# The Potential of Telepresence Robots for Intergroup Contact

Avner Peled[1][a], Teemu Leinonen[1][b] and Béatrice Hasler[2][c]
[1]Department of Media, Aalto University, Espoo, Finland
[2]Sammy Ofer School of Communications, Interdisciplinary Center Herzliya, Herzliya, Israel

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Abstract: We propose the use of telepresence robots as a medium for intergroup contact that aims at reducing prejudice between groups in conflict. We argue for robots as a midpoint between online communication and a face-to-face meeting, combining the flexibility of the virtual world and the depth of physical interactions. We define the basic architecture of telepresence systems and present a conceptual framework for robot-mediated encounters in an intergroup context. We then provide design guidelines for telepresence systems that may guide future implementations of robotic intergroup contact.

## 1 INTRODUCTION

The pervasive role of technology in intensifying the ability of humans to harm one another is well known; the use of technology to promote peace at both the collective and personal levels is considerably more modest. Over the years there have been calls within the Human-Computer Interaction research community to promote the use of technology to support peace in world conflicts (Hourcade and Bullock-Rest, 2011; Eckert et al., 2019). Often when people think of a technological contribution to conflict resolution, the emphasis is placed on decision support and negotiation for policymakers and national leaders. A different approach that is taken in the current paper, is using technology to reconcile the 'common' people in a situation of conflict and build more positive intergroup relations from the bottom up.

One of the most prominent models that act as a guideline for this approach is the contact hypothesis (Allport, 1954), which states that under the right conditions, encounters with members of the opposing group (i.e., the outgroup) can lead to reduced prejudice and more harmonious intergroup relations. We propose using robots as a communication medium for such contact, as they combine both the flexibility and accessibility of online communication and the corporeality of face-to-face encounters in a shared physical space.

The hypotheses presented in this article are partially based on observations from an initial test we conducted on intergroup telepresence contact (Peled, 2019). The test system included one remotely controlled telerobot that facilitated conversations between immigrants and local participants. We have analyzed the results qualitatively through post-session interviews.

[a] https://orcid.org/0000-0002-0525-6385
[b] https://orcid.org/0000-0002-6227-052X
[c] https://orcid.org/0000-0002-3251-4677

## 2 CONCEPTUAL FRAMEWORK

### 2.1 Intergroup Contact Hypothesis

The contact hypothesis, as formulated by Gordon Allport in his seminal book *The Nature of Prejudice* (1954), specifies four conditions that need to be fulfilled during positive intergroup contact: equal status, having common goals, active cooperation, and institutional support. Fifty years later, a meta-analysis across more than 500 studies in a variety of intergroup contexts (Pettigrew and Tropp, 2006) has revealed that contact is an effective means to reduce prejudice. However, the meta-analysis also showed that the conditions are not strictly essential for a positive outcome, yet they are factors among others that facilitate it. Later research focused on expanding the theory to include more conditions such as forming cross-group friendships (Cook, 1962) and identifying affective drivers, such as empathy and (reduced) anxi-



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ety, that play a mediating role in contact interventions (Pettigrew et al., 2011; Brown and Hewstone, 2005). An additional factor that moderates the outcome of contact is *group salience*, the degree in which the participants' group identity is evident. A high level of group salience facilitates the generalization of attitudes from the interpersonal level to the group level (Voci and Hewstone, 2003).

Most previous intergroup contact studies were conducted in face-to-face (FtF) settings. However, face-to-face contact can be challenging to implement, particularly in areas of violent conflict (Hasler and Amichai-Hamburger, 2013). Organizers commonly face practical issues such as gathering diverse groups, finding a neutral, accessible location, and compensating participants for travel expenses. Therefore, recent projects have used technology (especially online communication) to facilitate intergroup encounters.

