

INTERGROUP INTERACTION AND IDENTITY EXPRESSION IN IMMERSIVE SOCIAL VIRTUAL REALITY

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ABSTRACT

This study investigates how bias, cooperation, and power asymmetries unfold between minority and majority groups in immersive social virtual reality (SVR). Seventy-two Jewish Israelis—including Ethiopian Israelis, ultra-Orthodox (Haredi), and secular participants—took part in structured collaborative and competitive sessions within a shared virtual gallery, and their behaviors were analyzed through qualitative observation and post-session questionnaires. Five interrelated themes emerged: spatial dynamics of partner selection, whereby initial choices were driven by immediate virtual proximity rather than cultural identity; cultural identity signaling in VR, as verbal references and customized avatar elements (e.g., head coverings and color palettes) subtly reinforced group belonging; a digital divide in VR interactions, with technological proficiency functioning as social capital that enabled skilled users to assume leadership roles; gender roles in virtual interactions, where explicit gender cues embedded in avatars saw women more often mediating or supporting and men directing task flow; and trust building through virtual interaction, progressing from competence-based partner selection to cross-group coalitions and an emotional shift from discomfort to connection. Together, these findings show that while SVR mirrors real-world power structures and identity cues, its immersive, task-oriented design can also catalyze new cross-group bonds, highlighting the need to narrow technological gaps and encourage inclusive collaboration to realize SVR's potential as a bridge across social divides.

KEYWORDS

Social Virtual Reality (SVR), Intergroup Contact, Cultural Identity, In-Group Bias, Behavioral Observations, Minority-Majority Relations

1. INTRODUCTION

1.1 Intergroup Contact and Prejudice Reduction

Intergroup contact can reduce prejudice by fostering understanding and cooperation (Pertiwi et al., 2020). Its effectiveness depends on factors like group status and interaction quality (Bornman, 2016). Allport's (1954) optimal conditions, equal status, cooperation, common goals, and institutional support, are crucial (Di Bernardo et al., 2022). Strong group identifiers may initially exhibit higher prejudice, but meaningful contact has been found to reduce bias (Kteily et al., 2019). However, observational studies suggest a tendency toward in-group interactions, which may potentially limit the effectiveness of intergroup initiatives (Swyngedouw, 2013; Pryce et al., 2021).

Intergroup contact has been widely studied across diverse contexts as a strategy for improving relationships between groups in conflict, addressing tensions over resources, cultural recognition, and political representation. Structured interactions can reduce prejudice and foster understanding through dialogue (Tropp & Pettigrew, 2005; Crisp et al., 2010). The success of such encounters depends heavily on their design - poorly managed intergroup contact may reinforce existing stereotypes, while meaningful and well-structured interactions under conditions of equality can foster solidarity and mutual understanding (Kotzur et al., 2019). Crucially, effective intergroup contact requires more than mere co-presence; meaningful interaction between group members must actually take place. Simply placing different groups in the same physical or virtual space without facilitating direct engagement is insufficient for prejudice reduction (Pettigrew & Tropp, 2006). The quality and depth of these interactions, including collaborative tasks, personal disclosure, and sustained dialogue, significantly influence outcomes (Dovidio et al., 2017). Virtual reality (VR) offers a promising tool in this context, enabling controlled and immersive interactions across diverse groups while potentially overcoming geographical, social, or physical barriers to meaningful contact.

This research seeks to examine how SVR might serve as innovative spaces for facilitating intergroup contact that reduces prejudice and builds understanding, while identifying both the opportunities and limitations of virtual interactions compared to traditional face-to-face encounters between minority and majority groups.

1.2 Intergroup Contact in Israeli Society: A Case Study

Israel presents a unique and complex case study of intergroup dynamics, involving diverse populations such as Arab citizens, Ethiopian Israelis, the Haredi (ultra-Orthodox) community, and other cultural, ethnic, and religious minorities. These groups face systemic inequalities, cultural and linguistic differences, and historical grievances that complicate their integration into mainstream Jewish-Israeli society. While structured intergroup encounters based on cooperation and shared goals have shown potential to reduce prejudice (Aharon-Gutman, 2010), deeply rooted social and ideological divisions continue to hinder the development of meaningful and sustained engagement.

This study focuses on two specific types of social divides in Israeli society: religious and ethnic. The religious divide refers to the gap between secular Jews and the Haredi population. This rift reflects fundamental differences in worldview, lifestyle, and values. The secular Jewish community is generally characterized by openness, pluralism, and a drive toward individualism.

In contrast, the Haredi community emphasizes cultural autonomy and religious preservation, often adopting insular practices and expressing concern about exposure to liberal, secular values—including the influence of the internet and free media. These differences have generated friction in areas such as military service, education, workforce participation, and public visibility.

The ethnic divide is exemplified in the experiences of Ethiopian Israelis, who struggle with issues of social status, discrimination, and unequal access to opportunities. In addition to structural barriers, many members of this community face challenges relating to identity, recognition, and belonging. As the *Aluma Association and ERI Institute* (2020) report, Ethiopian Israelis often report a sense of exclusion and marginalization, and continue to fight for full inclusion, visibility, and dignity within the Israeli societal fabric.

