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Exploring the future: introduction of a new paradigm to examine intergroup experiences

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Intergroup contact theory, as one of the most established research strands in social psychology, has mostly relied on overall measured averages of intergroup contact over larger time spans. Yet, in everyday life, intergroup contact experiences are far more complex: they are sequential and cumulative and may vary on a range of dimensions, such as, for example, their perceived valence. In this article, I introduce a new experimental paradigm, primarily developed as a research manipulation, to examine intergroup contact, manipulated on the unit of single interactions in a video-game setting, which can also be run from a web server, so that participants can join from their home computers. Depending on experimental condition, in a first study, participants rated the perceived quality of multiple positive or negative intergroup interactions with an alien species and intergroup attitudes in a storytelling questionnaire setting (Pilot Study, $N = 242$). Study 1 implemented these positive and negative interactions in a video game, which was played in the laboratory ($N = 44$), and examined their effects on the perceived contact quality and intergroup attitudes. Study 2 ($N = 64$) utilized a web-based version of the video game to test the effects on intergroup attitudes. In all three studies participants in the positive condition evaluated the interactions, as well as the overall outgroup, more positive than participants in the negative condition. Furthermore, Study 1 and 2 explored participants' perception of the virtual environment and previous experiences with video games. The results suggest that specifically developed video games offer new pathways to study intergroup interactions.

KEYWORDS

video games, intergroup contact, intergroup interactions, intergroup relations, valenced intergroup contact

1 Introduction

Intergroup contact research is one of the most established research traditions within social psychology (e.g., Pettigrew, 2021). Building on more than 70 years of empirical evidence, intergroup contact theory builds on the core assumption that, if individual members of different groups experience positive contact, they will not only improve their attitudes toward their contact partners, but these attitudes will also generalize to the respective outgroup (e.g., Allport, 1954) and possibly even beyond (e.g., Boin et al., 2021). A tremendous amount of empirical evidence supports this assumption: Pettigrew and Tropp (2006) identified 512 studies examining intergroup contact research up until 2000, a number which, since then, has more than doubled (Schäfer et al., 2024b).

Nevertheless, this impressive number of studies is still struggling with some shortcomings. First, a general lack of experimental research, which, despite the huge number of available studies, is still scarce (Pettigrew and Tropp, 2006; Paluck et al., 2019;

Schäfer et al., 2024b). Second, being driven to find ways to improve intergroup relations, and due to ethical considerations when it comes to designing manipulations, the field recently started to acknowledge the role of negative intergroup contact (e.g., Paolini et al., 2010; Barlow et al., 2012; Graf et al., 2014; Schäfer et al., 2021). Third, recent research in the field has called for a deeper understanding of the complexity of intergroup contact in everyday life (e.g., Dixon et al., 2005)—for example, by examining how single intergroup interactions constitute an overall experience of intergroup contact.

Understanding intergroup contact as the composite of many different intergroup interactions, which might either be positive or negative, on the one hand leads to the challenge to go beyond the accumulated measure of intergroup contact, whereby participants answer questions about average scores of interaction experiences, as commonly done in intergroup contact research. On the other hand, it also challenges us to observe and manipulate not only one single instance of an intergroup interaction, as commonly done in the realm of research on intergroup interaction (e.g., MacInnis and Page-Gould, 2015). Instead, attempts to address these shortcomings of intergroup contact research call for an observation and manipulation of a series of isolated instances of intergroup interactions, which then might form an overall experience of intergroup contact. Recent methodological advancements have started to address the issue of observing everyday intergroup interactions in contrast to overall measures of average levels of intergroup contact (e.g., Keil et al., 2020; Schäfer et al., 2021). And while near-time reporting of intergroup contact experiences in everyday life provides a maximized ecological validity (Keil et al., 2020), it comes with some methodological shortcomings, as the perception of intergroup contact itself might be biased, intergroup contact might indeed be scarce even in diverse neighborhoods, like in the context of Catholics and Protestants in North Belfast (Dixon et al., 2020), and negative contact, in particular, might not be observable on an everyday basis, for example between British-White and British-Asian people (e.g., Schäfer et al., 2021): to summarize, they provide low levels of experimental control.

Such challenges are not unique to intergroup contact research but have long troubled research on social psychology in general: if researchers are aiming for high levels of control (and high internal validity) in laboratory experiments, they often have to trade off mundane realism (Blascovich et al., 2002). Reductions in mundane realism might not only result in a reduced engagement of participants in the experimental tasks, but may also impact ecological validity (e.g., Lodewijkx et al., 2006). While advances in technology—such as detailed computer-generated pictures as manipulation materials—enabled researchers to reduce the necessary trade-off between experimental control and mundane realism, it has been suggested that virtual realities might help to close this gap (e.g., Blascovich et al., 2002).

Nowadays, more than ever before, virtual environments, online-interactions, and video games play an important role in structuring our social lives—at work, but also in private. Video games thereby take on a crucial role. It is estimated that about 40% of the world's population were playing video games in 2022 (Statista, 2023) and even more so in specific countries: for example, in a probability-based sample of 1,306 children aged 8–18 in the US, 89% reported having a computer and 79% reported having a video game player at home (Common Sense Census, 2022). Among American teenagers, 72% play video games (Lenhart, 2015). But this development is not limited to young people: in 2022, later adults from the age of 45 onwards outnumbered the 2–24-year-old cohort in consuming video games and even provided the fastest-growing consumer base (Circana, 2023).

