MUNI FSS

JOURNAL OF PSYCHOSOCIAL RESEARCH ON CYBERSPACE
CYBERPSYCHOLOGY

Mulak, A., & Winiewski, M. H. (2021). Virtual contact hypothesis: Preliminary evidence for intergroup contact hypothesis in interactions with characters in video games. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 15*(4), Article 6. https://doi.org/10.5817/CP2021-4-6

Virtual Contact Hypothesis: Preliminary Evidence for Intergroup Contact Hypothesis in Interactions with Characters in Video Games

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Abstract

This paper examines intergroup contact hypothesis in interactions in video games to conceptualize how intergroup contact with characters in games may relate to attitudes toward minorities. Intergroup contact hypothesis states that intergroup contact leads to more positive attitudes and stereotype reduction. It also specifies situational factors that promote or hinder such an outcome. In an online survey a sample of 1627 gamers stated games they played the most and filled out a questionnaire measuring their attitudes toward minorities. Independent judges assessed games that were played by most participants (N = 44 games). A multilevel regression analysis revealed that average quality of contact with minorities in a game (measured at game-level, as a characteristic of a game) was associated with higher acceptance of minorities of the players (measured at individual level). Diversity of the game world generated by fictional races had no significant connection to attitudes. Game-level predictors largely increased fit to the data showing that game worlds were significant for the acceptance of minorities. The results supply preliminary evidence for the validity of the intergroup contact hypothesis for the interactions with characters in video games.

Keywords: Video games; prejudice; diversity; attitudes; intergroup contact; virtual contact

Introduction

The prevalence of video games has prompted concern about their impact on players. Whereas the bulk of the studies have focused on the relationship between gameplay and players' aggression (Anderson & Bushman, 2001), researchers have also investigated the link between games and prejudice. It has been established that video games can negatively impact players' explicit (Stermer & Burkley, 2015) and implicit (Yang et al., 2014) attitudes toward specific social groups. Research examining this topic has focused mostly on the impact of stereotypes, due to their ubiquity in computer games (Dickerman et al., 2008). Game characters depicting racial, ethnic (Behm-Morawitz & Ta, 2014; Sisler, 2008) and gender (Behm-Morawitz & Mastro, 2009) stereotypes were linked to players' attitude change. Researchers have confirmed the impact of stereotypes in graphic design (Beasley & Standley, 2002; Burgess et al., 2011), behavior and roles of game characters (Dickerman et al., 2008). Exposure to minority representatives in games has been shown to increase negative attitudes and prejudice, even in the absence of violence (Saleem & Anderson, 2013). Contrary to these findings, Amichai-Hamburger and McKenna (2006) have postulated that games should depict more diverse characters, as it may result in prejudice reduction. Additionally, a positive impact of games on attitudes toward others has been discovered in case of cooperative gameplay (Ewoldsen et al., 2012).

The effects described above, both positive and negative, can be reconciled and explained within a broader framework of intergroup contact hypothesis (Allport, 1954). Confirmed by a multitude of research, this concept describes the link between intergroup contact and attitude change but has never been tested in a game world for contact with characters controlled by the computer. This study aims to investigate contact with characters in a game through the lens of intergroup contact hypothesis and therefore provide a more general framework for assessing how characters in games may impact players' attitudes.

Intergroup Contact Hypothesis

The intergroup contact hypothesis states that interactions between two members of distinct social groups can change attitudes toward the "other" group (the out-group) and affect the strength of stereotypes about the out-group (Allport, 1954). The initial formulation of the contact hypothesis specified four situational factors required for positive attitude change (i.e., stereotype reduction). These factors include common goals for both groups, contact involving cooperation, equal status of both groups within the situation, and norms of acceptance for contact, supported by laws and authorities. These requirements constitute "optimal conditions" for intergroup contact. Their absence in a situation, especially rivalry and lack of cooperation or interactions with an out-group of a lower status, might contribute to more negative attitudes.

The most extensive evidence supporting intergroup contact hypothesis to date is a meta-analysis conducted by Pettigrew and Tropp (2006), encompassing 515 studies with 713 independent samples from 38 countries. It confirms the impact of face-to-face contact on prejudice reduction, regardless of actors' demographic characteristics (such as age or gender), geographical settings, and the type of outgroup. Moreover, the analyses establish that positive attitude change generalizes from the immediate situation to other situations and from the interaction partner to the entire out-group and its representatives not involved in the contact. Furthermore, studies have shown the so called "secondary transfer effects", that is that the positive attitude change generalizes to different, secondary out-groups (Lemmer & Wagner, 2015; Pettigrew, 2009). For instance, contact with immigrants was related not only to more positive attitudes toward immigrants in general, but also toward lesbians and gay men as well as Jews (Schmid et al., 2012). Researchers have shown that reduction of prejudice toward secondary groups was mediated by attitude generalization, that secondary transfer effects occurred even when controlling for direct contact and cannot be explained by socially desirable responding (Tausch et al., 2010).