In this context, virtual reality (VR) simulations offer a promising avenue for creating controlled, immersive environments that enable participants to engage across cultural and identity-based divides. These environments can be designed to foster empathy, challenge stereotypes, and facilitate encounters that are difficult to initiate in real-life settings due to political, social, or logistical barriers. This approach aligns with Kimmerling's (2001) analysis of Israel's transition into a more diverse society, highlighting the need for inclusion strategies that respect cultural identities while promoting integration and shared civic participation.

By simulating interactions between groups with deeply entrenched differences, such as secular and Haredi Jews, or Ethiopian Israelis and members of the general Jewish population, VR-based encounters can serve as a laboratory for examining intergroup contact theory in action, within immersive and controlled environments. This allows researchers to explore whether patterns observed in the literature on intergroup contact also emerge in virtual reality contexts, offering a unique opportunity to test theoretical assumptions in a novel setting. In doing so, these simulations may help assess the effectiveness of digital tools as mechanisms for social bridging, fostering intercultural dialogue, inclusion, and the reduction of prejudice in Israeli society.

1.3 Contact between Minority and Majority Groups

Intergroup contact represents an effective means of reducing prejudice and fostering positive attitudes toward minorities. Research demonstrates that meaningful interactions yield significant reductions in bias and greater mutual understanding. However, the quality of contact is critical—positive interactions are beneficial, but superficial or poorly managed contact can reinforce negative perceptions (Tropp & Pettigrew, 2005).

Studies indicate that when encounters are inadequately facilitated, existing stereotypes may be reinforced rather than diminished. Ron and Maoz (2013) documented how in structured dialogue groups between Israeli Jews and Palestinians, participants often retreated to in-group clustering during breaks and informal moments, despite the contact being explicitly designed to promote intergroup engagement. Similarly, Maoz (2011) found that in educational coexistence programs, participants frequently self-segregated when given free choice in activities, maintaining stronger ties with members of their own group. These observations highlight how preferences for in-group interactions can limit the effectiveness of even deliberately designed intergroup initiatives.

These are actual studies that examine planned/organized intergroup contact programs rather than spontaneous public interactions, which better addresses your instructor's concern about finding examples of in-group preference within structured contact situations.

Minority group members often experience heightened anxiety during intergroup contact, which can undermine its effectiveness (Crisp et al., 2010). Encounters in majority-dominated spaces may perpetuate exclusion or power imbalances, limiting prejudice reduction (Barlow et al., 2013). Dovidio and colleagues (2017) emphasize that majority and minority group members have different needs and goals in their intergroup interactions. Majority group members tend to emphasize commonalities to create more harmonious interactions, whereas minority group members are motivated to address not only similarities but also group-based differences that validate their unique qualities and experiences.

To maximize benefits, encounters must foster equality, balanced representation, inclusive environments, and skilled moderation (Kotzur et al., 2019). Effective intergroup contact requires more than mere co-presence; meaningful interaction between group members must take place. Simply placing different groups in the same physical or virtual space without facilitating direct engagement is insufficient for prejudice reduction.

1.4 Interpersonal Proximity and Contact Theory

Physical distance between individuals during intergroup interactions significantly shapes outcomes. Seating arrangements and proximity patterns both reflect underlying intergroup dynamics and influence interaction success. According to interpersonal proximity theory (Hall, 1963), closer physical proximity tends to enhance positive interactions when properly managed. This theory defines three primary personal space zones: intimate space (reserved for close friends and family), social space (appropriate for acquaintances and casual interactions), and public space (used during impersonal interactions).

Four key factors contribute to interpersonal closeness: proximity, similarity, exposure, and responsiveness. Increased exposure typically fosters trust and positive emotional responses, especially when combined with positive experiences. In intergroup interaction contexts, individuals tend to seek proximity with their in-group, reflecting natural patterns of interpersonal closeness. This pattern aligns with contact theory research showing that people often gravitate toward familiar others when given the choice (Maoz, 2011; Ron & Maoz, 2013).

Proximity behavior can be particularly revealing of underlying attitudes—participants who maintain greater physical distance from outgroup members typically report higher levels of intergroup anxiety and less positive attitudes (Crisp et al., 2010). These patterns of distancing are observable in both physical and virtual environments, where minority members often cluster together, potentially indicating insecurity or, in digital contexts, technological barriers. However, positive contact experiences can bridge physical gaps across groups (Ryen & Kahn, 1975).

The relationship between proximity and prejudice reduction is bidirectional. Just as pre-existing biases can influence physical distancing behaviors, structured interventions that facilitate closer proximity can help reduce prejudice over time. Kotzur et al. (2019) demonstrated that well-designed intergroup encounters that encourage physical closeness while maintaining psychological comfort can promote more positive intergroup attitudes. This suggests that spatial proximity is not merely a reflection of existing attitudes but can be strategically utilized as an intervention mechanism.