Alongside these developments, our knowledge about the effects of virtual interactions increases. In recent years, a rising amount of research has demonstrated that virtual interactions and even interactions in video games can impact our real lives, such as our mental health (e.g., Sahi et al., 2021), or even our explicit biases toward social groups, for example among German participants[1] toward Black people (Breves, 2018). Recently, Bond et al. (2023) demonstrated, that online intergroup contact had a unique influence on prejudice, over and above the effects of direct contact for White and Black UK residents and Catholic and Protestant residents of Northern Ireland. Nowadays, developments in hard- and software solutions make it much easier not only to use, but also to design video games in immersive 2D settings of high quality (e.g., Unreal Engine ©Epic Games, Inc; ©Unity 2023)[2] (Unity 3D, 2023; Unreal Engine, 2023). Indeed, first notable software solutions specifically support researchers in designing experiments in immersive 2D settings to study research questions in the realm of, for example, visual perception (Bebko and Troje, 2020) or memory (Vasser et al., 2017). To my knowledge, the use of such immersive 2D video games to examine research questions in the realm of social psychology remains scarce. A 2D video game is one that is played on a traditional computer screen but may of course be designed in a modern 3D setting, which includes the simulation of physical properties: for example, objects in the distance appear smaller than close objects and the player's movements in the game depend on gravity. These 2D settings might yield user experience comparable to 3D solutions, as with, for example, head-mounted displays (Takatalo et al., 2011). The present paper introduces such a video-game setting to manipulate intergroup interactions, which can be utilized not only within laboratories, but can also be assessed by users from their home computers as a browser game solution.

The present paper demonstrates that not only full virtual realities, but also video games provide conditions to design highly controllable experiments. Through the ability to use artificial groups and fictional characters, video games additionally provide a setting where it is ethically much less problematic to implement negative experiences (e.g., Slater et al., 2006). Furthermore, by being adaptable down to every detail of the virtual interactions and environment, video games can examine and manipulate experiences in great detail and, through browser-based games, provide opportunities for a comparatively easy data collection.

The presented paradigm, which is primarily developed as a research manipulation, invited participants to a virtual

1 I could not find information on whether any of the participants identified as People of Color.

2 Frameworks like Unity and Unreal Engine even enable nonexperts to design their own virtual environments (e.g., Core Metaverse, © 2023 Manticore Games, Inc.; Struckd-3D Game Creator).

environment situated in a fictitious future, where participants were encouraged to interact with an alien species. The main aim of this paper is to establish that positive interactions are evaluated more positive than negative interactions in a video game setting and that interactions in the game affect overall outgroup attitudes. Therefore, a between-person approach is chosen. The video game could easily be adapted to a within-person design to address more complex research questions for future studies. The pilot study ($N =$ 242) provided a thorough development of materials to manipulate valenced interactions. Study 1 ($N = 44$) constituted a first feasibility study of the video-game paradigm conducted in the laboratory. A last utilization study, Study 2, took the paradigm out of the laboratory, where $N = 64$ individuals participated in a browser-based game version. A desktop version of the video game for Windows platforms (in German), the data for all three studies, as well as the markdown of the analysis are available at https://osf.io/9cyft/?view_only=86212758cad244ef8b2de9a9f0924fb8.

1.1 Psychological impact of video games

Video games nowadays are increasingly designed to go far beyond simple reaction tasks or logic puzzles and to provide rich and emotional complex experiences (Hemenover and Bowman, 2018). Indeed, video games are not only able to elicit enjoyment of the game, but a wide range of different emotions—for example, they can provide a sense of meaning (Olivier et al., 2016) or affect participants' short-term well-being and their need for relatedness (e.g., Ryan et al., 2006). One attempt to categorize these possible experiences suggests that individuals are motivated to play video games on three dimensions, namely: achievement (i.e., challenging others); immersion (i.e., escape from real life); and by social motivations, such as the motivation to help others, find and give support and the chance to collaborate to achieve common goals (Yee, 2007).

Most interestingly, it is therefore not necessary to interact with a real interaction partner (as, for example, in multiplayer games): even interacting with nonplayer characters (NPCs) can provide a sense of relatedness (Rigby and Ryan, 2011). A qualitative survey among players of video games identified a variety of seven forms of emotional attachment, ranging from admiration to deep emotional concern for NPCs (Bopp et al., 2019). While this deeper attachment was found among frequent players, it is suggested that players will build a relationship with NPCs—for example, if NPCs are providing help or need help from the player (Grasse et al., 2022), which suggests that the manipulation of an NPC's behavior in video games should affect the interaction quality for the player.

The impact of video games on players' experiences can even be demonstrated on biopsychological measures: for example, Garau et al. (2005) demonstrated that interactions with NPCs can affect heart rate and electrodermal activity. In their virtual implementation of the classic 1960s Milgram Experiment, Slater et al. (2006) even state that: "The main conclusion of our study is that humans tend to respond realistically at subjective, physiological and behavioral levels in interaction with virtual characters notwithstanding their cognitive certainty that they are not real" (p. 5). While of course such a powerful statement has to be made with caution, it seems safe to conclude, that video games in general, and interactions with NPCs specifically, can elicit positive and negative experiences.

1.2 Virtual reality and video games to examine intergroup contact

Indeed, researchers are increasingly trying to utilize this impact of video games and virtual settings overall, to address psychological research questions. In a systematic review, Tassinari et al. (2022), found 41 studies using virtual reality to examine the reduction of prejudice. Of these 41 studies, 15 examined interactions with either an NPC or an avatar (directed by a confederate/other player). In most of these studies these interactions affected participants' attitudes or emotions. Most of the current research focused on virtual reality settings with head-mounted displays (HMDs; for another impressive use of this approach see e.g., Drury et al., 2009). While HMDs have their upsides, like a greater presence in the virtual scene, they also have their downsides, such as a risk of motion sickness and dizziness, and a higher cognitive load for the participants, which reduces the memory of items placed in the settings (Roettl and Terlutter, 2018). Additionally, some empirical findings argue that despite the lower presence in the scene, video games on a common computer screen still elicit user experiences comparable to those provided by HMDs (Takatalo et al., 2011). Additionally, neither arousal nor evaluation of the game differ between the different settings (Roettl and Terlutter, 2018). Furthermore, due to the health risks associated with HMDs, such as motion sickness (e.g., Howard and Van Zandt, 2021), traditional video games are much easier to implement in settings outside the lab. Server-based video-game solutions even provide full flexibility, as in principle they can be assessed from any device with a compatible web browser.