The meta-analysis confirmed that direct contact was strongly linked to positive attitude change, even without the presence of optimal conditions. It did establish, however, that situations fulfilling the optimal conditions result in stronger positive effects. Moreover, the conditions are highly interrelated and thus are best treated not separately, but as one joint indicator of whether the circumstances in which the contact occurs are favorable for positive change. In view of this finding, we chose to conceptualize optimal conditions in game environments as a single factor signifying contact quality.

Positive and Negative Intergroup Contact

Intergroup contact theory initially aimed to specify conditions for positive change, and since then, research has focused mainly on positive outcomes. Video game research stands in contrast to this approach, focusing primarily on negative consequences and demonstrating that playing video games is correlated with stronger stereotypes (Behm-Morawitz & Ta, 2014; Stermer & Burkley, 2015). These findings are not necessarily contradictory, as contact hypothesis researchers also describe the conditions under which contact produces negative effects. Contact with stereotype-confirming out-group members strengthens stereotypical beliefs and cognitions, and results in more negative attitudes (Alvídrez et al., 2015). In game research, intergroup contact analyses focused mainly on the ubiquity of stereotypical characters in games (Dickerman et al., 2008) and its consequences: activating stereotypes (Burgess et al., 2011), inducing negative affect and stereotyping (Behm-Morawitz et al., 2016) and strengthened negative attitudes (Saleem & Anderson, 2013). Intergroup contact hypothesis researchers shown an association between negative contact and increased prejudice (Aberson & Gaffney, 2008; Barlow et al., 2012). Negative interactions (Techakesari et al., 2015) under conditions of inter-group anxiety (Pettigrew & Tropp, 2006) can strengthen negative affect and out-group attitudes. Whereas in the real world, positive intergroup interactions were found to be much more frequent than the negative ones (Graf et al., 2014), in the virtual worlds violent interactions are common (Dill et al., 2005). Moreover, some researchers postulate negative contact may have a stronger impact on intergroup attitudes than positive contact (Barlow et al., 2012; Graf et al., 2014; Paolini et al., 2010) especially when it comes to the cognitive aspects of prejudice (Aberson, 2015). Yet in the light of intergroup contact hypothesis, the prevalence of negative interactions and stereotypes does not unequivocally predict solely negative consequences of in-game intergroup contact. Árnadóttir et al. (2018) reported that positive intergroup contact can successfully mitigate the effects of negative contact thus demonstrating the need to take both positive and negative contact into account.

Extended Intergroup Contact

The initial contact hypothesis stated that the physical presence of two groups is necessary for an attitude toward a group to change. Subsequent research expanded the theory to one-on-one contact (Dovidio et al., 2011). For example, individual intergroup friendships were recognized to have a strong impact on attitudes (Hewstone & Swart, 2011). More pertinent to this study, even a one-time interaction with a single out-group member (i.e., watching television together) was found to have an effect on attitudes toward that group (Tal-Or & Tsfati, 2016), which implies that the time of a single video game playthrough might be enough for the effects of intergroup contact to occur.

Various forms of contact apart from face-to-face interactions have been found to impact attitudes and consequently included in contact theory (Hewstone & Swart, 2011). Wright et al. (1997) proposed that knowledge of an in-group member who has an out-group friend, or observing such friendship (*extended contact*), could result in similarly positive effects as direct contact. Since then cross-group friendships were found to be consistently linked to less prejudice (Vezzali et al., 2014). Extended cross-group friendship was found to significantly improve attitudes toward outgroups through reducing intergroup anxiety, generating perceptions of positive ingroup and inclusion of outgroup in the self (Turner et al., 2008) as well as through self-disclosure. Positive effects of extended contact were observed even while controlling for direct contact (Turner et al., 2007) and were not limited to cross-group contact of one's friend (Tausch et al., 2011). Positive attitude change does not only occur with knowledge of intergroup friendships among one's peers. Studies have shown that even living in diverse environments where cross-group contact is more common improves out-group attitudes through more positive social norms (Christ et al., 2014). Positive interactions of an in-group member with a member of a different group, including interactions presented in media (*vicarious contact*), were found to promote positive attitude change toward the entire out-group (Di Bernardo et al., 2017). Again, this allows for an assumption that intergroup interactions in video games could have an effect similar to contact observed in other media.

Another form of indirect contact recognized within the contact hypothesis is *imagined contact*. Studies confirmed that simply imagining interactions with an out-group member significantly improves attitudes toward out-groups (Turner & Crisp, 2010), enhances intentions for future contact (Crisp & Turner, 2009) and reduces inter-group bias in attitudes, emotions, intentions and behavior (Miles & Crisp, 2013). Even if the subjects were aware that no actual contact occurred between them and another person, as is often the case in single-player video games, the effects predicted by the intergroup contact hypothesis were still observable. Moreover, imagined intergroup contact produces secondary transfer effects, that is it generalizes to other out-groups (Harwood et al., 2011).