1.5 Social Virtual Reality (SVR)

SVR platforms offer interactive and immersive environments that allow users to engage in a wide range of social activities. These include group interactions using VR headsets and motion controllers. A central element of the SVR experience is the creation of a virtual representation, or avatar, which embodies the user in the digital space (Tassinari et al., 2022b; Slater et al., 2022; Lin and Latoschik, 2022).

These platforms simulate realistic behaviors and support rich communication through shared environments and features that convey both verbal and nonverbal cues (Hasler et al., 2021; Lin and Latoschik, 2022; Torro and Pirkkalainen, 2023; Tassinari et al., 2024). Key features of these environments include customization options, object interaction, spatial audio, and a strong sense of immersion. These qualities make SVR a promising environment for intergroup contact, particularly for people who are unable to meet face to face due to cultural, political, or geographic barriers.

SVR environments offer several experiential characteristics that distinguish them from standard digital communication. One such feature is *Spatial Presence*, the feeling of being in the virtual setting. This occurs when users respond to virtual stimuli in a way that mirrors their reactions in the physical world (Slater et al., 2022). Another is *Social Presence*, the feeling of being together with others in the same virtual space. This sense of connection is enhanced when avatars can express gestures, facial expressions, and other forms of nonverbal behavior. *Body Ownership* is also important. It refers to the psychological sense that the avatar is one's own body. When the avatar's movements closely match the user's physical movements, this sense becomes stronger, creating a deeper connection to the virtual experience, and *Immersion*, being fully absorbed in the digital world, adds emotional and cognitive depth to these interactions.

SVR also allows for the expression of *Social Identity*. Users can shape and personalize their avatars, which influences how they perceive themselves and how others perceive them (Tassinari et al., 2022b). In societies like Israel, where social and cultural divisions often limit contact between groups, this flexibility in identity expression can be especially valuable.

In addition to the expanded interaction possibilities, research suggests that SVR may be associated with changes in attitudes and emotions. Studies show that virtual contact with minority groups can be linked to increased empathy and reduced stigmatization, especially when users experience a strong sense of co-presence (Tassinari et al., 2022b; Stelzmann et al., 2021). Additional factors, such as shared identity and avatar customization, have also been found as potential contributors to more positive behaviors and attitudes (Peña et al., 2021).

However, most existing research focuses on one-on-one contact or on non-immersive platforms (Hoter and Shapira, 2022). Few studies explore the social dynamics that emerge in fully immersive, multi-user environments. This gap limits our understanding of how group behaviors, such as cohesion, exclusion, or leadership, develop in virtual settings.

1.6 Research Gap and Current Study

Despite growing interest in digital spaces for intergroup contact, there remains a significant gap in our understanding of how SVR specifically influence interactions between minority and majority groups. Traditional contact theory has been extensively studied in physical settings, and significant research exists on non-immersive digital contexts as well.

The current study addresses this gap by exploring intergroup contact in SVR environments. It focuses specifically on how participants from minority groups interact with majority group members in a new and unfamiliar technological space. The study examines interaction patterns such as in-group cohesion, hesitation, and leadership emergence, while considering how differences in technological familiarity may shape power dynamics and social engagement in these virtual contexts.

Immersive virtual reality environments offer unique affordances such as embodied presence, spatial interaction, and novel social dynamics. These capabilities, which will be explained in detail in the following chapters, constitute the central innovation of this research and remain underexplored as influential factors in intergroup relations.

By observing these processes, the study highlights the potential of SVR as a platform for meaningful intergroup contact. SVR environments enable exposure to social diversity and support cooperation in ways that may not be possible in traditional settings due to geographical, social, or institutional barriers. The findings contribute to both theoretical understanding of contact in digital spaces and practical applications for the design of inclusive and accessible SVR environments, offering new insights into how digital spaces can help bridge social divides in complex multicultural contexts such as the Israeli society.

2. RESEARCH QUESTIONS

- 1) How do participants from minority and majority groups experience intergroup encounters in SVR?
- 2) What behavioral patterns are observed regarding in-group preferences, spatial proximity, and leadership between minority and majority group members, and do these patterns reflect group affiliation dynamics?
- 3) How are power differences between minority and majority groups reflected in intergroup dynamics within SVR, in relation to cultural identity, gender, and familiarity with technology?

3. METHOD

3.1 Participants

The study included 72 Jewish Israeli participants (ages 20–45), consisting of a pilot study (n=8) and a main study (n=64). The aim of the pilot study was to examine the research design and evaluate the suitability of the VR environments for the study. It involved eight university students: 4 Ethiopian Israeli and 4 non-Ethiopian Israelis, and focused on exploring intergroup dynamics.

In the main study, participants were divided into two demographic groups:

- Ethiopian Israeli (n=16; 12 women, 4 men) vs. non-Ethiopian Israelis (n=16; 7 women, 9 men).

- Haredi (n=16; 8 women, 8 men) vs. secular Israelis (n=16; 8 women, 8 men).

These groups were chosen to reflect social tensions and minority-majority dynamics in Israeli society.