## 2.2 Online Contact

Communication technologies expand the models of contact and add new modalities of interaction while compromising on the benefits of traditional FtF encounters. Research on online intergroup contact has shown its potential to reduce prejudice and aid in conflict resolution (Amichai-Hamburger et al., 2015; Hasler and Amichai-Hamburger, 2013; Walther et al., 2015). However, online contact is not always constructive, and may result in a negative outcome and increased prejudice. The remote nature of the medium makes participants less accountable for their actions and less engaged in the conversation (White et al., 2015; Schumann et al., 2017). The lack of nonverbal cues (Burgoon and Hoobler, 1994) obstructs the path to a mutual understanding and impairs the turn-taking process, which may evoke negative feelings between the group members, such as anger and frustration (Johnson et al., 2009).

Virtual reality (VR) is studied as a medium that offers an immersive communication experience that increases the user's sense of embodiment during communication (Kilteni et al., 2012). It was positively evaluated for use in intergroup contact, both as a space for dialog (Hasler et al., 2014), and as a tool that allows individuals to immerse themselves in the perspective of the other side (Hasson et al., 2019; Kabiljo, 2019). However, along with its promise, VR also raises a number of ethical and moral concerns. While the experience of *being* in the virtual space intensifies as the technology develops, our corporeal body is left behind as we subsume an abstract representation as our new reality (Penny, 1993). This quintessential mind-body split may alter one's relation to corporeality, leading to psychological deficits, such as *depersonalization* and *derealization* or body neglect (Spiegel, 2018). Additionally, immersive perspective-taking risks in assuming an 'improper distance' (Chouliaraki, 2011; Nash, 2018) between the viewer and the outgroup member, in which one subordinates the other, incorporating their representation, rather than recognizing their irreducible alterity.

Prejudice can be seen as an abstraction of the human body (Ahmed, 2000); yet despite the inherent abstraction in virtual mediums and the widely recognized role the body in forming social cognition (Dewey, 1986; Merleau-Ponty, 2013; Gallagher, 2006; Malafouris, 2013), little attention has been given to robots as a tool for intergroup contact. Remotely controlled robots (telerobots) have a lot in common with online mediums and may carry similar risks when used for contact. Nevertheless, telerobots have a physical presence; we use our bodies to interact with robots just as we would with a living being. They provide corporeal depth to mediated contact, situating a midpoint between online communication and an FtF meeting.

## 2.3 Telepresence and Telerobots

Originally, the term *telepresence* was used by Marvin Minsky and Patrick Gunkel to describe a vision of a futuristic economy in which people perform manual, physical labor from remote locations (Minsky, 1980). Although the term is nowadays used to describe a human's presence in a virtual environment (Steuer, 1992), telepresence originally refers to the experience of being in a remote environment that is *real* and mediated by a physical sensing agent, that is, a *telerobot*. (Campanella, 2000). When a telerobot serves as a remote representation of a human operator, it is referred to as its *avatar*. In phenomenological terms, the experience of operating a telerobot is named *re-embodiment* (Dolezal, 2009). Today's telerobots go beyond industrial use and are deployed in social care (Michaud et al., 2007), education (Tanaka et al., 2014), and interpersonal communication (Ogawa et al., 2011), utilizing the internet as the medium for tele-operation.

## 2.4 A Conceptual Model for Telepresence Contact

Based on previous models of prejudice reduction in intergroup contact (Pettigrew, 1998; Brown and Hewstone, 2005), we suggest a conceptual model for telepresence-based contact (see fig. 1). We hypothesize that an ingroup member first develops an atti-

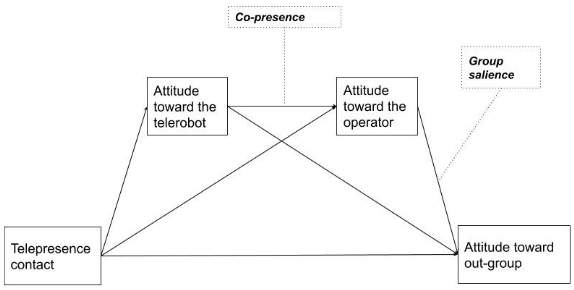


Figure 1: Telepresence Contact: Conceptual model.