Researchers have further expanded the theory to interactions via internet, confirming that intergroup contact on an online platform (Amichai-Hamburger, 2008), on Facebook (Schumann et al., 2012), and in chatrooms (White et al., 2015) weakens stereotypes and results in more positive attitudes toward the out-group. Lemmer and Wagner (2015) conducted a meta-analysis of interventions designed to reduce prejudice, that were conducted either online or in the real-world. Their results support intergroup contact theory, showing that contact via the internet does decrease negative attitudes, and that this change persists over time. More importantly for this study, their results demonstrated that interventions conducted online did not differ from real-world, face-to-face interventions with regard to attitude change outcomes.

Virtual Contact Hypothesis

Online interactions have an impact on attitudes similar to that of interactions conducted face-to-face. Interactions in game environments and with computer-controlled characters could follow the same pattern. Playing video games, as has been shown earlier, is known to change both implicit and explicit attitudes toward real-world groups

(Yang et al., 2014). Although the influence of video games is most prominently described in terms of negative impact, which might appear incongruent with the intergroup contact theory, such findings prove that interactions conducted with characters presented in video games are in fact capable of changing attitudes toward a real-world out-group.

The negative impact of video games on attitudes was most commonly assigned to exposure to violence (Ferguson, 2007) and stereotypes (Burgess et al., 2011) in games. Conditions under which contact strengthens negative attitudes, as described by the intergroup contact hypothesis, include negative interactions (Techakesari et al., 2015) under conditions of inter-group anxiety (Pettigrew & Tropp, 2006) and with stereotype-confirming out-group members (Alvídrez et al., 2015). This could mean that previous games' research focused on interactions with very specific features that promote negative outcomes, as specified by the intergroup contact hypothesis.

There is growing evidence on the positive impact of video game play on attitudes in general and on social attitudes in particular. Designed specifically to elicit change, serious games are consistently used to improve motivation (Lee et al., 2017), attitudes toward a designed subject (Mavridis et al., 2017), or, to some extent, attitudes toward discriminated minorities (Roussos & Dovidio, 2016). Playing a prosocial video game increases access to prosocial thoughts (Greitemeyer & Osswald, 2011) and behavior (Greitemeyer et al., 2012). Even violent recreational games, when played cooperatively with another person, increase the tendency for future cooperation (Ewoldsen et al., 2012). Most pertinent to this study, Stiff and Bowen (2016) demonstrated that playing with someone whom participants believed to be a human out-group representative (another player) reduced prejudice toward the out-group. Therefore, there is reason to believe that interactions in games could positively impact attitudes in the way predicted by the intergroup contact hypothesis.

The bulk of research on games' impact on attitudes focused on game characteristics that contribute to attitude change, i.e., in case of negative change they were the ubiquity of violence and negative stereotypes (Behm-Morawitz & Ta, 2014; Dickerman et al., 2008; Saleem & Anderson, 2013; Sisler, 2008), whereas positive impact was described mostly for diversity in the game world (Amichai-Hamburger & McKenna, 2006) and for games specifically designed to elicit positive change (Greitemeyer et al., 2012; Greitemeyer & Osswald, 2011). Other researchers focused on players' individual choices and experiences within the game (e.g., cooperating in an otherwise competitive and violent game) showing they could contribute to attitude change regardless of game design (Ewoldsen et al., 2012; Stiff & Bowen, 2016). These approaches suggest that the presence of optimal conditions and thus occurrence of contact that is positive in the light of intergroup contact hypothesis is possible and that it might be dependent on both game design as well as on players' individual choices in how to play the game. Moreover, the assumption should not be restricted to contact with other players only, as the majority of research on the negative impact of games analyzes the impact of in-game characters.

We therefore propose the virtual contact hypothesis, claiming that interactions with nonplayer characters (NPC) or other players' avatars representing the out-group within a game, can be construed as intergroup contact and linked to change in the level of prejudice. Thus, the study was designed to answer the question: Does intergroup contact with minority characters in a game correspond to lower prejudice when conducted under optimal conditions and to higher prejudice in adverse conditions?

Method

To investigate the link between intergroup contact in video games and players' prejudice, the study encompassed an online survey of gamers and an evaluation of games they played by independent judges. The questionnaire for players included measures for prejudice against minorities and questions about the games they played the most in the past month. Independent judges were asked to list real world and fictional minorities present in indicated games and evaluate intergroup contact with each minority experienced in those games.

Participants

Participants were volunteers, recruited with posts on three largest polish Facebook groups for gamers. No incentive was offered for participation in the study. The initial sample consisted of N = 2324 polish gamers. Only respondents who provided answers to all scales (N = 1857) were taken into account. The procedure of games' evaluation by competent judges further restricted the sample to *N* = 1627 by excluding participants who indicated 3 of 3 games that were rare and thus not evaluated.