Table 1. The number of research participants by group affiliation

| | | Group affiliation | | | | |
|-------------|--------|-----------------------------|----------------------|---------|--------|-------|
| | | Not Ethiopian Israeli | Ethiopian Israeli | Secular | Haredi | Total |
| Pilot study | Male | 2 | 2 | | | 4 |
| | Female | 2 | 2 | | | 4 |
| Main study | Male | 9 | 4 | 8 | 8 | 29 |
| | Female | 7 | 12 | 8 | 8 | 35 |
| Total | | | | | | 72 |

3.2 Procedure

Participants from the studied groups, Ethiopian Israelis and non-Ethiopian Israelis, secular and Haredi individuals, were recruited for the study. None of the participants in each session were previously acquainted. Approximately two weeks prior to the research activity, all participants completed a demographic questionnaire, which was used to inform the design of personalized avatars reflecting key aspects of their identity. These avatars were designed to represent participants' gender, ethnic background, and social identity through distinctive cultural and physical markers: dark brown skin tones for Ethiopian Israeli participants to reflect their ethnic features, traditional religious attire for Haredi participants (including gender-appropriate clothing and head coverings), and contemporary casual dress for secular participants. This design approach ensured culturally sensitive and authentic representation in the virtual environment, acknowledging both visible ethnic characteristics and religious cultural markers. The study was conducted in various locations across Israel, with each participant placed in a separate physical space before the virtual activity to prevent interaction outside the virtual environment. During the activity, participants used virtual reality headsets and motion controllers to operate within the virtual space.



Figure 1. Avatar representations of Israeli ethnic and religious groups

Virtual interactions took place on two different social VR platforms: one for the pilot study and another for the main study. A total of 9 research sessions were conducted, each involving eight participants. 4 sessions facilitated interactions between Haredi and secular participants, and 5 involved participants of Ethiopian Israeli and non-Ethiopian Israeli in each session, participants entered the virtual room simultaneously and interacted with one another. The session began with an introduction to the platform, during which participants practiced navigating their avatars and using virtual tools. The activities included a cooperative task and a competitive game. In the first activity, conducted on both platforms, Participants were asked to choose a partner for the activity, engage in a dialogue, and agree on a shared social value. Together, they illustrated this value as a pictorial riddle, encouraging collaboration and mutual understanding. The riddles were later presented to the other groups, who attempted to identify the intended social value based on the drawing. Observations focused on partner selection, dominance, role allocation, listening skills, and technical proficiency.

After the cooperative game, participants were informed that the second part would consist of a competitive game. First, they were asked to select team leaders. Subsequently, they were divided into two groups and instructed to choose with whom they preferred to be on the same team competing against the other group. Competitive game activities varied between pilot study and the main study.

The pilot study's competitive game *Prison Life* involved participants as guards or prisoners to observe group competition and cooperation. For the main study, drawing conclusions from the pilot study, we decided to change the environment to a more realistic environment and the competitive game to a more neutral competition game. For the competitive game, participants were divided into teams, chose leaders, and completed a quiz based on memorizing and listing Israeli locations shown in a video. The aim in introducing a competitive activity was to observe how participants choose their partners or team up with individuals they perceive as strong partners, that may contribute to the group and assist them with competing successfully against the other group.

This study employed qualitative research design, integrating observations based on video recordings of the sessions and open-ended participant feedback. The methodological approach combined observational fieldwork within an immersive environment and qualitative responses to explore participants' experiences and behaviors during intergroup contact in SVR. The immersive VR sessions were documented using dual headset-mounted cameras, capturing interactions from multiple perspectives within the virtual space.

A rigorous collaborative analysis process was implemented for the video recordings. At least two researchers or research assistants independently viewed each video, documenting relevant events according to the research focus. After individual reviews, the researchers met to compare and refine their observations, followed by a comprehensive discussion among all research assistants and principal investigators. These discussions centered on recurring patterns and significant interactions, with researchers providing specific examples from the recordings. Through this collaborative analysis, key themes emerged related to proximity behaviors, intergroup versus intragroup interactions, and patterns of engagement across different social identity groups.

To capture subjective user experiences, participants completed a post-session questionnaire that included open-ended questions adapted from two validated instruments: the Virtual Reality User Experience Questionnaire (Tcha-Tokey et al., 2016) and the Social Presence in VR Questionnaire (Li & Cesar, 2023). These two instruments served as the foundation for constructing the questionnaire, ensuring both relevance and reliability in assessing users'

experiences in immersive environments. In addition, the questionnaire included open-ended questions specifically designed by the researchers to explore participants' reflections on intergroup contact within the virtual setting. These open-ended questions were grounded in the theoretical framework of Contact Theory, allowing for an in-depth examination of participants' experiences of intergroup interaction.

The questions explored participants' perceptions of the virtual environment, their awareness of group characteristics (e.g., cultural or religious identity markers), and how these shaped their social behaviors—such as partner selection, spatial proximity, and tendencies toward collaboration or avoidance. The questionnaire included several open-ended questions focusing on participants' experiences, such as: 'When you connected with others to participate in the group activity, what were the circumstances or considerations that led you to connect with people in your group?' and 'How did you feel about the diversity of the group? Do you think the diverse backgrounds of the participants was a strength or weakness in the context of the meeting?' By combining validated measures with theory-driven open-ended questions, the questionnaire enabled a nuanced understanding of how participants experienced their social interactions in the immersive environment. This approach provided insight into both the technological and social dimensions of engagement, with particular attention to how identity, proximity, and group dynamics influenced participants' feelings and behaviors during intergroup contact in SVR.