Of course, researchers have not relied only on HMDs to study intergroup contact effects. One other way for researchers to utilize video games for research questions is to use existing video games and to observe their impact on psychological outcomes. For example, using cross-sectional survey data of a sample of 116 male players of existing multiplayer online games, Kordyaka et al. (2022) demonstrated that positive interactions with female players in the game were not related to prejudice, while negative contact was related with higher levels of benevolent and hostile sexism. In contrast, Adachi et al. (2015) demonstrated that playing a cooperative, violent video game with an outgroup member against zombie-like enemies reduced prejudice in comparison to playing with an ingroup member. While these authors focused on interactions of real people while playing video games, others examined the effects of interacting with NPCs. Breves (2018) examined whether an instruction given by a black NPC in the video game Skyrim would reduce prejudice compared to a control group who were given the same instructions by a white experimenter. They found no significant decrease in prejudice after receiving the instructions from a black NPC. Yet, Mulak and Winiewski (2021) evaluated the average interaction quality with minorities in 44 frequently played video games. They demonstrated that 1,627 gamers' acceptance of minorities at the individual level was

higher for individuals who played games involving more positive contact with real-world and fictional NPCs. Overall, these findings suggest that, indeed, intergroup contact in video games—and, more specifically, intergroup contact with NPCs—would elicit intergroup contact effects. Yet, utilizing existing video games carries with it the drawback of a lot of additional variables to be considered, such as extensive violence within the game, or additional tasks in the game, which may diverge the players' focus.

1.3 Materials and equipment: paradigm for the present paper

To examine the usability of video games for intergroup contact research, beyond the use of pre-existing games, I decided to develop a paradigm tailored to examine the interplay of single instances of intergroup interactions. In contrast to the utilization of existing games, this allowed us to fully control the interaction partners, environment, storyline, and content of the interaction.

For these utilization studies I decided on a humanoid extraterrestrial alien species, adapted using Blender (Version 3.4, 2023) from a template (Mixamo © Adobe Systems Incorporated) (Adobe, 2023) specifically for this purpose (Figure 1), as interaction partners. This choice was made to ensure that individuals would not have fixed expectations of this species (as expectations might influence intergroup contact effects, e.g., Zingora et al., 2021) and using a fictitious group reduces ethical concerns with regard to negative intergroup experiences (e.g., Hayward et al., 2017). To keep the effects of the environment as low as possible, it was designed as a modern office building (Figure 2). The environment was designed and programmed using ©Unity 2023 (Unity 3D, 2023).

The storyline told participants that they had fallen asleep at their computers and woken up in the near future. To encourage participants to interact with the virtual individuals in the virtual building, they were told that they had to ask for time crystals, to be able to power a time machine to bring them back to their own timeline to avoid a disruption in the time–space continuum. Therefore, participants had to walk through the office building, knock on different doors and engage with individuals situated in individual offices (Figure 3), through one of three potential ways to address these NPCs, which were all designed to be of a rather neutral, slightly positive valence.

The positive and negative responses participants would receive in the respective conditions are detailed in the pilot study (Table 3).

1.4 The present research

The present paper aims to demonstrate that a specifically developed video game during which participants interact with an outgroup will evoke intergroup attitudes and emotions and can affect future contact intentions. To establish this, a between-person approach is chosen, which for future studies could easily be adapted to more complex within-person designs. The pilot study describes a thorough examination of the perceived quality of the chosen interactions using a traditional questionnaire setting. Study 1 presents data from a first utilization study of the video-game scenario in a laboratory setting. Study 2 takes the same setting to a web-based version and tests the hypothesis that participants experiencing positive interactions will evaluate the interactions, as well as the social group of their interaction partners more positively and report less intergroup anxiety than participants experiencing negative interactions (preregistration at https://osf.io/s95mh).

2 Pilot study

The pilot study was conducted to ensure that participants perceived the valence (negative or positive) of the chosen interactions as intended. This study utilized the same narrative

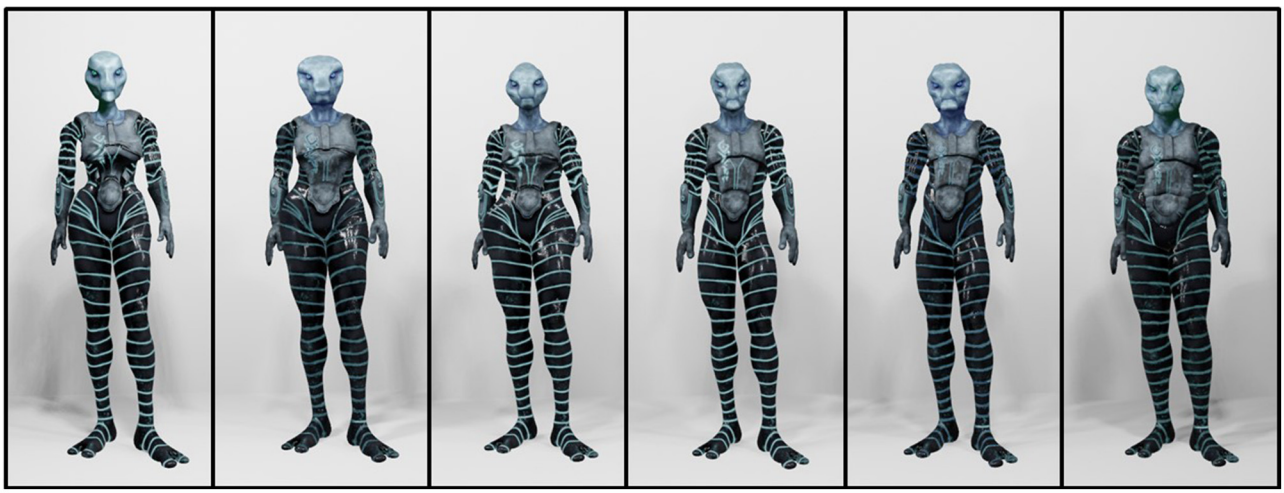

FIGURE 1
Overview of the interaction partners. The characters were adapted for this purpose from a template provided via Mixamo © Adobe Systems Incorporated.