In the final sample, players' age ranged from 11 to 52 years old, with an average age of 19 years (*SD* = 6.53).[1] Respondents included in the analysis were mostly male (64.7%, see Appendix, Figure 1 for histograms of players' age and hours they play per week). Females comprised 13% of the sample; the rest self-identified as "other" (0.4%) or did not state their gender (21.8%). This might reflect polish gamer profile; Although about half of the players in Poland are female, women are more casual gamers and PC and console gamers are mostly men (Polish Gamers Observatory, 2018). Female players did not differ significantly from male participants in how many our per week they played ($t(1) = 0.031$, $p = .86$) but were slightly better educated ($t(1) = 16.43$, $p < .001$, $\eta^2 = .007$), older ($t(1) = 20.94$, $p < .001$, $\eta^2 = .008$) and on average lived in larger cities ($t(1) = 13.88$, $p < .001$, $\eta^2 = .007$).On average, they were also less prejudiced ($t(1) = 103.43$, $p < .001$, $\eta^2 = .036$ for the generalized social distance towards minorities).

Due to ethnic composition of polish society, where according to the last national census 97.1% of residents are of polish ethnicity and the two next largest ethnic groups are white and polish (the Kashubians and the Silesians, 1.1% and .05% respectively, Statistics Poland, 2011), we assume the respondents were of polish ethnicity, as was done in the Polish Prejudice Survey (Winiewski, 2017).

Measures

We used two kinds of measures: individual-level, acquired from the surveys filled out by gamers, and game-level, acquired from independent judges' ratings of games.

Individual Level Variables

Games. Participants were asked to name from one up to three games they played the most in the previous month (the questionnaire required participants to state at least one title, but allowed for two or three). We acquired 1953 games and grouped those that were part of a series as one, resulting in 802 titles (362 titles mentioned as the game played the most). Most of the games were mentioned by several participants (*M* = 24.56, *SD* = 6.35), with the most popular played by 587 people (by 307 people as the game played the most) and 458 mentioned by a single person (195 appeared once as the most played game). For practical reasons, we decided to use the 44 most popular titles (assessing the popularity by the titles named as played the most in the first place) for the judging procedure. The selected games were played by at least nine participants and allowed us to include 70.6% (*N* = 1627) of respondents in the final analyses (adding another title would increase the sample by only 0.3%).

Gameplay Time. We asked the participants, how many hours per week they played computer games last month. On average respondents spent 25.92 hours per week playing games (*SD* = 19.73, see Appendix, Figure 1 for a histogram of hours per week the respondents spent playing games).

Attitudes Toward Minorities. Attitudes toward minorities were measured with the modified version of the Bogardus (1933) scale, which consists of three questions asking about acceptance of a minority representative as a family member (e.g., "Would you accept a relationship of a member of your family with a Jew?"), co-worker (e.g., "Would you accept it if a Jew was hired I your workplace?"), and neighbor (e.g., "Would you accept a Jew as your neighbor?"). The answers were given on a 4-point Likert scale, coded so that a lower score signifies a higher *social distance* (i.e., lower minorities acceptance). The scale was validated in Poland in three nation-wide, represetative prejudice surveys (Bilewicz, 2009; Winiewski, 2017). Questions were repeated for six minority groups strongly stereotyped in Poland: Jews, Roma, Eastern Europeans, Asians, Black people and Muslims. The reliabilities of the scales were high, ranging from $\alpha = .88$ for the acceptance of Muslims to $\alpha = .91$ for the acceptance of Roma (Table 1). The presence of these minorities in chosen games, as assessed by the independent judges, was scarce. Thus, instead of including measures of social distance toward particular out-groups in the analysis, we computed a mean for all scores, thus creating a *generalized social distance* scale, reliable at Cronbach's $\alpha = .96$, an approach based on the generalization of attitudes to multiple out-groups (intergroup contact hypothesis' secondary transfer effects described in this article, Pettigrew, 2009; Lemmer & Wagner, 2015) and present in literature as a means to quantify general out-group attitudes (Genkova & Grimmelsmann, 2020; Parrillo & Donoghue, 2013). The generalized social distance served as our main dependent variable.

Table 1. *Reliability and Descriptive Statistics of the Social Distance Scales (N of Items = 3 for Each Scale).*

Scale	Cronbach's Alpha	No. of items	Mean	*SD*
Social distance to Jews	.89	3	2.05	0.82
Social distance to Roma	.91	3	1.56	1.01
Social distance to Eastern Europeans	.88	3	2.21	0.81
Social distance to Asian people	.89	3	2.20	0.84
Social distance to Black People	.88	3	2.15	0.84
Social distance to Mulsims	.88	3	2.28	0.79
Generalized social distance	.96	18	2.01	0.72

In-Game Behavior. Situational factors that determine the effects of intergroup contact (e.g., cooperation or competition) in video games are determined by the game's design but could also be influenced by individual choices in a game. We therefore included a measure of in-game behaviors. We chose Bartle's player typology (Hamari & Tuunanen, 2014) as it groups player behaviors into four categories that clearly relate to the type of players' interactions within the game: socializing, aggression, exploring and achieving. The typology assumes that two of these behavioral categories (the socializing and aggression scales) pertain to interactions with people or other characters and thus correspond to the preference for contact. Two other categories (the exploring and achieving scales) encompass interactions with the game world and its mechanics and thus a preference for interactions other than contact with characters in the game. Of the categories that describe contact behaviors, one includes behaviors related to negative contact (the aggression scale) and one encompasses behaviors related to positive contact (the socializing scale).

