

On the Plane: A Roleplaying Game for Simulating Ingroup-Outgroup Biases in Virtual Reality

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Abstract—Many conflicts emanate from failure to understand others’ perspectives. Computationally supported roleplaying games have the potential to promote successful perspective taking. When implemented with the affordances of virtual reality, nuances of embodied communication in roleplaying can be more robustly modeled. In this paper, we describe the design and development of a roleplaying game aimed at simulating ingroup-outgroup biases with the goal of supporting positive perspective taking in virtual reality: *On the Plane*. The game presents players with a simulation of air travel experience, from airport security screening to in-flight events. *On the Plane* affords the ability to experience the simulation as different characters, supporting both ingroup and outgroup perspectives. We describe how the game is structured to simulate and challenge ingroup-outgroup biases within the context of xenophobia and lay out our plans for future research using *On the Plane* to promote positive perspective transformation (e.g., challenging one’s own ill-founded preconceptions).

Index Terms—perspective taking, VR empathy, ingroup bias, outgroup bias

I. INTRODUCTION

Ingroup-outgroup bias is a social phenomenon in which individuals tend to exhibit differential treatment and perception of others based on their assumed social category membership [1]. Ingroup bias is usually manifested through favoring members of one’s own social category over others and considering them more valuable and important than others. Outgroup bias presents itself in the form of evaluating members of other social categories more negatively and usually involves some sort of discrimination against the outgroup members.

Perspective taking, which involves deliberate appraisal of others’ viewpoints, experiences, and emotions, has been shown to reduce conflicts arising from ingroup-outgroup biases [2]. Because they can engagingly encourage people to take on roles outside of their typical experiences, roleplaying games (RPGs) can be harnessed to support and promote successful perspective taking [3] and have been shown to be effective in this endeavor [4].

One increasingly promising conduit for promoting perspective taking is virtual reality (VR) [5], [6], which provides individuals with the ability to interact with computer-generated three-dimensional virtual environments and objects. Because they enable individuals to embody virtual characters, experience events from a first-person perspective, and feel a sense



Fig. 1: A scene from *On the Plane*. Sarah is the hijabi woman on the left, and Marianne is the Caucasian woman on the right.

of actually inhabiting the virtual world, VR experiences offer tremendous potential for inducing and improving empathy for others, thereby supporting positive perspective taking [7], [8]. In fact, VR perspective taking has been shown to reduce implicit and explicit biases against people of color [5], [9], to increase empathy for the homeless [10], and to improve appraisal of the emotions of victims of domestic violence [6].

Capitalizing on previous research and the unique affordances of VR, we developed a roleplaying game for simulating ingroup-outgroup biases in VR, *On the Plane*. In this paper, we present an overview of the structure of the VR simulation and describe our plans for using *On the Plane* as a testbed for studying the effects of perspective taking on ingroup-outgroup biases in a variety of contexts. Our hypothesis is that perceptions of ingroup-outgroup membership are malleable through roleplay experiences and that shifting perspectives such that outgroup members are perceived as ingroup members can yield positive effects toward understanding.

II. THEORETICAL FRAMEWORK

Following Mezirow’s approach to perspective transformation, our simulation is designed to promote “critical self-reflection”, wherein individuals engage in deliberate reevaluation of the assumptions and preconceptions that shape their thinking and attitudes about certain topics, people, and/or events [11]. Mezirow asserts that it is through such critical reflection that individuals can transform their perspective in a positive direction by challenging their assumptions germane to epistemic, sociocultural, or psychic issues [11]. Therefore, our roleplaying game simulates various ingroup-outgroup biases

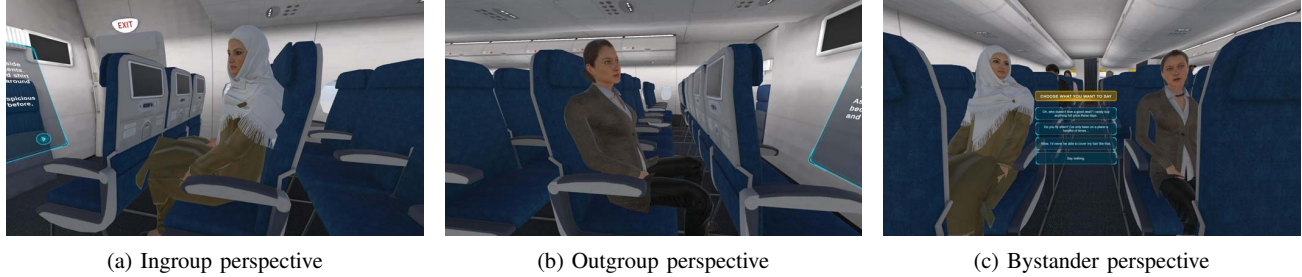


Fig. 2: Roleplaying perspectives. Players are oriented to assume their corresponding role and experience the simulation from that character’s perspective. In the bystander perspective, players are oriented to assume the role of a flight attendant who is witnessing an exchange between two passengers.

and seeks to involve players in critical reflection. To achieve this goal, our simulation presents coda clauses at the end of the experience, which are based on the players’ choices and alignment with the characters. Coda clauses also specify how the players’ choices affected the characters’ states throughout and at the end of the game. Players are then asked to reflect on their experience using open-ended questions and validated survey instruments.