The study was grounded in a qualitative research design, specifically within a Participatory Action Research (PAR) framework, emphasizing real-time observation of group dynamics and participant agency, that is, their capacity to act intentionally, make autonomous decisions, and influence the flow of interaction within the immersive virtual environment.

Thematic analysis of the video recordings focused on key behavioral features, including spatial positioning and proximity between participants, task performance using VR controllers, styles of communication and emotional tone, the emergence of leadership roles, reliance on or support with technology, initiative-taking, group alignment, and dialogue or negotiation around content, agreements, and disagreements. Special attention was given to how gender, ethnicity, and social identity were expressed through behavior. In analyzing partner choice and team composition, emphasis was placed on the actions of minority participants (e.g., Ethiopian Israelis and Haredi Jews) during their interactions with majority-group members. These patterns were examined to identify tendencies toward in-group cohesion, strategic alliances, or hesitation driven by cultural distance or perceived exclusion.

By combining observational data with participants' self-reported reflections, the study offered a comprehensive qualitative perspective on both observable behaviors and internal perceptions. The integration of these data sources deepened the understanding of engagement patterns, intergroup interactions, and attitudes toward social diversity in a controlled yet immersive VR setting. This methodological approach enabled nuanced insights into the potential and limitations of SVR as a medium for intergroup dialogue and inclusion.

4. RESULTS

Thematic analysis of the qualitative observations and the participants' open-ended reflections revealed five inter-locking themes that map directly onto our three guiding research questions. First, they illuminate how minority and majority participants perceive, feel, and make sense of

their intergroup encounters in social virtual reality (RQ 2.1), shedding light on moments of curiosity, tension, and unexpected affinity. Second, they describe the observable behavioral patterns that unfolded in the space (RQ 2.2), detailing when and why participants gravitated toward in-group members, chose specific spatial positions, or assumed (and contested) leadership roles, thereby exposing the subtle signals through which group-affiliation dynamics were enacted. Third, the themes reveal how asymmetries of power surfaced within these interactions (RQ 2.3), showing the ways cultural identity markers, gendered expectations, and differential technological fluency intersected to shape authority, voice, and influence in SVR. Together, these themes offer a coherent analytic lens through which to interpret the complex social choreography that took place during the virtual-reality sessions.

4.1 Spatial Dynamics of Partner Selection

In the initial stages of the session, during the period in which participants practiced navigating the immersive environment, differences in technological proficiency became apparent. Some participants demonstrated confidence and fluency in using the VR controllers, while others struggled to operate them and adapt to the virtual setting. Participation in the upcoming collaborative activities required movement through virtual space, compelling participants to overcome technological difficulties to approach potential partners.

When the first task, a collaborative creative activity, was introduced, participants were asked to choose a partner and work together. At this point, most selected partners based on spatial proximity within the virtual environment, often choosing those who were standing nearby or appearing more accessible. This selection pattern addresses research question 2.2 regarding behavioral patterns of spatial proximity, revealing how the virtual environment's spatial organization directly influenced social grouping.

Participants who were technologically proficient moved freely and had greater flexibility in selecting a partner. Those who had trouble tended to remain stationary and selected others who were also less mobile. In most cases, partner selection was driven not by explicit in-group preference, such as along religious or ethnic lines, but by considerations of comfort and accessibility within the virtual landscape.

However, clear in-group preferences were observed in two specific groups: one composed of Ethiopian Israeli and non-Ethiopian Israeli participants, and another composed of Haredi and secular Jewish men. In these cases, participants explicitly signaled group identity and chose partners accordingly, reflecting persistent social boundaries despite the immersive setting. As the session progressed, particularly during the second task, a competitive group activity requiring participants to select new partners, greater flexibility in partner selection emerged. Some participants began choosing teammates based on perceived task-relevance or observed capabilities. For example, the second task was a geographical quiz that required proficiency with the virtual drawing tools and knowledge of locations in Israel. Participants who had demonstrated confidence and technological competence with the drawing tools during the first part of the session, and thus gained social prominence, were frequently selected as partners regardless of their cultural background. As one participant noted in the post-session questionnaire, they selected people who were "prominent and moving around - those who I felt understood more than me or at least more than me on the technical level," while another explicitly mentioned considering "technical abilities in using VR" when choosing partners. In many cases, participants opted to collaborate again with those they had partnered with in the

previous activity, with one participant stating, "those I played with in the first activity, I preferred to continue with them for the following activities as well," suggesting that new in-group associations were formed through shared experience.

4.2 Cultural Identity Signaling in VR

Beyond the pragmatic considerations of proximity and access, participants also engaged in symbolic acts of cultural identity signaling. This dynamic was distinct from mere physical or functional accessibility and reflected deeper layers of social alignment based on shared cultural background.