As a measure of in-game behaviors, participants were presented with a list of behaviors common in video games and were asked to assess how often they performed each of those actions in the games they played in the past month. Assessments were made on a 6-point Likert scale with the answers ranging from 1 "never" to 7 "almost all the time" (e.g., "How often did you use weapons (sword, machine gun, stick etc.)?"). The four scales were measured with the following items: *the socializing scale* included assessment of the frequency of three behaviors: 1) giving advice about the game to others, 2) showing others how to do something and 3) cooperating with other players or NPCs to complete a task (a scale with the mean M = 10.9, SD = 4.51 and reliable with Cronbach's α = .80); *the exploring scale* was comprised of an assessment of frequency of tree types of behavior: 1) exploring the game environment, 2) building objects or structures and 3) designing or creating something in the game (M = 10.16, SD = 4.07, α = .69); *the aggression scale* encompassed: 1) causing damage to objects 2) damaging, hurting or killing characters controlled by other players 3) damaging, hurting or killing NPCs and 4) using weapons (guns, knives, swords etc.) (M = 13.96, SD = 3.68; with low reliability α = .58); and *the achieving scale* measured frequency of: 1) working toward a high score, 2) striving to win (a race, match, battle, game etc.) and 3) working on increasing skills (M = 14.76, SD = 3.39, α = .72).

The items in the aggression scale were only weakly correlated and the reliability could not be improved by removing any specific item. This might be due to the fact that in games each type of the aggressive behaviors we asked about requires a lot of effort to design and implement and often in one game only one group of aggression behaviors is fully accessible (e.g., combating NPCs and not other players or the ability to damage many objects in the environment). Due to its low reliability, the scale was excluded from the analysis.

Game-Level Variables

The game level variables were coded by two independent judges (male and female) who were asked to evaluate the 44 most popular games (see Appendix, Table 1A for the complete list of games with basic information about each of them). For each game, the judges rated the presence of characters representing out-groups to the player, percent of each group in the game population and quality of contact with each group (see Appendix, pt. 3 "Evaluation of games by independent judges" for a detailed description of the evaluation process).

Intergroup Contact. The judges were presented with a list of the same minorities for which we measured players' social distance and asked to indicate which of them appeared in each game (answering with a "yes" or "no" for each group in each game). Because attitude change due to contact generalizes to different out-groups, we also inquired about groups other than those evaluated by gamers. The judges listed all additional real-world minorities and (separately) all fictional races of each game. We also asked the judges to evaluate what percentage of characters seen by the player belonged to each of the groups. From this we calculated the Hirschman-Herfindahl diversity index (HHI) (Schaeffer, 2013) separately for real-world social groups (*real-world diversity index*) and for fictional groups (*fictional diversity index*) for each game, for each judge. The diversity indices were reliable between the judges' evaluations with the Interclass Correlation Coefficient (ICC) of .81 for the real-world diversity index ($p < .000$) and .96 for fictional diversity index ($p < .000$). For each game we have used an averaged real-world diversity index (a measure with $M = 0.48$, $SD = 0.23$) and averaged fictional diversity index ($M = 0.53$, $SD = 0.31$), that were means calculated from the judges. Hirschman-Herfindahl diversity index can be interpreted as the likelihood that two randomly drawn individuals are from different groups (see Appendix, pt. 3.2. "3.2. Hirshman-Herfindahl Diversity Index and game-wide contact quality" for the formula); in our analysis, it served as a proxy for the amount of contact with minorities in a game.

Contact Quality. The judges also assessed contact quality. Optimal contact conditions can well be construed as a single factor (Pettigrew & Tropp, 2006), so we asked the judges a single question about the quality of the contact with each of the groups present in a game (the answers were given using a 7-point slider with ends marked as "entirely positive" and coded with the value of 6, and "entirely negative" coded as zero). The average of those served as an approximation for contact quality with all real-world groups (*real-world contact quality*, ICC = .74 between the judges, a final measure with $M = 3.39$, $SD = 0.87$) and with fictional races (*fictional contact quality*, ICC = .89 between the judges' evaluations and the combined score with $M = 1.97$, $SD = 1.37$).

Of the chosen 44 games, five did not include any interactions with in-game characters (neither player-controlled nor NPCs). On average, the games featured 3.9 real-world minorities and 5.1 fictional ones and had an average diversity index (Hirschman-Herfindahl index, Schaeffer, 2013) of .48 for real-world minorities and .53 for diversity index calculated for fictional minorities. The average contact quality with real world minorities equaled 3.4 ($SD = .87$) whereas for fictional minorities the contact quality averaged at 1.9 ($SD = 1.37$) (see Appendix, Table 7A for descriptive statistics of all game-level variables).