FIGURE 2
View of the main hallway, shortly after entrance.

FIGURE 3
View of an interaction partner, shortly before starting the interaction.

as the final paradigm, but was implemented through a traditional online-questionnaire solution [Enterprise Feedback Suite (EFS), 2022]. In this questionnaire setting, participants first read the core aspects of the storyline reported above (see Section 1.3). The text was embedded in pictures designed to look similar to the planned video-game environment. After reading the background story, in a between-person design with one factor (contact quality: negative or positive), participants were randomly assigned to either a positive or a negative condition. Within each condition, participants were instructed to imagine meeting six members of the alien species. Each of the six interaction partners (see Figure 1) was represented by a picture including a speech bubble and participants were asked to evaluate the perceived interaction quality below each picture. While the pictures were identical across conditions, participants in the positive condition read positive interactions, whereas participants in the negative condition read negative interactions. The main themes of the texts can be found in Table 2, the exact wording is documented in the online materials.

TABLE 1 Main variables pilot study, means, standard deviations, and correlations with confidence intervals.

Variable	*M*	*SD*	1	2
1. Mean quality	50.49	29.31		
2. Feeling thermometer	48.43	30.00	0.84*** [0.80, 0.87]	
3. Previous experiences	2.81	1.30	0.04 [−0.10, 0.17]	0.08 [−0.06, 0.21]

$N = 233$. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval (CI) for each correlation.
***$p < 0.001$.

Participants afterwards answered several questions regarding their experiences and evaluations of the outgroup.

2.1 Method

2.1.1 Participants

Participants were recruited online through the private networks of 70 students who participated in a research seminar at a large German university. The raw data set included $N = 242$ participants. Two participants were excluded from the data set because they did not agree to the inclusion of their data, two further participants stated that they had not participated seriously, and five participants were underage. After the exclusion of these nine participants the final data set included $N = 233$ participants, of whom $n = 118$ participated in the positive and $n = 115$ in the negative condition. A total of 147 participants defined their gender as female, 83 as male, no participants reported diverse gender, and one participant chose another gender. The mean age of participants was $M_{age} = 38.17$, $SD_{age} = 14.09$; German was the first language of $n = 211$ participants; 174 participants were not currently enrolled as students, while 37 participants reported they were students. Most of the participants were highly educated: 204 reported having completed college, a professional qualification, or a degree from higher education. Participants who were currently enrolled at most universities in Germany could receive a course credit after participating in the study. Participants provided full consent to the storage and usage of their data and were fully debriefed at the end of the final questionnaire. Using G*Power 3.1.9.7 to determine an appropriate sample size for a small to medium effect size, with a one-tailed test, and a power of 0.90, yielded a total sample size of 282.

2.1.2 Measures

The perceived quality of each interaction was measured with a single item "How would you evaluate this situation overall?" on a scale from *negative* (1) to *positive* (100). Additionally, I computed an overall mean score for the six experiences for each participant which represents the *mean perceived quality* (McDonald's $\omega = 0.97$).

TABLE 2 Perceived interaction quality for all interactions, as well as a mean of overall perceived contact quality pilot study.

Type of interaction (neg/pos)	Negative contact condition		Positive contact condition	
	M	*SD*	*M*	*SD*
Rejection/welcome	32.22	18.94	69.60	22.58
Derogation/sharing	35.15	19.11	77.93	23.47
Competition/cooperation	28.92	19.7	70.60	25.4
Derogation/helping	23.73	19.28	80.47	22.87
Stealing/helping	19.36	18.10	79.98	21.36
Threat/support	17.96	16.63	70.98	22.86
Mean perceived quality	26.70	14.17	74.93	18.80

$N = 233$ (n = 115 for negative contact condition and n = 118 for positive contact condition). Interactions were presented in a randomized order.

A feeling thermometer measured *outgroup attitudes*. Participants were instructed that they had now met some of the alien individuals and were asked to provide a general evaluation of the whole alien species using a scale ranging from *very cold* (1) to *very warm* (100).

Previous experiences with aliens were measured with a single item "How much previous experience do you have with the imagination of alien lifeforms (e.g., from video games, books, movies) do you have?" on a scale from *none* (1) to *a lot* (5)[3].

Table 1 presents means, standard deviations, and correlations for the main measures across the overall sample.

2.2 Results and discussion

For all three studies, I analyzed the data with R (version 4.2.2), in RStudio (Build 576, 2022.07.2; © 2009–2022 RStudio, PBC). Further detailed analysis and the packages used can be found at: https://osf.io/9cyft/?view_only=86212758cad244ef8b2de9a9f0924fb8.

2.2.1 Perceived quality of positive and negative interactions

Table 2 displays the mean and standard deviations for all positive and negative interactions. All positive interactions were rated well above the mean of the scale, and all negative interactions well below. A *t*-test supported that, overall, positive interactions, $M = 74.93$, $SD = 18.80$, were evaluated as being more positive than negative interactions, $M = 26.70$, $SD = 14.17$, $t_{(206.33)} = 21.784$, $p < 0.001$, $d = 2.903$ on the average overall perceived quality ratings.

3 The full questionnaire of all three studies can be requested from the author.

TABLE 3 Variables Study 1, means, standard deviations, and correlations with confidence intervals from the overall sample.

