participants' perception of the international community's quality of life (pre $M = 3.5$, $SD = 1.0$; $post$ $M = 2.7$, $SD = 1.0$; Figure 4b).

6.3 Interviews and Qualitative Feedback

Based on the participants' responses during the semi-structured interview that follows Caulfield's guidelines [17], we present a deductive thematic data analysis [4], as the following categories.

6.3.1 The VR Experience and Experiment.

Impression: The post-experiment interviews mainly brought up positive responses from the participants. Several participants mentioned that the VR experience was impressive, surprising, and interesting, making them (re-)think about the hardships happening to the international community. For instance, P13 said: *"After the VR experience, I thought about the stories for a moment and just let my head process what I experienced."* and P12 stated: *"I was surprised that people get treated based on their nationality."* Moreover, several participants noted that the VR environment of the university increased the impression of the VR experience since the environment was familiar to them, and they could recognize where they were, as P7 emphasized *"locations felt real"*. However, it is worth mentioning that P16 was the only participant who stated that the VR experience was not impressive because of using controllers for movements, and that the player was perceived as the half size of NPCs, as participant P16 accomplished the tasks in a sitting posture.

Effectiveness: Our participants reflected on their opinions on whether the VR experiment did what it was designed to do or not. Many participants claimed that the VR experiment did its job and helped them to go through the experience. P15 noted in this regard: *"I did think that there was an actual person there telling their story, that the story came from that person."* Likewise, the VR experiment increased many participants' interest in the topic of the study. P18 stated during the interview: *"I felt like I would like to hear more about their experiences, and it was touching."* Three participants also mentioned that since the stories were indicated as text, they could not realize the necessity of employing VR or comparing the experiment with when they read the stories in an article.

Revision and Enhancement: We asked our participants' opinions on enhancing the VR experience. Three participants said we should employ voice-over for avatars to allow participants to listen to stories rather than read them. Several participants suggested enhancing the rotation system in the experiment since it caused them to feel dizzy. P10 noted that we need to improve the stories to make them more relatable to participants – *"More versatility in the story elements of the system."* Furthermore, several participants suggested improving the design of the VR experiment by adding more details to the environment, such as adding *L1* on the wall for the signage lecture room. Two participants mentioned that the dialogue box should be changed with subtitles to improve the readability of the stories, or we move the dialogues to the below of the avatars. Also, as P17 stated: *"Maybe there could be more body language"*, we should add more diversified animations to the avatars.

6.3.2 Reflection on the Stories.

Memorability: We asked our participants which stories and why they remembered most clearly. Several participants had emotional resonance with the stories that they experienced similar hardships, e.g., financial difficulties and finding a paid internship position.

Also, some participants related themselves to some stories since they had been there when a similar situation happened to others. In this regard, P8 noted about language: *"Many people mention how people change to Finnish and maybe some people dont understand the language. I could imagine myself being guilty of that."* Furthermore, some participants remember some stories more clearly because they knew another person who experienced that hardship. P20 brought an example in this regard as *"There was the one story about the bar experiencing harassment because I know a Brazilian person who has an afro who has experienced harassment in bars."* Other participants mentioned several stories since they found those stories harsh and shocking, such as our first story, about a German person who was called a Nazi. Also, some participants remembered the stories that they saw first and last, as they claimed. It is worth mentioning that mainly our Finnish participants mentioned the stories related to the language barrier as memorable stories.

Informativeness: Our participants elaborated on whether the stories included new information for them. Several participants stated that the stories contained many new topics and increased their knowledge – P18 noted: *"I got a feeling that international students have things worse than you might think. When you see them in a big group at the university, you might not necessarily think they have issues with being lonely or having money."* Also, some participants expressed that they knew about some topics beforehand. However, the VR experiment told them new aspects of hardships they had never experienced or known about them, such as waiting for a long time for a resident permit. In contrast, two participants mentioned that the experiment was not informative to them since they already knew about the topics of the stories and the happening of these hardships. P17 said about this point of view as follows: *"Not really, when in primary school there were a lot of discussions about this. Half of the students didn't speak Finnish natively, and they told similar stories."*