Results

In order to test the hypothesis, we constructed a multilevel model, treating every individual as nested within a game that they played within the last month (so that each respondent was included once and nested within the game they played the most frequently. For example, respondents who stated two evaluated games were included only once, within the game they played more frequently of the two. They were assigned corresponding game-level variables' values of that game). We used stepwise strategy recommended by Joop Hox (2010) and assessed differences between models using the loglikelihood test (Satorra & Bentler, 2010). The results are presented in Table 2.

In the first step, we calculated the null model assessing the effects of game choice (clustering variable) on generalized minorities acceptance (dependent variable, reversely coded social distance). The ICC = .06 (at the 95% confidence interval between 0.037 and 0.083) shows that 6% of variance in generalized social distance toward out-groups is at the game level.

Following the bottom-up procedure (Hox, 2010), in the next steps we added individual-level variables (player gender, hours of gameplay per week, socializing, exploring, aggression and achieving in the game in the second step) and game-level predictor variables (contact quality with the real-world and fictional minorities in the third step and the diversity indices HHI for the real-world and fictional minorities in the fourth). In each step, each parameter's significance was evaluated and a decision whether to exclude the parameter was made.

Of the individual-level variables, the achieving scale of player behavior and player gender proved insignificant and were removed from the model at level 1 and level 2 respectively. Thus, the second model included gameplay time and two subscales of in-game behavior: the socializing and exploration scales. Socializing was associated with lower acceptance of out-groups. Exploration behaviors were associated with greater minorities acceptance. Longer gameplay time was associated with significantly lower acceptance of out-groups, demonstrating that on average, playing the popular video games could increase negative attitudes, but the effect was very small. Lower deviance at this step showed the model was a better fit for the data.

Table 2. *Multilevel Regression Analysis of in Game Contact on Minorities Acceptance (for the Exact p values, see Apendix A, Table 8A).*

	Null Model	Fixed			Random model
		level 1 predictors	level 2 predictors Contact Quality	level 2 predictors HHI	
Intercept	3.07 (0.03)***	3.23 (0.07)***	2.87 (0.13)***	2.77 (0.10)***	2.51 (0.11)***
Level 1 predictors					
Hours of play per week		-0.003 (0.001)***	-0.003 (0.001)**	-0.003 (0.001)**	-0.004 (0.001)***
Socializing		-0.03 (0.01)*	-0.04 (0.01)**	-0.04 (0.01)**	-0.04 (0.02)*
Exploring		0.02 (0.01)*	0.02 (0.01)	0.01 (0.01)	0.005 (0.01)
Level 2 predictors					
Contact Quality real			0.12 (0.03)***	0.13 (0.03)***	0.13 (0.03)***
Contact Quality fictional			0.03 (0.01)*	0.03 (0.01)*	0.02 (0.01)*
HHI real				0.14 (0.07)[a]	0.16 (0.08)*
HHI fictional				0.03 (0.07)	0.03 (0.07)
Random part					
Within game variability σ_e^2	0.49 (0.01)***	0.49 (0.01)***	0.47 (0.01)***	0.47 (0.02)***	0.46 (0.02)***
Between variability σ_e^2	0.03 (0.01)***	0.02 (0.01)*	0.005 (0.01)	0.003 (0.004)	0.002 (0.01)
Variance of slopes Hours $\sigma_{u_1}^2$					0.000 (0.000)
Variance of slopes Socializing $\sigma_{u_1}^2$					0.001 (0.004)
Variance of slopes Exploring $\sigma_{u_1}^2$					0.001 (0.001)
Deviance	6552.098	6496.266	3582.03	3576.424	3570.706
S&B Chi2		34.19***	1582.88***	20.87***	65.13***

Note. In parentheses S.E. of estimate.
[a]$p < .08$, *$p < .05$, **$p < .01$, ***$p < .001$.

In the third and fourth models, game-level predictors were added (in-game contact quality and games' diversity indices respectively, both constructs measured for real-world and fictional minorities separately). Both contact quality measures proved significant predictors of generalized social distance; better contact with in-game characters was associated with higher acceptance of out-groups. The relationship was stronger for the quality of contact with real-world groups than for contact quality with fictional groups. Hirschman-Herfindahl diversity indices did not turn out significant predictors although the effect of the diversity index for real-world groups on generalized social distance was noticeable.

Adding game-level predictors decreased the significance of socializing behaviors and rendered exploration behaviors insignificant. The deviance in this step was almost half that of the previous model, demonstrating that adding game-level predictors largely increased fit to the data. Game worlds were an important factor in explaining changes in acceptance of minorities.