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Contact quality	2.99	0.81							
2. Warmth	2.72	1.47	0.58*** [0.34, 0.75]						
3. Competence	3.44	0.82	0.36* [0.07, 0.59]	0.26 [−0.04, 0.52]					
4. Threat	2.45	1.15	−0.28 [−0.54, 0.01]	−0.53*** [−0.71, −0.27]	0.03 [−0.27, 0.32]				
5. Anxiety	3.03	0.94	−0.35* [−0.58, −0.06]	−0.72*** [−0.84, −0.53]	−0.21 [−0.47, 0.10]	0.61*** [0.38, 0.77]			
6. Future intentions	3.08	1.22	0.26 [−0.04, 0.52]	0.58*** [0.34, 0.75]	0.13 [−0.17, 0.41]	−0.62*** [−0.78, −0.40]	−0.78*** [−0.87, −0.62]		
7. Previous experiences	2.98	1.22	0.00 [−0.31, 0.30]	0.24 [−0.07, 0.50]	−0.13 [−0.41, 0.18]	−0.04 [−0.34, 0.26]	−0.19 [−0.47, 0.12]	0.26 [−0.05, 0.52]	
8. MEC–SPQ	2.87	0.70	0.26 [−0.05, 0.52]	0.09 [−0.21, 0.38]	−0.08 [−0.37, 0.23]	−0.18 [−0.45, 0.13]	−0.06 [−0.35, 0.25]	0.10 [−0.20, 0.39]	0.20 [−0.12, 0.47]

$N = 44$. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation.
*p < 0.05.
***p < 0.001.

2.2.2 Outgroup attitudes

Outgroup attitudes were more positive in the positive, $M = 69.31$, $SD = 24.81$, than in the negative condition, $M = 27.36$, $SD = 17.43$, $t_{(197.43)} = 14.554$, $p < 0.001$, $d = 1.955$.

This pilot study demonstrates that participants perceived the chosen interactions according to their respective valence: positive interactions are perceived well above and negative interactions well below the mean of the perceived quality scale. Yet, the large variance for both positive and negative interactions demonstrates that individuals can vary in their evaluation of interactions. Notably, the evaluation of positive interactions varies more than the perception of negative interactions. This larger variance of the quality of positive intergroup contact compared to the variance of negative contact can also be found in other research on intergroup contact (e.g., Hayward et al., 2017), but seems to contradict findings from studies on the basic perception of positive and negative events, which postulate that negative information should be more diverse (e.g., Unkelbach et al., 2019). In line with the existing literature (e.g., Pettigrew and Tropp, 2006; Pettigrew, 2021), the experience of positive or negative intergroup contact within the respective conditions also generalized to the evaluation of the whole outgroup: participants in the positive condition expected the whole alien species to be warmer than participants in the negative condition. In comparison to available evidence on intergroup contact effects, which usually report small to medium effects (e.g., Pettigrew and Tropp, 2006), the pilot study finds large effects on intergroup attitudes. This finding can probably be explained by the fact that I purposely chose a fictitious group with whom participants had no previous experiences (e.g., Page-Gould et al., 2022). Notwithstanding the rather artificial story-telling questionnaire setting, this pilot study provided convincing evidence that participants followed the general storyline and evaluated the interactions according to their respective valence.

3 Study 1

Study 1 took the interactions which were pretested in the pilot study to a video-game setting. Using the video-game setting elaborated in Section 1.3., data for Study 1 were collected using the video-game paradigm described above in the laboratory of a large German university for a utilization study of the video game. At separate computers in the laboratory, participants entered the video game in an office-like environment (Figure 2) and read through the background story, before beginning to move through the virtual environment. When entering the second virtual room, in a between-person design with one factor (contact quality: positive or negative) participants were randomly assigned to either make six positive or six negative experiences with the alien avatars (Figure 1). After interacting with six avatars, participants were directed to an online questionnaire to answer the questions for the outcome measures.

3.1 Method

3.1.1 Participants

For Study 1, data were collected in two research seminars at a large German university, $N = 44$. Everyone agreed to the inclusion of their data and stated they had participated seriously. Participants' age ranged from 18 to 64, $M_{age} = 34.67$, $SD_{age} = 11.62$. Thirty-one participants defined their gender as female, 12 as male, and one person did not report their gender. Thirty-eight participants reported German to be their first language.

Two participants reported having some visual limitations, which might have interfered with their perception of the pictures in the manipulation material. Of these $N = 44$ participants, 23 participated in the positive condition, 21 participated in the negative condition. Participants were fully debriefed at the end of the final questionnaire and fully informed about the storage and usage of their data.

3.1.2 Measures

Perceived contact quality was measured after the video game, on seven items which were translated to German (enjoyable, informal, unpleasant, superficial, boring, pleasant, involving, Paolini et al., 2010) and have been used in previous studies (Schäfer et al., 2024a) on a 5-point scale ranging from *does not apply* (1) to *fully applies* (5). Three items were recoded, so that higher values indicate a more positive perception of the contact quality, and one item (informal) was dropped from the analysis because it was negatively related to some of the other values (McDonald's $\omega = 0.89$).

To measure *outgroup attitudes* I report results for *warmth* (e.g., warm, McDonald's $\omega = 0.94$), *competence* (e.g., competent, McDonald's $\omega = 0.75$), each measured on three items (Asbrock, 2010), and *intergroup threat* (e.g., threatening, $r = 0.66$), measured with two items. All items were rated on a 5-point scale ranging from *does not apply* (1) to *fully applies* (5).

To measure *intergroup anxiety* participants stated how likely it would be that they would experience ten emotions (e.g., "worried," "happy") when next meeting a member of this alien species (Birtel and Crisp, 2012). Items were measured on a scale from *not at all* (1) to *fully* (5) and three items had to be recoded (McDonald's $\omega = 0.95$).

Additionally, *future contact intentions* were measured with two items ($r = 0.77$) asking whether participants would choose to interact with an individual from the outgroup if they had the choice and how likely they would start a conversation with an outgroup member (adapted from Husnu and Crisp, 2011).

Previous experiences were measured with the same item used in the pilot study.