Realisticness and Plausibility: Our participants express their thoughts regarding the realisticness and believability of stories. Most of the participants mentioned that the stories were realistic and believable for several reasons, such as having familiar and varied topics and having good details in the stories. P1 noted this matter as *"Felt like chatting online"* during the interview, and P11 stated: *"They sounded like realistic events, things that actually happen to some people."* However, three participants, such as P3, mentioned that some stories were hard to believe since they had no similar experiences. This participant stated this opinion as follows: *"However if you haven't faced these kinds of things, (it) is more difficult to believe it has happened before."*

6.3.3 Influence on Empathy.

Empathic Awareness: Our participants elaborated on their empathic awareness and how the experiment affected them. Most participants mentioned directly that the VR experience increased their understanding of the hardships and the study topic. P01 noted during the interview: *"I've always known that there are some difficulties, but I have not thought about the scale of the effect on one's daily life."* Furthermore, increasing empathic awareness regarding the international community's hardships allowed some participants to review and express their opinions in this regard. For instance,

P11 stated the following view: *"Maybe I'm living in some form of bubble where the people I know are more open. I suppose it's easy for me to forget that not everyone thinks of minorities in the way I do."* More importantly, some participants knew about these hardships, but this study reminded them of these issues. P17 said: *"The VR experience increased awareness and brought back the discussions I had many years ago. I haven't got a daily reminder of them. It reminded me of the issues people have."* Many participants expanded their responses on the topic and discussed their opinions on avoiding these hardships.

Empathic Reaction: We asked our participants about their empathic reactions during the interview, analogous to what P14 brought up: *"Could we on some level react better to these issues? For example, if you were in a situation where these things happen, you would react immediately and not just let them happen."* Many participants expressed that their empathic reactions would depend on the situation, the context and topic of the hardship, and their relation with the person who experienced it. Several participants started their responses with phrases such as *"I don't know"* or *"It's hard to answer"*. In contrast, some participants mentioned that they would attempt to help, be a good listener, ask more about what happened, and be empathic such as P10 mentioned: *"But I would not judge either the person being the target of the hardship or the person who is the 'cause.'"* Some participants also noted that these reactions would be general and are not limited to when someone tells them about the hardship experienced. For instance, P13 stated that: *"Whenever I interact with exchange students or international folk, I try to take them into consideration and create a sense that they belong in the group."*

6.3.4 Benefits, Technology, and Going Forward.

Stakeholders and Beneficiary Groups: Our participants explained different types and groups of people who would be benefited from this VR application if we develop it further. Some participants expressed that generally, anyone could be in the beneficiary group, as P10 stated in this regard: *"Limitless scope. You can raise awareness in anyone. Just being exposed to these hardships will improve people's understanding and awareness."* Nonetheless, several participants claimed that this system could be more beneficial for natives or, in more detail, for people who have not been in touch with foreigners. P01 noted this opinion as to the following statement: *" People who haven't been in contact with different cultures would likely be the ones to benefit most."* In contrast, some participants mentioned that this system could help international people become familiar with the situation and reflect their issues to others.

Furthermore, several participants discussed this topic with a distinct view of point. Some mentioned that official authorities and responsible organizations could benefit greatly from this system. For instance, responsible persons at the university and immigration authorities could help international students to get their resident permits if they become aware. Likewise, several participants expressed their opinions about how this system could be helpful for younger people or vice versa. They claimed younger people benefit more from this system since they would be more interested in game-like experiences and could be used in societal studies at schools. In

this regard, P14 noted: *"Even if the kids don't fully understand the matters or can relate to everything, it would still be instructive."*

VR Usefulness: During the interviews, participants discussed the advantages and disadvantages of employing VR technologies in this study. They elaborated on their opinions by sharing their experience during our experiment. Most participants agreed that VR was a promising approach for this study since it has more impact than other approaches with similar attitudes, such as reading from a paper. P9 also stated: *"It was far better than reading some texts from a screen."* Similarly, P19 noted that *"You can see the environment, and you can go by yourself. It is more interesting than on a paper or a website."* Analogous to that statement, many participants mentioned that being in the interactive virtual environment helped them connect better with the stories and avatars.