In the next step, we added a random component for individual level variables. There was no significant variability between games for gameplay time, but there was for in-game behaviors. The final model with a random part had the best data fit. The effects observed are similar to those in previous models. The significance of the effects for in-game behaviors decreased; The effect for exploration behaviors dropped below significance level, but the trend for socializing remained significant. The effect for Hirschman-Herfindahl Diversity Index for real groups, already noticeable in the previous model, became significant. The diversity index calculated for fictional groups remained insignificant. Therefore, diversity in the video game world was associated with higher acceptance of minorities, as long as it involved characters from groups that exist in the real world. Diversity generated by fictional races had no connection to real world attitudes.

Discussion

Video games have been shown to strengthen both negative (Saleem & Anderson, 2013; Stermer & Burkley, 2015; Yang et al., 2014) and positive (Ewoldsen et al., 2012) attitudes toward others. Intergroup contact hypothesis provides a framework for reconciling these notions, as well as means of analyzing contact circumstances. This study offers preliminary evidence for its validity for interactions in video games with people and non-playable characters alike.

Our analysis confirms that characteristics of a game are related to players' social distance towards minorities. What matters in this regard is the choice of a game, not individual differences in how to interact with the game. Game level variables explained 6% of variance in players' prejudice level. The result was observed across all games' types, and for players with varying amounts of game-play times which might indicate stronger effects for some groups e.g., hardcore gamers as opposed to casual, although such notion requires further research. Player behaviors (individual-level variables) varied between games, which suggests game design was an important factor determining player in-game behaviors. More importantly, game-level predictors rendered almost all individual differences in behavior insignificant in our model. That is, after considering the choice of the game (game world design), individual play style became insignificant in explaining players' prejudice level. The only behaviors significant in our final model were socializing behaviors. Socializing was weakly associated with lower acceptance of out-groups. This might be because most of the questions in the scale were about helping, thus implying interactions with a partner of a lower status. From the perspective of the intergroup contact hypothesis, such interactions may not be optimal for contact (Allport, 1954) and may lead to negative outcomes. Higher socializing might also indicate more in-game interactions, both positive as well as negative and stereotype strengthening. The weak negative link may in such case correspond to the prevalence of negative stereotypes in games, reported by the researchers (Dickerman et al., 2008).

In our model, quality of contact with in-game characters proved to be the best predictor of players' attitudes toward others, with better contact quality (with both real-world and fictional minorities) predicting higher acceptance of minorities (measured as social distance). This indicates that intergroup contact hypothesis is valid for interactions with characters in video games and that optimal conditions, as defined by the hypothesis (Pettigrew & Tropp, 2006), may play a similarly important role for contact in video games as they do for face-to-face contact.

The diversity of the social world depicted in a game (HHI for the real-world and fictional minorities) was a significant, positive predictor of players' acceptance of minorities (social distance). This finding is congruent with the intergroup contact hypothesis, as well as claims that more diverse game worlds could lead to more positive players' attitudes toward minorities (Amichai-Hamburger & McKenna, 2006). Contact hypothesis stipulates that contact itself is often enough to produce positive effects although negative conditions might diminish or reverse the effect (Pettigrew & Tropp, 2006). Whereas in the real-world positive contact was found more common than the negative (Graf et al., 2014), video games often contain levels of violence rarely encountered in real-world interactions (Anderson & Bushman, 2001). Thus, accounting for contact quality and factors contributing to it might be even more important in games than for common real-world interactions. Simply increasing diversity in a game world (in our study operationalized as Hirschman-Herfindahl Diversity Index) with lack of consideration for the contact quality (the strongest predictor of minorities acceptance in our model) might negatively impact players' attitudes toward others. A violent and non-cooperative game with a diverse social world might do more harm than a similar game with a homogenous world.

It is important to note that the measure of contact quality with a minority was an indicator for average quality of players' interactions with a given social group in a game. Therefore, consideration for contact quality in games does not necessarily mean demanding the absence of violent interactions. Rather, it implies the need for cooperation and positive interactions in games that could offset the negative ones.

We investigated contact quality with game characters that belong to groups that exist in the real world separately from the quality of contact with sentient fictional races. Both proved significant, although the latter was a much weaker predictor of players' social distance to out-groups. Game world diversity followed a different pattern. The effect on generalized social distance occurred only for diversity of real-world social groups presented in a game, and not for diversity generated by fictional races. Thus the claim that games with diverse social worlds would positively impact players' attitudes towards minorities (Amichai-Hamburger & McKenna, 2006) was only partially confirmed as this suggests that the mere presence of fictional races does not create an impactful diversity in a game and has little meaning for real-world attitudes (i.e., a game world with many alien races and a homogenous group of humans might not be considered diverse when assessing its possible impact on players' attitudes).