Perception of the story and virtual situation was measured with an adapted version of the MEC Spatial Presence Questionnaire (MEC-SPQ, Vorderer et al., 2004), on a 5-point scale ranging from *not at all* (1) to *completely* (5). As this scale was added for exploratory purposes only, and I wanted the questionnaire to stay as short as possible, I selected two items for each of the subscales of the MEC-SPQ based on the highest interitem correlations as provided in the original article: Attention Allocation (i.e., *I devoted my whole attention to the game*); Spatial Situation Model (i.e., Even now, *I still have a concrete mental image of the spatial environment*); Spatial Presence (i.e., *I felt like I was actually there in the environment of the presentation*); Spatial Presence Possible Actions (i.e., *I had the impression that I could be active in the environment of the presentation*); Higher Cognitive Involvement (i.e., *The game presentation activated my thinking*); Suspension of Disbelief (i.e., *I concentrated on whether there were any inconsistencies in the game*); Domain Specific Interest (i.e., *I felt a strong affinity with the theme of the game for a long time*); Visual Spatial Imaginary (i.e., *When someone describes a space to me, it's usually very easy to imagine it clearly*); and I added one item stating *I had the feeling that I could interact with the individuals in the story*. The item *I didn't really pay attention to the existence of errors or inconsistencies in the game* was negatively correlated with most of the other items of the MEC-SPQ; for our purpose (to gain a first impression of the overall experience of the story), I excluded the respective subscale, suspension of disbelief, from the scale, and computed an overall mean score of the remaining items, whereby higher scores indicate higher involvement in the story and environment (McDonald's $\omega = 0.89$).

TABLE 4 Study 1 means and standard deviations and *t*-test by condition.

Variable	Negative contact condition		Positive contact condition	
	M	*SD*	*M*	*SD*
Contact quality	2.50	0.78	3.44	0.55
Warmth	1.35	0.66	3.97	0.62
Competence	3.19	0.93	3.67	0.64
Threat	3.14	1.10	1.83	0.78
Intergroup anxiety	3.68	0.60	2.44	0.79
Future contact intentions	2.48	1.18	3.63	0.99

$N = 44$ (n = 21 for negative contact condition and n = 23 for positive contact condition).

3.2 Results and discussion

Table 3 presents means, standard deviations, and correlations for the main measures across the overall sample. Please note that for the group comparisons Bonferroni correction should be used to address the multiple-comparison problem, therefore results with $p < 0.006$ can be considered significant. Participants in the negative condition did not report significant differences in their previous experiences, $M_{neg} = 2.75$, $SD_{neg} = 1.29$, compared to participants in the positive condition, $M_{pos} = 3.18$, $SD_{pos} = 1.14$, $t_{(42)} = -1.14$, $p = 0.260$, $d = -0.36$. This finding supports a successful randomized assignment to the two experimental groups. Furthermore, we find no significant difference in the perception of the story and the virtual situation $M_{neg} = 2.76$, $SD_{neg} = 0.68$, $M_{pos} = 2.96$, $SD_{pos} = 0.73$, $t_{(42)} = -0.96$, $p = 0.343$, $d = -0.29$. Table 4 presents means and standard deviations separated by experimental groups.

The quality of the interactions was perceived to be less positive in the negative compared to the positive condition, $t_{(42)} = -4.61$, $p = <0.001$, $d = -1.41$. It is therefore worth noting that the positive contact condition was evaluated above, and the negative contact condition below the mean of the scale. Furthermore, participants also generalized their experiences to expectations toward the whole alien group: in the realm of outgroup attitudes, the alien species was evaluated as less positive in the negative than in the positive condition on the measure of warmth, $t_{(42)} = -13.53$, $p < 0.001$, $d = -4.1$, and threat, $t_{(42)} = 4.55$, $p < 0.001$, $d = 1.4$, but not of competence, $t_{(42)} = -1.97$, $p = 0.057$, $d = -0.6$. The missing effect of competence can be explained by the nature of the interactions:

they were designed to be positive and friendly, but did not address issues related to competence. Intergroup anxiety was higher in the negative compared to the positive condition, $t_{(42)} = 5.92$, $p < 0.001$, $d = 1.76$, and participants in the negative condition reported lower future contact intentions, $t_{(42)} = -3.5$, $p = 0.001$, $d = -1.06$. Overall, Study 1 provided evidence of a successful implementation of a positive and a negative intergroup contact condition in the video-game scenario. As expected, participants in the positive contact condition reported more positive generalized attitudes toward the outgroup. While the sample size of Study 1 was rather low, the manipulation yielded large effect sizes in line with our assumptions.

4 Study 2

Study 2 used the same video-game paradigm and between person-design with one factor (contact quality: positive or negative) as Study 1. While in Study 1 participants played the video-game at computers in the laboratory, for Study 2 participants played from their home computers. Therefore, a server-game version of the game was used. Study 2 was preregistered at https://osf.io/s95mh.

4.1 Method

4.1.1 Participants and design

During an online lecture, $N = 64$ students participated as part of the very first lesson of a research seminar during their undergraduate psychology program at a large German university. Participants were fully debriefed after the final questionnaire and informed about the data storage and usage. Participants had the option to indicate at the end of the questionnaire whether or not they had participated seriously. Before starting the experimental trial, participants had been told that choosing "not seriously" would provide an option to join the experience of the experiment, but would lead to an exclusion of their data, for example if they were tending other tasks in parallel or simply felt uncomfortable to have their data included. Two participants reported that they had not participated seriously and their answers were deleted from the data. No further participant disagreed to the usage of their data or had participated in a similar study at an earlier time. With regard to gender, forty-six participants stated their gender to be female, 14 as male, two participants did not state their gender. Participants' ages ranged from 20 to 57, $M_{age} = 32.85$, $SD_{age} = 9.04$. Of these $N = 62$ participants, $n = 32$ participated in the positive and n = 30 in the negative condition. Given the large effect sizes found in studies 1 and 2, I preregistered to reach at least 50 participants. Sensitivity analysis for a one-tailed t-test with a power of 0.9 suggested that an N of 50 would be sufficient for an effect size of 0.84.

4.1.2 Measures

Study 2 used the same measures as Study 1, namely perceived contact quality (McDonald's $\omega = 94$), warmth (McDonald's $\omega = 0.94$), competence (McDonald's $\omega = 0.55$), threat ($r = 0.83$), intergroup anxiety (McDonald's $\omega = 0.95$), previous experiences with aliens and future contact intentions ($r = 0.73$) and the MEC-SPQ (McDonald's $\omega = 0.88$).