Technology Utilization: We asked our participants to express their ideas regarding approaches to using technology to communicate our topic to a broader audience. Several participants mentioned that VR is a promising technology for raising awareness of hidden issues. P12 noted: *"I think the virtual space makes the experience more memorable."* Nevertheless, many participants claimed that VR is not yet generally accessible to everyone, making it difficult to reach a vast audience. Therefore, some participants suggested several ways on publicly available platforms, such as video games, movies, and documentaries. Some participants also mentioned new enhancements to achieve better to a large audience. For instance, P16 suggested translating the stories to Finnish to ensure everyone could understand them. Also, P18 brought an idea to share the stories in public spaces such as bus stations.

7 DISCUSSION

Significant efforts compared VR with other media technologies and named VR the ultimate empathy tool [2, 3, 69]. VR is practical and impactful in enhancing human empathy [62], especially when conveying abstract yet emotional messages to audiences [60, 64, 78], making the audience empathic or sympathetic [64]. Other work showed that participants would be sympathetic and might even be offended if they were the person who was experiencing the situated empathy [64]. Being sympathetic might cause effective feelings such as anger which is not the purpose of the study [76]. In this case, analogous to some prior works that other researchers have done, the VR application makes participants empathic since they read the stories and put themselves in the person's shoes [16, 42] who experienced the hardship [16, 56].

The results of the experiment questionnaires indicated that the average participants' responses to their knowledge and tendency to discuss the hardships increased by 1.05 and 1.11 on the 5-point scale, respectively. Likewise, the results showed that they rated the international community's quality of life worse after the experiment by decreasing the average of responses by 0.77 on the 7-point scale compared to themselves. Evaluation of the follow-up interview responses presented enhancement in participants' situated empathy and awareness about the hardships of the international community. It also indicated mainly positive considerations on the VR experience's believability, the stories' plausibility, and the impact of VR as a promising technology in fostering empathy.

In this study, we collected several hardships that the University of Oulu's international community faces during their lives and studies in Oulu through a survey. It is shown in much research that VR is a promising approach compared to other technologies to put people in others' shoes to showcase their hardship experiences [16, 42, 46], particularly for empathic and challenging issues such as social problems [20, 56]. Therefore, we used collected stories to develop a VR experiment to showcase the hardships to mainly local participants to measure their situated empathy.

The QCAE is a recent quantitative technique to measure people's cognitive and affective empathy [65]. Also, semi-structured interviews allow participants to reflect on a topic in-depth [25, 83]. We used quantitative and qualitative methods such as the QCAE, pre-experiment and post-experiment questionnaires, and semi-structured interviews to measure the situated empathy in participants.

In this chapter, we first revisit the thesis objectives and research questions and elaborate more on our results compared to related efforts. Then, we explore the thesis stakeholders and significance to our organization and society. Then, we reflect on several VR-related issues in design and implementation based on the participants' interviews, research literature, and the author of the thesis insight. We also explain the key limitations of the thesis and conclude this chapter with an introduction to our future work.

7.1 Key Implications

First, our study successfully probes the hardship stories and answers '*RQ I: What kind of hardships are experienced by the international community in Oulu?*' After the data collection phase, we conducted thematic data analysis on the collected hardships. We revealed that many international members suffer from these difficulties, including Social Problems, Language Barriers, Bureaucracy, Racism, Job Seeking, Financial, etc. Some participants also described that these hardships affected their welfare and mental health. For instance, one participant visited a therapist due to depression and stress. It is important to note that depression, anxiety, and post-traumatic stress are exposed by researchers as possible outcomes of immigration's hardships [53]. Also, there has been a debate that adapting oneself to an entirely new place with a different culture, language, and society's behavior might lead to mental problems and affect employment, social status, and integration [47]. By leveraging VR as a transmedia, our discovery can promote the hardship of new arrivals and inform the native members to show a helping hand to their situation.

Second, our work examined '*What effects of communicating the hardships of the international community have on the local participants?*' Our questionnaires' results indicated that participants' knowledge and understanding of the hardships happening to the international community increased on average after the VR experiences. Also, it showed that participants would like to talk more about these issues with others. Qualitative methods in measuring situated empathy are impactful since it allows researchers to understand participants' insight in-depth [25, 83]. It is a common issue that some participants might have lacked attention during the study [55]. Conducting interview help researchers alleviate this issue [25].