tude toward the robot before projecting it onto the out-group human operator. The initial attitude toward the robot could be influenced by a previous general bias or by characteristics of the particular robot. We then expect the perception of the robot as a representation of the operator's agency to be moderated by the degree of perceived *co-presence*. Initially formulated by Goffman as a measure of our awareness of another human being in our physical space (Goffman, 2008), the term is now used in literature to measure the feeling of "togetherness" in mediated communication, virtual (Söeffner and Nam, 2007; Casanueva and Blake, 2001; Bente et al., 2008), and physical (Hwang et al., 2008; Choi and Kwak, 2017). Finally, as previous research on intergroup contact suggests (Voci and Hewstone, 2003; Brown and Hewstone, 2005; Kenworthy et al., 2005), a generalized attitude toward the outgroup is moderated by the level of group salience apparent in the conversation.

### 2.5 Telepresence Systems

A communication event that is mediated by telepresence robots could manifest in different architectures that we define as *telepresence systems*. We identify three different types:

1. *Asymmetric*: Participant A (operator) is represented by a telerobot and is operating it from a remote location using a computer or mobile device. Participant B (interlocutor) is co-located with the robot, interacting with it in a shared physical environment. Implementations of asymmetric systems include industrial robots, military robots, surgical robots, office work telepresence, and social service robots.
2. *Symmetric bidirectional*: Both participants are simultaneously interacting with a co-located robot and operating their remote telerobot. The operators do not see a dedicated control interface as they would in a computer-based interface. Instead, they interact with the robot of their partner, allowing it to capture their movements and transmit them to the telerobot representing them on the opposing end. This type of system is more challenging to implement, and only a few implementations exist as prototypes and proofs-of-concept (Nagendran et al., 2015).
3. *Symmetric unidirectional*: Both participants are operating a telerobot via a control interface, without any physical human-robot interaction taking place. The two robots are co-located with each other, while the participants are in separate spaces. Implementations of this system include cooperative multi-robot tasks (Sirouspour and Setoodeh, 2005) and Robot combat competitions such as *Battle Bots* [1].

## 3 TELEPRESENCE DESIGN CONSIDERATIONS FOR INTERGROUP CONTACT

Research in Human-Robot-Interaction (HRI) over the past two decades offers insight on a wide range of possibilities for designing social robots (robots that conduct social interaction with humans). Key factors that influence the attitude toward the robot include the level of anthropomorphism of the robot's appearance (Hancock et al., 2011; Fink, 2012), the use of an external display on the body of the robot (Thrun, 2004; Choi and Kwak, 2016), the use of affective touch and soft materials (Kerruish, 2017; Stiehl et al., 2005; Bao et al., 2018), and the use of nonverbal cues (Hirano et al., 2016; Lala et al., 2019). In telepresence, research focused on factors affecting the sense of presence and self-extension from operators toward their robotic avatars. Key elements include the responsiveness and feedback level of the control interface (Cole et al., 2000; Dolezal, 2009) and appearance of the robotic avatar (Lee et al., 2015a; Groom et al., 2009). Fig. 2 depicts a variety of existing telerobot designs. Designs vary from the commonly used video conferencing tablet on wheels to full-body anthropomorphic, zoomorphic, and caricature appearances.

The above factors are all relevant for establishing trust and positive relations between interlocutors and robotic avatars. In this article, however, we focus on the design and architectural elements that may be of particular importance to intergroup contact and conflict resolution. The following sections hypothesize potential pitfalls and opportunities one may encounter when applying telepresence robots as a means to reduce prejudice between groups.

[1] https://battlebots.com/

Figure 2: Telepresence Robots. Left to right: Double Robotics[2], Telenoid (Ogawa et al., 2011), BOCCO [3], stuffed-bear robot (Kuwamura et al., 2012).

## 3.1 Equality

One of Allport's conditions for positive intergroup contact is having an equal status between group members; for example, colleagues in a workplace context (Allport, 1954). It was further shown that maintaining symmetry and equality during communication is beneficial for contact in groups that are in asymmetric conflicts, such as the Israeli-Palestinian conflict (Maoz, 2005).