4.2 Results and discussion

Table 5 presents means, standard deviations, as well as correlations for the main measures in the overall sample. As in Study 1, Bonferroni correction should be used to address the multiple-comparison problem and therefore results with $p < 0.006$ can be considered significant. As in Study 1 we neither found significant differences between the groups for previous experiences $M_{neg} = 2.86$, $SD_{neg} = 1.19$, $M_{pos} = 2.48$, $SD_{pos} = 0.77$, $t_{(58)} = 1.45$, $p = 0.153$, $d = 0.38$, nor for the MEC-SPQ, $M_{neg} = 2.74$, $SD_{neg} = 0.59$, $M_{pos} = 2.88$, $SD_{pos} = 0.72$, $t_{(58)} = -0.83$, $p = 0.408$, $d = -0.21$. Table 6 presents means and standard deviations separated by experimental groups.

As in the previous studies, contact quality was perceived as being less positive in the negative than in the positive condition, $t_{(58)} = -7.25$, $p < 0.001$, $d = -1.86$. Additionally, participants stated a more negative outgroup attitude in the negative than in the positive condition on the measure of warmth, $t_{(58)} = -15.12$, $p < 0.001$, $d = -3.86$ but not for competence, $t_{(58)} = -1.68$, $p = 0.098$, $d = -0.43$. The perception of threat was higher in the negative, compared to the positive condition, $t_{(58)} = 5.49$, $p < 0.001$, $d = 1.42$, and future contact intentions were lower in the negative than in the positive condition, $t_{(58)} = -3.45$, $p = 0.001$, $d = -0.88$.

5 General discussion

The present paper demonstrates that it is possible to manipulate the perceived quality of intergroup interactions in a video-game setting, not only in the lab, but also with a server-based version accessible from participants' home computers. Furthermore, the perception of these interactions also generalized to the evaluation of, and emotions toward, the interaction partners' group. Our findings demonstrate that specifically adapted or developed video games nowadays provide rich toolkits to examine a variety of (social-)psychological research questions. Not only do they provide a promising approach to bridge the gap between experimental control and mundane realism (Blascovich et al., 2002), they also provide opportunities to address otherwise ethically sensitive topics (Slater et al., 2006), such as negative intergroup contact. Furthermore, video games allow participants to join research from their home computers.

The findings of the present research that perceived contact quality generalizes to the outgroup are in line with the established research strand of intergroup contact theory (e.g., Pettigrew and Tropp, 2006) and recent advances in this field examining the role of negative intergroup contact (e.g., Schäfer et al., 2021). The effect sizes in the findings of this paper are larger than those found in the meta-analysis by Pettigrew and Tropp (2006), who found small to medium contact effects. On the one hand, it has to be highlighted, that the present research compares differences between a positive and a negative condition and not

TABLE 5 Means, standard deviations, and correlations with confidence intervals study 2.

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Contact quality	2.71	0.99							
2. Warmth	2.70	1.42	0.75*** [0.61, 0.84]						
3.Competence	3.41	0.72	0.44*** [0.22, 0.63]	0.30* [0.05, 0.52]					
4. Threat	2.55	1.24	−0.44*** [−0.63, −0.21]	−0.64*** [−0.77, −0.46]	−0.13 [−0.37, 0.13]				
5. Intergroup anxiety	3.08	1.01	−0.68*** [−0.80, −0.52]	−0.80*** [−0.88, −0.68]	−0.27* [−0.49, −0.01]	0.70*** [0.55, 0.81]			
6. Future contact intentions	2.71	1.19	0.44*** [0.21, 0.63]	0.53*** [0.31, 0.69]	0.14 [−0.12, 0.38]	−0.42*** [−0.61, −0.19]	−0.63*** [−0.76, −0.44]		
7. Previous experiences	2.67	1.00	−0.04 [−0.29, 0.21]	−0.10 [−0.34, 0.16]	−0.05 [−0.30, 0.21]	0.14 [−0.12, 0.38]	−0.00 [−0.25, 0.25]	0.11 [−0.15, 0.35]	
8. MEC–SPQ	2.81	0.66	0.32* [0.07, 0.53]	0.19 [−0.06, 0.43]	0.28* [0.02, 0.50]	−0.29* [−0.50, −0.03]	−0.26* [−0.49, −0.01]	0.33* [0.08, 0.54]	0.28* [0.03, 0.50]

$N = 60$. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation.
*p < 0.05.
***p < 0.001.

TABLE 6 Study 2 means and standard deviations by condition.

Variable	Negative contact condition		Positive contact condition	
	M	*SD*	*M*	*SD*
Contact quality	2.01	0.61	3.36	0.83
Feeling thermometer	12.97	11.83	71.23	21.63
Warmth	1.40	0.53	3.91	0.75
Competence	3.25	0.69	3.56	0.72
Threat	3.29	1.04	1.85	0.98
Intergroup anxiety	3.85	0.45	2.36	0.83
Future contact intentions	2.21	0.92	3.18	1.24

$N = 60$ (n = 29 for negative contact condition and n = 31 for positive contact condition). Bonferroni correction should be used to address the multiple–comparison problem, therefore results with significance p <0.006 can be considered significant.

between more or less positive contact, as it is the case for most studies included in Pettigrew and Tropp's meta-analysis. On the other hand, the presented paradigm examined initial intergroup interactions with a previously unknown, fictitious, alien species, which are expected to yield larger effects on prejudice than measures of overall intergroup contact over larger time spans (e.g., Page-Gould et al., 2022). Future research should consider finding an appropriate control condition to increase comparability to traditional intergroup contact effects. This would allow to examine how much of the effect size can be attributed to meeting a new group and to disentangle the effects of positive and negative intergroup contact.

