

# Twilight Rohingya: The Design and Evaluation of Different Navigation Controls in a Refugee VR Environment

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**Abstract**—Virtual reality (VR) has shown great potential in enhancing users' empathy towards vulnerable populations. Previous work has demonstrated that navigation modes relaying different spatial information can affect a user's presence and understanding. In this research, we designed a 360° VR video-based prototype environment to depict real-life scenarios of a refugee camp in Southern Bangladesh. Our study consists of 2 conditions: active (i.e., selecting thematic video clips freely) and passive (i.e., watching sequence-determined clips passively). Thirty-six participants evaluated the prototype's usability and its effects on their empathy towards refugees. The results showed that active navigation resulted in higher kindness and usability scores. Finally, we provide empirical insights into navigation modes in future VR design. This research should help refugee groups receive more attention and promote recognition and empathy towards refugees and their families.

**Index Terms**—Virtual Reality, Navigation System, Refugee, First Person Perspective

## I. INTRODUCTION

According to the United Nations High Commissioner for Refugees (UNHCR), the total number of refugee groups has increased and their living conditions lack attention from the general public [1]. This is especially true for Rohingya refugees, who live with scant resources in Southern Bangladesh. Researchers have underscored that refugees face challenges that impact their health and well-being with noted discrimination and bias [2].

Virtual reality (VR), known as the "ultimate empathy machine" can enhance empathy for vulnerable populations [3]. Among VR technology, 360° video, has the great impact on understanding the content and making people feel immersive [4]. Previous research has also used VR to reveal the living conditions of refugees, including *Clouds Over Sidra*, a 360° documentary film that introduced refugees' lives by following a Syrian girl from her first-person perspective (FPP) [5], and another VR film, *Waves of Grace*, which enabled viewers to explore the life of an Ebola survivor in a refugee camp [6]. While these projects provided insights into the lives of refugees, they did not investigate whether these experiences enhanced people's empathy towards refugees. They also didn't study the immersiveness and the effect of active exploration in VR.

Allowing users to experience VR in an active way has positive effects on enhancing memory [7], improving spatial knowledge acquisition and increasing the immersiveness [8]. Previous work inspired us to study how different navigation modes with the FPP can affect users' empathy towards refugees in VR. Thus, our research questions are:

- 1) What are the effects of exploring refugee camps freely versus watching sequence-determined clips on participants' empathy towards refugees?
- 2) How does the usability of these two experiences differ in VR?

To answer these research questions, we recruited thirty-six participants and conducted a between-group study. We used the System Usability Scale (SUS) [9] and the Compassion Scale (CS) [10] to understand the effects of different VR navigation modes on empathy towards refugees by comparing two conditions: Active Navigation (AN) and Passive Viewing (PV). We also evaluated participants' donation behavior by allowing them to choose between accepting experiment compensation or donating the equivalent amount to a refugee camp. We then conducted a semi-structured interview after the study.

As a primary contribution, this research provides empirical evidence that experiencing through FPP in both active and passive navigation while consuming 360° VR videos can enhance empathy and that active navigation results in higher kindness and usability ratings. In addition, it provides implications that applying active navigation in VR can enhance the understanding and acceptance of refugees and promote empathy towards refugees and their families.

## II. RELATED WORK

The development of our prototype and the design of our studies was inspired by research on refugees, navigation design, and increasing empathy for vulnerable people through 360° films in VR.

### A. The Refugee and Developing Empathy in VR

As defined by the UNHCR, a refugee is someone who has been forced to flee their country due to persecution, war, or violence [11]. When this occurs, the general public often fails

to provide timely assistance to refugees due to unawareness or bias. Since the Rohingya crisis in Myanmar in 2016, violent clashes have left more than 250,000 in exile, resulting in the fastest-growing refugee crises for humanity in recent decades [12]. Rohingya refugees live only at a near-subsistence level, and the Bangladesh government has portrayed them as militants and self-serving outsiders who seek to exploit the country's resources and these stigmas make them less likely to get empathy and assistance [13]. One of the most common methods that has been used to raise awareness about refugees has been to create films. Many of the narratives in films about refugees are, however, based on scripts, and while these films do shed light on the physical and emotional impact that being displaced or fleeing can have, audiences are watching scenes from a director's perspective rather than their own.