Symmetric telepresence systems provide the hardware foundation for equality in contact situations, but asymmetric systems produce an experience that is different in nature for both sides. The side that is interacting with the robot is less aware of the mediation that is taking place and may experience stronger senses of *agency* (the sense that I am the initiator of an act) and *ownership* (the sense that it is my body that is moving) in the interaction (Gallagher, 2000; Cole et al., 2000). The side that is operating the telerobot from a distance is more aware of the control operation and may exhibit behaviors characterizing anonymous computer-mediated-communication (CMC), as posited in the *SIDE* model (Spears et al., 2002) or the *hyperpersonal* model (Walther, 1996).

[2]https://www.doublerobotics.com/

[3]https://www.bocco.me/en/

In one use-case between advantaged and disadvantaged groups, a disadvantaged-group member may operate a telerobot anonymously from their home, while the advantaged-group member is interacting with it in a public space. This scenario is likely to reduce anxiety as the operator remains in their comfort zone and may get empowered by the ability to see through the robot's camera while not being seen by the interaction partner. That may not only lower the participation threshold in an intergroup contact project but may also encourage bringing up more difficult topics related to conflict during the conversation. However, such a reversed power asymmetry in robotic intergroup encounters could also hinder the experience. In an initial test case conducted in an intercultural setting between minority and majority groups in Finland, participants felt uncomfortable with the asymmetry. One member of a minority group noted that they felt as if they were a government official investigating their exposed partners (Peled, 2019, p.132).

## 3.2 Anthropomorphism and Dehumanization

A pivotal discussion revolves around the question of *anthropomorphism*: the degree in which a robot's appearance and behavior resemble that of a human. Current literature paints a picture that is manifold (Fink, 2012): while anthropomorphic features may increase empathy and acceptance of the robot, the effect is context and culturally-dependent. In some cases, people have preferred pet-shaped over human-like robots, particularly in the realms of child therapy and elderly care (Lorenz et al., 2016). Human-like robots may also raise negative emotions when they appear eerily human but are noticeably non-human (See the theory of the *Uncanny valley* (Mori et al., 2012)). Additionally, research by Groom et al. (2009) suggests that robot operators have a greater sense of *self-extension* (Belk, 1988) to their avatar when it is non-human.

Despite the advantages of a non-anthropomorphic appearance, the question deepens in the context of intergroup contact. *Dehumanization* (i.e., seeing an outgroup member as non-human or less than human) is both a marker and a driver of intergroup conflict (Haslam, 2006; Kteily et al., 2016). Specifically, individuals involved in intergroup conflict tend to view the outgroup as either animal-like or mechanistic automata, both common forms for robots. Current research does not yet deal with the effects of avatar anthropomorphism on intergroup conflict, but a study on video games points out that people find it easier to make immoral decisions toward non-human avatars

(Lin, 2011). Additionally, the distance formed by CMC increased dehumanization in decision making (Lee et al., 2015b).

When using a zoomorphic, mechanistic, or caricaturistic image for a telerobot, measures should be taken to mitigate dehumanization. Encouraging the display of secondary human emotions such as affection and admiration may help group participants to humanize one another (Leyens et al., 2000). Such emotions could rise as a result of self-disclosure in the conversation (Kashian et al., 2017), or by discussing an unrelated case of group suffering (Gubler et al., 2015). Additionally, the use of visual, auditory, and intellectual cues that remind the interlocutors of the human operator could mitigate the effect of a non-anthropomorphic avatar.

## 3.3 Designing with Group Salience in Mind

When participants are aware of their interaction partner's group membership and if the interaction partner is regarded as a (typical) representative of his or her group, positive effects of the interpersonal encounter are more likely to generalize to the outgroup as a whole. One approach, suggested by Pettigrew (1998), is to expose group identities gradually, starting with a low salience, allowing initial contact to form, and increasing it over time as the interaction partners establish an interpersonal relationship.