To support and promote successful roleplaying, our roleplaying scenarios are designed based on Yardley-Matwiejczuk’s roleplay induction principles [12], including *Particularization*, *Presencing*, and *Personalization*. The first principle, *Particularization*, refers to providing players with all details about a particular roleplaying scenario. Therefore, our orientation and entrance clauses provide detailed descriptions of the airplane scenario by explicitly specifying the background of the characters (e.g. “You are Sarah, a Muslim woman born in Indianapolis, IN. You travel frequently for work...”). The second principle, *Presencing*, involves making the roleplaying scenario familiar and realistic to the player. We incorporate the second principle into the simulation by situating the players in the context of the trip (e.g., “You just visited family in Indianapolis and are on your returning flight to Newark, NJ...”). The last principle, *Personalization*, refers to the extent to which a particularized scenario incorporates player-provided content. Our simulation supports personalization by providing players with the affordances of changing character names, specifying trip details (e.g., departure/destination cities), and editing the appearance of avatars prior to the onset of the simulation. The simulation can then be dynamically updated to use player-provided details in the scenario.

III. VR SIMULATION

As a topical case study, we modeled our ingroup-outgroup conflict scenario after the increasing xenophobic attitudes and behaviors against Muslim people in the U.S. political climate [13]. Regardless of their immigration status, Muslims are often treated as outsiders in the U.S. and experience overt and covert forms of bias and discrimination [14], [15]. Our VR experience simulates the travel experience of two women from different

backgrounds, namely Sarah and Marianne (see Fig. 1). Sarah is a woman wearing a hijab who was born in the U.S. to immigrant parents from an unspecified predominantly Muslim country. Marianne is a woman who was born in an unspecified town in the U.S. Midwest, with limited exposure to different cultures and customs.

On the Plane provides the affordance of experiencing the simulation from the perspective of the ingroup member, the (initially) outgroup member, or a bystander. This enables us to put participants in the shoes of Marianne (see Fig. 2a), Sarah (see Fig. 2b), or a flight attendant as a bystander (see Fig. 2c) throughout the simulation. At the beginning of the simulation, players are oriented to the game narrative and to their role through what are called “orientation clauses” in sociolinguistics (see Fig. 3); “clauses” are the basic units of conversation in this simulation. These orientation clauses are also used to modify experimental conditions for research purposes, enabling us to study the effect of different roles.

During the simulation, players go through the experience based on their role and can control the flow of the story with their choices. For this purpose, we use a computationally supported narrative engine that can automatically select clauses based on players’ current standing in the simulation called *Chimeria* [16]. *Chimeria* has been used in several studies to computationally model and study social group membership in interactive narratives [3], [17]. The *Chimeria* engine can present a certain set of choice clauses based on players’ alignment with one of the characters and players can choose how they want to react to a given character’s response, as seen in Fig. 2c. These choices can, in turn, cause changes in players’ current standing in the simulation (e.g., increase/decrease affinity toward one character).

As for the characters, they are implemented using game AI techniques controlled by probabilistic finite state machines, and their avatars are fully expressive and animated. In addition to speaking, they use body language for expression (custom animations applied to the model’s skeleton) and perform various gestures. Their facial expressions are also customizable and can reflect the current standing of the character based on a set of features that can be customized. For instance, by changing the animations for facial expressions and body



Fig. 3: Orientation Screen. Orientation clauses are used for explicitly describing the role players should assume. They are supplemented by audio instructions.

language, we can customize how comfortable Marianne, the ingroup member, appears while interacting with Sarah, the outgroup member. By the same token, we can customize how Sarah dynamically reacts to the xenophobic attitudes portrayed by Marianne. Characters can also automatically respond to player's current standing in the game based on a number of features. The way this works is that the finite state machine driving character animations listens to these features and triggers the corresponding state and accompanying animations for the characters. For instance, one such feature tracked in the game is alignment with characters, which determines the extent to which the player aligns with the characters in the choices they make throughout the narrative. Alignment with the ingroup member involves selecting a clause that favors the ingroup member or discredits the perceived outgroup member. Thus, Marianne, the ingroup member, can express her dissatisfaction with the player through facial expressions if the player aligns more with Sarah, the perceived outgroup member. Through these customizations, we can generate multiple experimental conditions and study various aspects of ingroup-outgroup biases.

The simulation was developed on the Unity game engine using XR Interaction Toolkit [18]. Currently, the simulation can be experienced on both desktop computers and Meta Quest headsets, which are standalone VR headsets requiring no cable connections to a desktop computer.

IV. RESEARCH PLANS

Our research agenda includes using *On the Plane* to study the effects of perspective taking on ingroup-outgroup biases from various angles. We plan on addressing the following research questions in our future research:

- 1) What is the effect of outgroup perspective taking on outgroup bias?
- 2) What role does xenophobia play in the effect of perspective taking on outgroup bias?
- 3) How does perceived homophily of the outgroup influence outgroup bias?
- 4) What is the role of stigmatization of outgroup members in the effect of perspective taking on outgroup bias?
- 5) How does VR roleplaying compare to desktop roleplaying?

V. CONCLUSION

In this paper, we described the design and development of a roleplaying game in VR to simulate ingroup-outgroup biases and to enable players to engage in successful perspective taking. We plan on harnessing the affordances of *On the Plane* for promoting positive perspective change toward a world where our similarities are perceived to be more important than our differences.

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