VR experiences have been found to enhance empathy for vulnerable populations, such as biases due to race, gender, age, or refugee status. [14]–[17]. Unlike the high-fidelity artistic representations of refugees, albeit from a distant and static perspective, the researchers adopted dynamic movement and spatial audio to present unscheduled panoramic footage in an immersive VR environment that evokes empathy with the viewer [18]. Researchers have also found that shifting users' perspectives to non-player characters can directly enhance their empathy and subsequent prosocial behavior in the real world [19].

Previous work, *Clouds Over Sidra*, a 360° documentary VR film introduced refugees' lives by following a Syrian girl from her first-person perspective (FPP) [5], and another VR film, *Waves of Grace*, enabled viewers to explore the life of an Ebola survivor [6]. These works inspired us to present refugees' living conditions through a FPP in VR to enhance people's empathy for refugees.

### B. Active versus Passive Navigation in VR

Several theories have been used to justify the use of different navigation modes in VR. For example, Wilson et al. [20] presented a mode of psychologically active navigation in which the subject could freely explore in VR. Sauz on [7] suggested that active navigation can benefit object recognition and relational processing because it involves planning skills. In the gaming domain, Ferguson [8] found that navigating freely encourages users to onboard more spatial information and further explore environments. Another study by Cao et al. [21] also found that people in active exploration conditions find treasure hunting more difficult due to the intensive acquisition and spatial knowledge processing required. As noted above, 360° videos have been used to explore the lives of refugees via panoramic and omni-directional views [22], which enables viewers to explore more details compared to two-dimension fields of view. However, most 360° videos present content as a narrative documentary, which prevents viewers from being able to interact with the content. Thus, We propose the hypothesis that active navigation increases people's empathy by providing more spatial details and allowing them to freely



Fig. 1. The 3 phases of the prototype during the AN condition.(a) On-boarding: An introduction of the system, (b) Landscape: Navigate the refugee camps via the panoramic landscape, (c) Location Exploration: Watching the 360-degree videos about a selected locations.

explore the provided environments with their own eyes rather than a third-person perspective.

## III. TWILIGHT ROHINGYA

To better understand the role of different navigation modes on empathy development, we created a prototype called *Twilight Rohingya* that allows users to explore the living conditions of the Rohingya refugee camp in VR.

During the experiment, participants wore a Splaks Google Cardboard V2 attached to a HUAWEI Mate 20 Pro mobile phone (6.39-inch OLED display 3120 x 1440 pixels, 19.5:9 aspect ratio). The video used in the PV condition was edited using Final Cut Pro. The prototype used in the AN condition was developed with Unity.

The designed VR environment consisted of 360° video clips that were taken from the FPP of a refugee boy and shot by one of our authors. The clips documented daily activities in a Rohingya refugee camp in Dhaka, Bangladesh, such as climbing hills and playing football. Five locations were selected and edited from a collection of 61 clips into five clips that were ten minutes long in total (e.g., two family scenes, a shared kitchen, a playground, and a bridge). The PV condition played the clips in a pre-determined order, while the AN condition enabled participants to explore the entire VR scene freely, and view entire VR scene freely via our website<sup>1</sup>.

During the AN condition, the system allowed for direct navigation through a panoramic landscape, which follows the workflow: on-boarding (Fig. 1a), landscape (Fig. 1b), and location exploration (Fig. 1c). The user started by reading an introduction to the navigation method. A navigation map was also displayed, indicating the position of each location before the corresponding video began. A landscape then reflected the natural features of the refugee camp with details that could help users perceive the living conditions of refugees. Users could explore the different scenes, which were highlighted by indicators, by triggering a raycasted pointer that was controlled by the user's head movements. The location exploration method allowed participants to choose content without the need for additional input devices.

<sup>1</sup><https://twilightrohingya.com>

## IV. METHOD

The study used a between-group study design to understand the influence of navigation mode, either active navigation (AN) or passive viewing (PV) condition, on empathy development.

### A. Participants

Thirty-six participants were recruited to participate in the study (i.e., 11 employed individuals and 25 students; 20 female and 16 male; age: 25 years, std: 5 years). All participants had normal vision or wore contact lenses. Twenty-three participants had previously used VR devices. Participants were informed of the study's purpose and procedures and asked to sign an informed consent form before participating. The study received IRB approval from Duke Kunshan University. Participants were assigned to one of two conditions after their demographic information was collected. Participants were then asked to don the VR headset and adjust it so it was comfortable.