Group identity can be transmitted through a variety of channels in robotic telepresence, beginning with the design of the avatar; its appearance, voice, and its surroundings, and proceeding into the content of the interaction. A robotic avatar may have a non-humanoid appearance, but still maintain group identity through group symbols, cues, and language. It may speak in a group-specific language or accent, wear typical accessories or flaunt national colors. The freedom to use material objects brings up new design possibilities that are not available in an online encounter. Group cues may be positioned in subtle ways to be gradually revealed by the interlocutor. If the initial appearance and behavior of the robot are engaging enough, an interpersonal bond may form despite the presence of group-related cues.

## 3.4 Language Translation

The outstanding benefit of mediated verbal interaction for intergroup contact is the ability to translate between different languages and dialects (Amichai-Hamburger, 2012). Often groups in conflict do not speak a common language and are required to speak in a third language in the language of the advantaged/majority group. This situation forms an obstacle to achieving equality in contact. Language translation may reinforce equality in communication, as all participants can express themselves in their native language. Machine translation, however, may also be destructive to cultural and political nuances (Lehman-Wilzig, 2000; Cronin, 2012), and contemporary deep-learning translators exhibit stylistic and gender bias based on their training datasets (Hovy et al., 2020; Stanovsky et al., 2019). Models such as Timo Honkella's "peace machine" (Honkela, 2017; Koulu and Kontiainen, 2019) attempt to resolve this problem by preserving cultural-dependent meanings within a translation.

While no data exist on the implications of machine translation in intergroup contact, human translators and interpreters often suffer from a lack of trust by the participants who fear of bias and misinterpretation (Monzó-Nebot, 2019); a machine translator may enfold similar risks. In our initial test for automatic language translation in contact between minority and majority groups in Finland, participants enjoyed their newly acquired ability to speak to one another in their language, but have raised concerns about being misrepresented by the machine (Peled, 2019). Further research should focus on implementing and evaluating feedback mechanisms within the translation process that may reduce the fear of misinterpretation.

## 3.5 Public Space Interventions

Robots can transcend both physical borders set by governments and online borders set by IT corporations (Del Vicario et al., 2016). They have the potential to reach crowds that would not normally engage in intergroup contact. One might consider whether the group identity of the telerobot's operator should be widely exposed to passersby, allowing them to make a voluntary decision to approach, or whether they should only realize it during the conversation. A meta-analysis by Pettigrew et al. (2011) concluded that in contacts that had a negative outcome, it was worse when initiated involuntarily. However, when the group identity is known, members may avoid interaction (Wessel, 2009), which results in a self-selection bias in organized interventions between groups (Maoz, 2011). A balanced approach may work well here: Some cues could be exposed, providing only subtle hints about the telerobot's identity, allowing passersby to approach an intergroup encounter voluntarily.

## 4 DISCUSSION

The guidelines set forth in this article provide a foundation for further research and implementation of an innovative medium for intergroup contact. Any organized forms of intergroup contact should always be questioned and scrutinized regarding its internal motivation, especially in the context of violent, asymmetric conflict. When involving technology, a transparent and fully open-source strategy should be employed to expose inherent biases and avoid concentrations of power. The practice of *Co-Design* can increase the involvement of minority groups in the process, disseminate technological knowledge, and reduce the notion of a higher power from above coming to restore peace without perceiving the situation and its nuances.

Moreover, Groom et al. showed that operators had a greater sense of self-extension to a robot that was assembled by them, rather than another (Groom et al., 2009). Robots were also successfully co-designed with children as the target users (Alves-Oliveira et al., 2017; Henkemans et al., 2016), and co-design methods improved the general attitude of students toward robots in educational settings (Reich-Stiebert et al., 2019).

Toward the first installment of telepresence robots in sensitive conflict situations, benefits and risks are to be carefully evaluated in dedicated focus groups and with A/B testing of particular features and interactions. We look forward to unveiling the potential of telepresence robots for intergroup contact in further research, ultimately leading to positive social change.

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