Interviews would let researchers ask many open-ended questions that might be left blank in questionnaires [25].

Finally, our paper responds to '*How suitable is VR as a technology in communicating hardship experiences of the international community to the local participants?*' As evident in the interview results, many participants expressed that the stories were believable and plausible. They also noted that the experiment was practical in understanding the international community's hardships due to being in an alternative environment and interacting with NPCs.

It has been debated that VR enhances human empathy more effectively than desktop monitors or videos [20, 56]. Likewise, several participants mentioned reading those stories in the virtual university environment was better than reading text on desktop monitors and articles. Potentially, VR has indicated a more substantial impact on enhancing empathy compared to other technologies to showcase content regarding others' hardship experiences as it can simulate an environment for experiencing situated empathy [16, 20, 42, 56]. Our participants reflected on what technologies could be used to communicate these issues with the audience and further suggested VR as the most impactful approach to allow the audience *to be there* while experiencing the situated empathy, which aligned with prior work's advocates for using VR for empathic purposes [2, 3, 40, 50, 69].

7.2 Exploring Empathic Support from Stakeholders

Overall, this work increased our local participants' knowledge and tendency to discuss these hardships. Presenting the hardships that several of Oulu's international community members experienced through a VR application enhanced empathy with a positive attitude in the audience. Our local and international participants expressed that the VR application helped increase their awareness during the experiment. The empathy enhancement in both local and international audiences helps better understand the other side. For instance, the people would offer greater support to the international community to integrate the local community smoothly. On the other hand, our system can serve as a starting point and a guideline for international members. They would know how to react better in hardship situations, such as understanding cultural differences and thus achieving expectation management.

Likewise, this application can increase local people's awareness of the international community's hardships, particularly helping those with lesser contact with the international community. Also, as some participants suggested, it can be used in education institutes to let young people put themselves in the international community's shoes to increase their situated empathy and knowledge regarding these hardships. The university campus working on internationalization and other related authorities, such as immigration offices, could be aware of these hardships through this application. For instance, the university authorities can hold more programs to help international students integrate with Finnish students. Meanwhile, the immigration authority can accelerate the issuing of resident permit procedures with the help of the university.

7.3 Limitations

The process of gathering data on locals' hardship experiences for communication and empathy was successful, which motivates future work to assess the effectiveness of the method. The presented study is limited by a lack of baseline condition that could improve the analysis of the results. Related to this, future studies can explore how different immersive media (as often explored, cf. [12]) or the situated aspect affects communicating these local hardships.

Participant profiles in both the story collection and VR experiences can influence ecological validity. Our hardship stories represent 40 international members from 20 countries but the topics of hardship may vary if we could acquire more participants. In addition, the choice of a city for stories and local participants could impact the study results.

Online engagement for collecting hardship stories could be less engaging than in-person story collection [85]. Online collection process is more susceptible to missing highly private experiences, e.g., financial difficulties [21, 22], or when their experiences might affect their lives, e.g., in cases of racism or social harassment [10, 63].

For qualitative study and participant interviews, prior work regards 5 – 50 participants as a sufficient number [26]. Our study is subject to a relatively homogeneous population, and data saturation could occur with only 12 participants [5, 82]. Our sample of 18 participants could lead the investigation to variability and uncovered biases, compared to larger sample sizes [75].

8 CONCLUSION

Our work promotes the understanding of immigrants' hardship by communicating such hardship stories through VR. Our two-stage approach explored situated empathy regarding the hardship experiences the international community faces during their studies and lives in Oulu. We first surveyed the hardship stories of 40 participants from diverse countries and backgrounds and summarised five representative stories based on the ten common issues (e.g., language barriers). Accordingly, we developed a dialogue-based and interactive VR environment to enable the empathy experience, in which several NPCs describe the hardship experiences as stories to our participants. The final evaluation with 18 participants, who primarily were Finnish natives, had made effective responses to their knowledge and tendency to discuss the hardships reflected by QCAE and user questionnaires. In addition, the participants think that the empathy experience generates believable and plausible stories, implying that VR effectively fosters empathy. The development of the situated empathy experiment motivates future work to explore how different media and situatedness affect the experience of virtual empathy for communities.

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