Furthermore, an adaptation of this video-game in which participants would be asked to return to the game over a couple of days or even longer could provide a pathway to empirically test the comparison between the effects of short initial interactions and overall intergroup contact effects over larger time spans (e.g., Page-Gould et al., 2022). Additionally, while the current research kept contact quality constant for each participant (participants would either be assigned to experience positive or negative contact only) future research could vary the sequence of positive and negative intergroup contact which participants would experience and, in this way, advance research on interactions of positive and negative contact effects (e.g., Paolini et al., 2014; Schäfer et al., 2022). Such future research should also consider moving from a between-person design to a within-person design. For a within-person design, behavioral measures, for example the distance kept from avatars when starting the interaction, or a free choice of dialogue elements, or scales implemented in the game, like one item measures for emotional states, could be used to study how participants would change their behavior and emotions toward the outgroup throughout the course of several interactions.

While a fictitious outgroup as chosen for this research has many upsides, such as not being related to group-specific expectations making it possible to study initial intergroup interactions, and having limited ethical considerations with regard to negative intergroup contact experiences (see also Hayward et al., 2017, Study 2), it is also limited in its generalizability. While the easiest way to address this would be to try to involve real intergroup settings (e.g., by portraying avatars in traditional clothing or with religious symbols), the above concerns will stand and might limit possibilities for such adaptations. First, many intergroup interactions in real-life situations will be shaped by expectations and previous experiences. Even if direct intergroup contact might be scarce in some settings, other forms of intergroup experiences, such as extended and vicarious intergroup contact (Vezzali et al., 2014), contact with for example similar groups (Kauff et al., 2023),

and media portrays of outgroups are likely to affect any intergroup interactions we would be able to implement in such a video game setting, as previous research demonstrated that previous experiences with the respective group will affect subsequent intergroup contact (e.g., Paolini et al., 2014; Schäfer et al., 2022). One important focus for future research should therefore be to examine the interplay of real-life experiences and experiences in virtual settings. Second, even though, as I just pointed out, this is an open empirical question, building on previous research on intergroup contact effects (e.g., Barlow et al., 2012; Graf et al., 2014) one would expect negative as well as positive intergroup interactions to generalize to outgroup attitudes and emotions even for real groups. Therefore, researchers considering the use of avatars representing real groups should proceed with great caution when implementing negative intergroup interactions.

This is especially true, as intergroup contact effects might not only generalize to the specific outgroup, but also have secondary transfer effects (e.g., Lolliot et al., 2013), whereby outgroup attitudes generalize toward groups not involved in the interaction itself. Even though to date, evidence regarding a secondary transfer effect of negative contact is still scarce (e.g., Kauff et al., 2023), this possibility should not be neglected. Yet, this also bears opportunities for positive contact induced in such a paradigm to impact intergroup relations up and above the contact directly induced. Future contact could even examine if contact with an alien species or other, still fictitious, but more similar outgroups might positively affect intergroup relations with real world social groups.

More so, even though this paradigm is foremost developed as a tool to foster intergroup interaction and intergroup contact research, as the use of video-games enabling the experience of positive intergroup interactions could provide important pathways to virtual interventions in the future. Even though such video games would need further adaptations sensitive to the respective contexts, when used with real groups, it might provide pathways to prepare for intergroup interactions in real life, or even to reduce intergroup tensions if intergroup contact is scarce or not possible, due to ongoing conflicts. Foremost, it might be a tool which could be rather attractive to use with a low threshold to get started, especially for specific groups, such as older children or to train individuals working with people who might be perceived as outgroup members.

Regarding the perception and experience of the story and the virtual environment, I found no large differences between an implementation of the paradigm in the lab and during an online session from participants' home computers. This result is quite promising for future studies, as it might be possible to assess data without bringing participants to the lab, which reduces costs and allows data collection of many individuals synchronously—or even asynchronously—without being limited to lab capacities. Although I found satisfying levels for the MESCQ, there is still room to improve the perception and experience of the video game. It has to be noted, though, that while I used the MESCQ as one scale for an overall impression of participants' evaluation of the video game, it was originally not designed to be used as a single scale (Vorderer et al., 2004). As I had to shorten the scale to fit it to our research design, the items I chose did not reliably form subscales. A detailed overview of the means and SDs for the single items can be found in the online materials.

One way that might increase the level of immersion in the game might be to implement it in a full virtual-reality (VR) setting. Indeed, the game was explicitly built to be compatible with VR solutions and future research will examine an implementation in a VR setting. While VR offers the prospective of heightened immersion, it still presents potential drawbacks, such as motion sickness (e.g., Howard and Van Zandt, 2021), and a higher cognitive load for participants (Roettl and Terlutter, 2018), as well as increased costs and organizational efforts. Therefore, researchers should carefully consider whether a full virtual-reality setting in comparison to video games is actually necessary to examine the research question at hand.

One important limitation, which I mainly identified when talking to participants, both in the lab and after the online participation, is that participation can be challenging for participants who had never navigated in a video game before. A few even reported that they might have stopped if they had not been in a synchronous setting. Given the wide use of video games nowadays, this feedback was scarce, but it has to be considered that such research settings might systematically exclude individuals without video-game experiences, as they might find it hard to navigate the situation. For future versions of the video game, my team and I are now developing a more extensive tutorial to learn navigation before starting the game. Still, researchers working with video games should always reflect on the potential nonrandom selection the use of this method could imply. In addition, researchers should reflect on contextual differences, which might not only be due to differences in the use of video games. For example, the specific cover story chosen here might not be appropriate in contexts with less exposure to science fiction stories, or might gain different meaning where communication in such settings might be structured by different cultural conventions than in the German context.

Nevertheless, the present paper demonstrates a new research paradigm, which will help to address important shortcomings in the traditional research on intergroup contact. Furthermore, the paradigm opens up avenues for other fields of (social)psychological research, as it demonstrates that it is nowadays possible to rather easily design and develop video games that influence participants' attitudes and emotions.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/9cyft/?view_only=86212758cad244ef8b2de9a9f0924fb8.

Ethics statement

The studies involving humans were approved by Ethikkommission der Fakultät für Psychologie, FernUniversität in Hagen (EA_731_2023). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SJS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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