The virtual environment in this study was intentionally designed to include visual markers of identity, such as culturally specific clothing and skin tone. These features likely enhanced the salience of group affiliation and enabled participants to recognize and respond to identity-related cues within the immersive space.

For example, in a group composed of Ethiopian Israeli and non-Ethiopian Israeli participants, one individual asked, "Are all of us here Habasha?", an effort to affirm shared cultural identity using a culturally specific term. In another session, a Haredi participant referred to a peer as "Tzadik" and to the female facilitator as "Rabbanit," invoking religious titles meaningful within his community. These cultural identity markers were also evident in the values selection activity, where a pair of Haredi participants worked together and chose "Messiah" as their core value, creating a drawing that illustrated their belief in the coming of the Messiah. In contrast, two teams of secular participants selected values such as "love of the homeland" and "contribution to national security," while another secular team chose "environmental protection." Post-session reflections confirmed these identity-based dynamics, with one participant explaining, "In the beginning I connected with a group that had brown characters, and in the second part, I simply connected to a different group that didn't look like me." Another participant specifically mentioned trying "not to be only with secular people like always" when choosing partners. These value choices and partner selection patterns clearly reflected the differing value systems of secular versus Haredi society in Israel. These expressions served as symbolic acts of recognition, helping to establish a familiar cultural frame of reference and reaffirm in-group belonging.

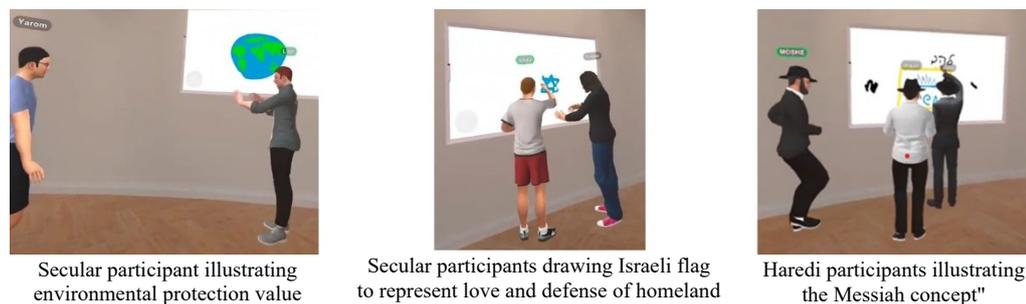


Figure 2. First social activity in SVR: Expressing values through collaborative drawing

Such linguistic and visual cues demonstrate that cultural identity can be asserted, negotiated, and recognized even in immersive virtual settings. Rather than diminishing social cues, the avatar design in this study likely amplified the visibility of identity and encouraged participants

to express affiliation. The virtual environment, in this context, did not neutralize cultural boundaries but offered a new medium through which they were actively performed and perceived. These findings highlight the importance of deliberate identity design in Social VR and suggest that avatar features can significantly shape social dynamics in intergroup encounters.

4.3 Digital Divide in VR Interactions

Technological adaptation significantly influenced social roles within the virtual environment, revealing important insights into research question 2.3 concerning how familiarity with technology affects intergroup dynamics. Participants with high VR proficiency naturally assumed leadership positions, directed group tasks, and supported others. In contrast, participants who struggled with the VR tools were more passive and often relied on guidance from more experienced users. This created visible power dynamics within groups, particularly disadvantaging participants from minority communities with limited access to advanced technology in their everyday lives.

This emergent social hierarchy manifested in participants' emotional experiences as well. One participant noted, "It felt like someone was watching me and it was a bit stressful," while another commented, "It was chaotic and noisy, and I didn't feel like part of the group." Several participants suggested "more time to practice with the headset" and "clearer technical instructions" in their feedback, highlighting the significance of technological barriers to full participation. These testimonials reflect how technological competence quickly transformed into social capital, creating unspoken but palpable status differentials among participants.

4.4 Gender Roles in Virtual Interactions

Gender dynamics distinctly shaped engagement patterns throughout virtual interactions, directly addressing research question 2.3 about how differences between groups are reflected in virtual environments. Men, particularly those from majority groups, were more likely to take initiative and lead the group activities, reproducing traditional gender roles despite the novel environment. Women tended to adopt supportive or observational roles, often hesitating to take command even when they displayed technological proficiency.

These patterns mirror broader social dynamics and suggest that traditional gender roles may be reproduced in virtual settings unless intentionally addressed. The virtual environment, rather than disrupting established social scripts, seemed to provide a new stage upon which familiar gender performances were enacted, albeit sometimes in more subtle forms than might be observed in physical spaces. This finding contributes to our understanding of how participants experience intergroup encounters in SVR (research question 2.1), showing that familiar social structures may persist even in novel technological contexts.

4.5 Trust Building Through Virtual Interaction

The second group task provided a unique opportunity to observe how the initial patterns of partner selection evolved in response to experience and familiarity.

4.5.1 Competence-Based Selection

Greater flexibility in partner choice emerged as some participants began to select based on perceived task relevance or observed capabilities. For example, a secular participant approached a Haredi participant to team up after being impressed by their contribution in the previous activity. This behavior demonstrates how observed performance began to override preexisting social categorizations as the session progressed.