### B. Instruments

In a post-experience survey, empathy development was measured via the Compassion Scale (CS; i.e., the kindness, indifference, and separation categories) and usability via the System Usability Scale (SUS).

1) *The Compassion Scale (CS)*: Researchers introduced implicit attitudes as a manifest of actions or judgments that are under the control of automatically activated evaluation, without the performer's awareness of that causation [23], and other researchers suggested that compassion was operationalized as experiencing kindness, a sense of common humanity, mindfulness, and lessened indifference toward the suffering of others [10]. Therefore, to examine how participants experience refugees' living conditions and their empathy toward refugees the Compassion Scale was used to measure three categories (i.e., kindness: being caring toward and concern for others who are in pain, accompanied by the desire to support those in need; indifference: the manifestations of emotional responding, and separation: the manifestations of cognitive understanding).

2) *System Usability Scale (SUS)*: SUS: a robust and reliable evaluation tool which correlates well with other subjective measures of usability [9]. Ten items with a five-point Likert were adapted to measure and analyze the usability of the prototype.

3) *Donation Behaviour*: Herrera et al. suggested that one method to measure prosocial behavior is to provide participants with the option of donating their compensation to a charity and determine how many participants actually opt to do so after an empathy test [24]. Following this method, we provided vouchers of 10 euros or 100 CNY as compensation to participants and gave participants the option to accept the voucher or donate the equivalent amount to a refugee camp in Dhaka, Bangladesh [25].

4) *Semi-structured Interview*: After the conditions concluded, we first asked about participants' experiences of, and feelings toward, using VR devices in the past and the differences they noted in our experiment. Additionally, we referred to the User Engagement Scale [26] and designed questions to investigate how participants felt about the VR aspects of the experience. We had additional questions for participants in AN condition, e.g., Where do you start exploring when you accessed the interface?, In what order did you watch the videos, and why did you make that choice?, Did you repeat or cut a short scene?, etc. Participants were also asked to summarize their implicit bias against refugees, including their previous means of understanding them and whether they had donated to vulnerable groups in the past.

## V. RESULTS

First, we report on the quantitative results of the CS and SUS. Then, we summarize the results of the donation behaviors and the interview.

### A. Quantitative Results

Participants scored slightly higher on kindness in the AN condition than the PV condition, but the difference was not significant ( $t = 1.6587, p = 0.1069$ ; Fig.2(a)). On the SUS, participants rated the AN condition ( $Mean = 68.4, SD = 7.8$ ) slightly higher than the PV condition ( $Mean = 65.0, SD = 6.6$ ; Fig.2(b)). However, the AN condition was expected to receive a higher rating because it enabled participants to choose their viewing path. When asked if they would like to donate their compensation to the refugees through a non-profit organization, 19 participants (53% across both conditions) chose to donate all of the money, 15 participants chose to donate part of it, and two chose not to donate at all. Participants in the AN condition gave an average of ¥66.47 ( $SD = 39.2$ ), while those in the PV condition gave ¥70.58 ( $SD = 37.6$ ).

### B. Interview Results

Two authors coded the post-experiment interview data to better understand the effects of different navigation modes on empathy. We generated a rich description synthesizing users' empathy with refugees' lives that they witnessed in VR.

***The sense of immersion is stronger with 360 VR videos.*** According to data, eleven AN condition versus five PV condition participants thought the experience was immersive. Six participants from the PV condition said that the controllability of the VR system was better than their previous experiences with two-dimensional displays. P8 (AN) offered feedback: "There was a boy who kept looking at me. I felt like he was talking to me and he wanted to guide me" .

***The experience changed biases against refugees.*** Based on feedback from the questions "Have you ever seen any videos or films about refugees before?" and "How do you think what you saw today is different from the previous videos?", twelve participants (34% of both conditions) said their bias towards refugees had changed and their empathy for refugees had been

enhanced after the VR experience. Some participants reported that “*The news is full of reports of refugees fleeing the war, but that’s not all, what we see today is their daily lives*” [P11, P23, P33 (all in the PV condition)]. There was also agreement that the VR experience was closer to the refugees natural life, “*The films I had seen were more artistic, and what I see today is closer to life*” [P19 (PV), P28 (AN), P30 (AN)].