4.5.2 Formation of New In-Group Associations Through Shared Experience

In many instances, participants chose to partner with someone they had collaborated with in the previous task. This suggests that new in-group associations were formed through shared experience rather than pre-existing social categories. The choice was often based on the connection established during the first activity, regardless of ethnic or religious group affiliation. Partner selection thus became grounded in interpersonal familiarity and task experience.

4.5.3 The Emotional Journey: From Discomfort to Connection

The evolution of partner selection reflects a broader emotional journey that directly addresses research question 2.1 about how participants experience intergroup encounters in SVR. Most participants described the overall session as engaging and positive, using terms like "pleasant," "interesting," or "inclusive" to characterize their experience. Although a few participants reported initial discomfort, such as shyness, disorientation, or physical symptoms like dizziness, many described increased comfort and a stronger sense of connection as the session progressed.

As one participant reflected, "At first it was strange, but then I got used to it and really enjoyed being with people I didn't know," suggesting a gradual opening to diversity with increased exposure. Another participant described the experience as "weird at first, but fun and different." Notably, structured tasks that required cooperation facilitated some intergroup interaction, even among those who initially gravitated toward familiar others.

5. DISCUSSION

This study investigates the social dynamics that emerge among diverse participants in SVR, specifically focusing on intergroup relations between majority and minority social groups within Israeli society. Through a careful analysis of participants' behaviors, interactions, and reflections, we offer insights into how real-world social structures, biases, and interpersonal patterns may manifest and potentially transform within technologically mediated spaces. Grounded in contact theory (Allport, 1954) and interpersonal proximity theory (Hall, 1963), our research explores both the potential of SVR to facilitate meaningful intergroup encounters and the persistent challenges that influence these interactions.

5.1 Addressing Research Questions

Regarding the first research question: How do participants from minority and majority groups experience intergroup encounters in SVR? Our findings suggest that these experiences are shaped by a complex interplay of pre-existing social identities and the technological affordances of virtual reality. Most participants described the overall session as engaging and positive, using

terms like "pleasant," "interesting," or "inclusive" to characterize their experience. Although a few participants reported initial discomfort, such as shyness, disorientation, or physical symptoms like dizziness, many described increased comfort and a stronger sense of connection as the session progressed. As one participant reflected, "At first it was strange, but then I got used to it and really enjoyed being with people I didn't know," suggesting a gradual opening to diversity with increased exposure. Another participant described the experience as "weird at first, but fun and different." Notably, structured tasks that required cooperation facilitated some intergroup interaction, even among those who initially gravitated toward familiar others.

Regarding our second research question: What behavioral patterns are observed regarding in-group preferences, spatial proximity, and leadership between minority and majority group members, and do these patterns reflect group affiliation dynamics? We observed evolving patterns of spatial proximity and partner selection. Initially, interactions often reflected in-group preferences, particularly among minority group members. However, later interactions demonstrated a shift, with participants sometimes selecting partners based on task competence or previous collaboration rather than group affiliation. These initial observations suggest that shared virtual experiences could help redefine social boundaries through cooperative engagement. However, more research is needed to determine whether these patterns hold true in different contexts or with other groups, and to understand how widely these findings can be applied.

In relation to the third research question, which explores how intergroup encounters in SVR contribute to trust building, we noted a distinct emotional journey. While initial discomfort was common, participants often reported growing comfort and stronger connections as the session progressed. Partner selection also evolved, with participants increasingly choosing based on task competence or previous collaboration rather than solely on group affiliation. Many participants chose to work again with those they had partnered with earlier, signaling that shared experiences and task engagement played a significant role in developing new in-group associations. As one participant noted, "Those I played with in the first activity, I preferred to continue with them for the following activities as well," reflecting the formation of new social bonds through virtual interaction. This shift highlights the potential of SVR to foster cross-group connections and build trust, despite the initial social and technological challenges.

5.2 Research innovation and Contribution

The key innovation of this study lies in its examination of authentic intergroup encounters within immersive SVR environments. Previous studies on multi-user intergroup contact in VR have typically focused on non-immersive virtual environments, immersive video simulations for single users or dyads, or encounters where avatars do not represent real individuals but are either controlled by artificial intelligence or depict members of the same group with different avatar representations (Hoter & Shapira, 2022; Tassinari et al., 2022b; Stelzmann et al., 2021). This study, in contrast, explores genuine intergroup contact in immersive SVR between participants from distinct socially and culturally diverse communities, including minority groups with different religious, ethnic, and socioeconomic backgrounds. This methodological approach potentially offers deeper insights into how real intergroup dynamics may manifest in shared virtual environments, expanding our understanding of naturalistic interactions in these spaces.

The findings of this study contribute to theoretical understandings of how social psychological frameworks manifest in immersive virtual contexts. The spatial dynamics

observed during partner selection reflect elements of interpersonal proximity theory (Hall, 1963) while demonstrating potential adaptations to digital environments. Unlike physical proxemics, which are constrained by embodied presence, spatial behavior in immersive SVR appears more fluid and may be shaped by technological fluency and ease of navigation. This suggests that interpersonal proximity theory could benefit from conceptual expansion to better address digitally mediated interactions, particularly in the context of communication that some participants experience as unmediated, despite it being facilitated through the SVR platform. In our study, we argue and demonstrate that, for some participants, the experience within these environments was perceived as direct and unmediated.

The observed emergence of digital literacy as a form of social capital aligns with Bourdieu's (1986) theorization of symbolic resources structuring social advantage. In our study, technological proficiency not only conferred functional capacity but also, in some cases, informal status, influencing leadership and group dynamics. Participants with advanced technological skills often assumed leadership roles in solving collaborative tasks, and others sought their help regardless of original group affiliation. These findings suggest that digital divides—stemming from unequal access to technology and digital skills—might shape social interactions. This aligns with ongoing research on structural moderators of intergroup contact (Dovidio et al., 2017), particularly how access disparities and digital competence influence contact experiences.

Contemporary studies on immersive SVR contextualize these findings. Immersive SVR platforms offer environments where users engage through avatars that convey verbal and nonverbal behaviors (Slater et al., 2022; Lin & Latoschik, 2022; Tassinari et al., 2024). These platforms simulate group interactions with motion-tracked avatars, spatial audio, and shared tasks, fostering social presence and emotional engagement (Hasler et al., 2021; Torro & Pirkkalainen, 2023). Features like customizable avatars, spatial presence, body ownership, and identity signaling enable users to express aspects of their identities and form connections that might be harder to achieve in traditional face-to-face interactions.

The findings related to shared experience-based in-group associations support current literature on avatar-mediated identity flexibility, which can enhance intergroup attitudes. In societies with deep social divisions, such as Israel, immersive SVR's ability to enable identity signaling and collaborative narrative construction through embodied interaction could help reconfigure social boundaries in certain contexts.

This study contributes to bridging this gap by exploring how immersive social interactions in immersive SVR might reflect and potentially transform traditional group structures. We propose theoretical extensions that could account for the spatial, embodied, and technological conditions that shape intergroup contact in the digital age. These extensions include examining how interpersonal proximity theory might be applied to virtual spaces, viewing digital literacy as a form of social capital, and investigating the impact of VR features like embodiment and avatar customization on social identity boundaries. However, these proposed extensions offer an additional perspective on existing theory and provide an opportunity to examine it in new and different contexts in the digital age.

5.3 Study Limitations and Practical Implications

Despite its contributions, several methodological limitations restrict the generalizability of our findings. Our sample was relatively small and drawn exclusively from Israeli populations,

limiting broader applicability to global contexts. The unique sociopolitical landscape of Israeli society, characterized by specific ethnic, religious, and cultural divisions, may produce intergroup dynamics that differ from those in other multicultural societies.

A significant challenge emerged from the substantial variation in technological proficiency among participants. This variation was not merely a finding but a methodological issue, as differential familiarity with VR technology created uneven starting points for participation. This may have confounded our observations of intergroup behavior with participants' comfort levels with technology. This highlights the need for more inclusive protocols in VR-based social research, especially when working with populations with varied technological exposure.

The short-term nature of our observations limits our ability to assess the sustainability of the new intergroup connections that seemed to form. While we observed shifts in partner selection patterns during single sessions, the durability of these new affiliations beyond the immediate experimental context remains uncertain. Many intergroup effects may emerge through sustained interactions over time. Future research should explore whether these patterns persist or evolve through multiple VR encounters.

Our qualitative approach, while providing valuable descriptive insights, faces inherent limitations in establishing causal relationships. The interactions between technological proficiency, gender dynamics, and cultural identity are complex and potentially mutually reinforcing. A mixed-methods approach that incorporates quantitative measures of intergroup attitudes before and after VR experiences could strengthen future investigations.

Our findings suggest several practical implications for the design and implementation of VR-based intergroup interventions. The role of technological comfort in shaping participation suggests that pre-session training should be standardized and comprehensive, particularly for participants from communities with limited prior exposure to technology. This training should aim not only to ensure basic operational competence but also to foster a sense of confidence and autonomy in using the VR platform.

6. CONCLUSIONS

This study offers insights into the intergroup dynamics within SVR environments, highlighting the complex interactions between pre-existing social structures and emerging technological mediation. While virtual environments do not automatically transcend real-world social divisions, they can create unique conditions for meaningful intergroup contact and potential reconfiguration of social boundaries. Our findings suggest that SVR can facilitate cross-group connections based on task competence and interpersonal comfort, although cultural identity markers and power dynamics persist in shaping these interactions.

We propose four key directions for future research:

- Longitudinal studies examining the persistence of intergroup effects across multiple VR sessions.
- Targeted interventions addressing technological barriers through training protocols.
- Comparative studies of avatar design and identity representation.
- Integration of quantitative measures to assess the impact of SVR interactions on intergroup attitudes.

As virtual reality becomes more integrated into various sectors, understanding its implications for intergroup dynamics is crucial. This study suggests that SVR environments hold potential for fostering positive intergroup relations, especially in societies where face-to-face interaction is limited. However, realizing this potential requires careful attention to technological accessibility, thoughtful activity design, and skilled facilitation.

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