**Stronger empathy in active navigation mode.** Participants in the AN condition exhibited less bias and stronger empathy than those in the PV. Compared with the participants in the PV condition, who focused more on the details of the videos, those in the AN condition said that they thought more about the living conditions and future development of individual refugees. Nine participants (53%) from the AN condition said they were worried about health care, education, and child growth in the refugee camps. P22 noted that they were “*concerned about the poor hygienic conditions and worried about diseases and infections.*” Other participants had similar feelings: “*I grew up in a poor and underdeveloped part of China. Children were not well educated there, and so I care more about their educational opportunities*” [P18]. By comparison, participants from the PV condition did not report similar sentiments and focused more on the natural environment in the camp.

### C. Donation Results

Based on the interview results, more than 53% of participants chose to donate all of their compensation out of humanitarian concern for the vulnerable. Participants who chose not to donate or to only donate a small amount of money were less than 20%. This behavior may have been because Rohingya refugees have a greater psychological distance from the other participants, who belong to two different ethnic groups [27], [28]. Thus, when asked about their donation amount, some participants indicated that they felt that what they could provide was insignificant and that they were reluctant to donate.

Three participants in the AN condition also commented that they donated before the study. One of these participants told us she donated a fixed amount regularly and this time she wanted to maintain her habits so she only donated 80% of her compensation. As a result, there is a significant positive correlation between the level of their giving and their income [29], [30]. The donation amount from the AN condition was lower than the PV condition likely because participants would consider other factors such as income and giving levels when making donation decisions.

## VI. DISCUSSION AND CONCLUSION

This research explored the effects of different navigation modes in 360° VR videos on enhancing empathy for refugees. Despite no significance being found with the Compassion Score ratings, the AN condition showed higher kindness scores, and higher usability scores in SUS, compared to the PV condition. One possible reason is that participants received pre-recorded video information without interacting with the environment in real-time to make decisions and thus ignored

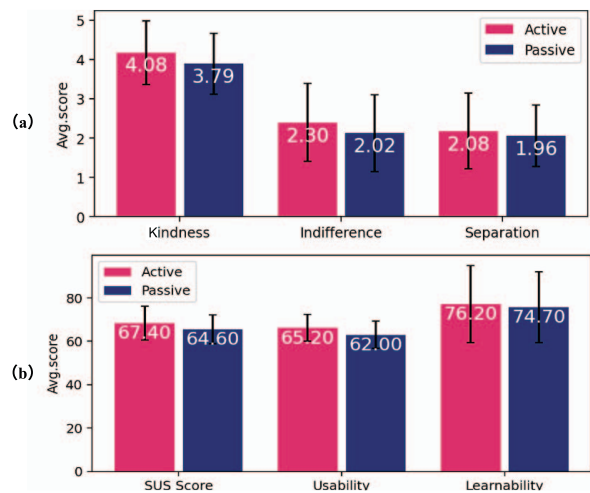


Fig. 2. (a) Means and standard deviations (error bars) of Kindness, Indifference, and Separation) of the CS. (b) The average SUS score, usability score and learnability score of the an condition was higher than the PV condition.

the need to use their planning abilities [7]. The experience reduced the opportunity to consider the temporal experience of the situation from the perspective of the boy involved. Additionally, the interview results suggested that empathy was stronger and implicit bias was less in AN condition.

The results also suggested that immersion in the 360° video was more salient compared to traditional two-dimensional displays, similar to prior hypotheses by Ferguson [8]. Taking the video content into consideration, our VR environment was based on on-site footage shot by one of our authors, which was created by inviting the refugee to control the camera with dynamic movement and spatial audio. Therefore, viewers could experience the daily life of refugees from their perspective rather than through the high-fidelity lens of an art director.

In terms of limitations, the study videos were also pre-edited and the footage depicted restricted content from a single refugee camp. Thus, in the future, collecting more diverse materials should be considered. We also only conducted a post-test study, therefore, future studies should compare pre-test and post-test results and apply mixed instruments such as the implicit association test (IAT) [23] or measure biomarkers such as skin conductance, heart rate, or reflex response times [31].

In summary, we designed and developed a VR prototype with active navigation that presented 360° videos about life in refugee camps. We conducted a study to understand how different navigation modes during VR experiences influence participants’ empathy towards refugees. We found that active navigation had positive effects on empathy for refugees. We believe that this work should encourage researchers to study empathy for refugees through diverse interaction approaches (i.e., navigation modes), including the tie between immersion and donation behaviour. Thus, refugees will receive more attention and this will enhance recognition and promote the acceptance of refugees and their families.

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