Limitations

The correlational nature of the study allowed us to include a broad sample of games and gamers, yet it poses a serious limitation. The intergroup contact hypothesis assumes a causal relationship and thus needs to be further tested in experimental studies that could examine the causal link between players' prejudice and intergroup contact in video games. Moreover, alternative explanations for such results need to be investigated. It is conceivable that more prejudices players prefer games that include negative contact with minorities (e.g., fighting with minority characters) and choose them more often. It is also possible that more prejudiced players seek out games where minorities are less present as they prefer to spend time in more homogenous social worlds. Another possibility is that the reverse is true; most prejudiced gamers might seek out games that are high in diversity, but with low contact quality, especially choosing games that allow them to combat minorities. Such preference could have contributed to contact quality being a stronger predictor of prejudice in our model than the diversity of the virtual worlds. It is also conceivable that contact quality is not unidimensional and that prejudiced players do not choose games that are low in contact quality, but rather avoid the ones that include positive contact with minorities, regardless of whether the game includes fighting with minorities (negative contact) or not. Players might choose games based on a completely different set of preferences (e.g., genre) but prejudiced players might enjoy more games that feature negative contact with minorities and spend more time playing them. Finally, there might be some other variable that influences all these factors that is the choice of a game and characteristics of the game world, e.g., preference for certain media or social connections, that inform which games are available and at the same time influence attitudes. Similar possibilities exist for the relationships between game characteristics and gameplay time.

The inclusion of many games that varied vastly and rarely featured the minorities that are most prominent in participants' real social environment, resulted in analyzing contact theory through very distant proxies. Further confirmation ought to include experimental studies with precisely designed measures, that would allow researchers to observe the impact of each situational factor in the virtual world separately and that could inquire about exposure to each minority group independently. Yet although remote proxies are bound to lead to smaller effects, the connections were significant in our study, allowing for the preliminary conclusion about validity of the intergroup contact hypothesis for contact with characters in video games.

Implications and Directions for Future Research

Intergroup contact hypothesis is well researched and describes numerous factors influencing the outcome of intergroup interactions (Hewstone & Swart, 2011; Pettigrew & Tropp, 2006). Therefore, preliminary confirmation of its validity for contact with characters in video games provides a clear framework for future research, as it directs attention to video games' aspects that could influence the outcome of interactions in games, such as status of minority groups, social norms present in the game world or the level of intergroup anxiety depicted in a game (Hewstone & Swart, 2011). It could also offer a new perspective for future research on the presence of stereotypes in games. Past research on this topic mostly examined negative stereotypes and their direct link to prejudice (Behm-Morawitz & Ta, 2014; Dickerman et al., 2008; Sisler, 2008). Intergroup contact theory researchers found that elements of prototypicality of the minority representative with whom contact occurs increase the salience of group affiliation and may be beneficial for attitudes (Brown et al., 1999). This implies the need to examine consequences of interactions with stereotypical characters in games with consideration for stereotype negativity as well as character prototypicality.

In our study the contact quality, which was the best predictor of players' prejudice, was a generalized measure. This implies that the effects of intergroup contact for players' attitudes might be dependent on the average emotional valence of interactions with a given minority and that violence in games could be offset by positive contact. This could inform future research in that positive interactions ought to be taken into account while testing for the effects of negative interactions and stereotypes on players' attitudes. It might also contribute to the ongoing dialogue about the negative consequences of violence in games in general (Mathur & VanderWeele, 2019) by directing attention to the proportion of violent and positive interactions in games, as opposed to the level of violence itself. The validity of such an approach requires further research.

In our study the diversity of a game world generated by real-world minorities corresponded to lower prejudice, whereas diversity generated by fictional races did not. This indicates the need to analyze interactions with real-world and fictional groups separately in future games' research.

The results may also have practical implications for game developers as well as parents and guardians of game playing youth. For game developers, the results could inform guidelines for a socially responsible game design that contributes to prejudice reduction. Such a design would entail creating video games with diverse societies where real-world minorities have their representation. Including fictional races may make the virtual world seem more diverse and increase game attractiveness to players, but the representation of real-world minorities is crucial in creating a socially beneficial game. Moreover, if games are to reduce prejudice and improve attitudes, positive interactions (e.g., cooperation) with representatives of minorities should be designed as a necessary part of gameplay. Violence, which is often an inherent part of the game, need not be abandoned for positive social effects. As long as developers include versatile interactions with minorities as part of the game design, violence could be offset by positive contact.

The study may also carry practical implications for game reviewers, parents and guardians who seek to appraise the potential harm or benefit of a particular game. As the results suggest, identifying games that contribute to prejudice reduction requires an assessment of game world diversity and of contact quality with minorities in the game. While assessing diversity, one may ignore the multitude of fictional races and simply gauge the diversity of humans depicted in a particular game. Violent games shouldn't be dismissed outright. One should rather evaluate the proportion of positive and negative interactions with minority characters.

Conclusion

This study offers preliminary evidence for the validity of intergroup contact hypothesis for virtual contact, that is for interactions with characters in video games. Due to its correlational nature, results require confirmation in experimental research. The limitations notwithstanding, the contact hypothesis offers a framework that reconciles current notions about positive and negative effects of playing video games on attitudes towards minorities and identifies factors that may contribute to positive effects of intergroup contact in games. The results offer support for the notion of the importance of diversity in virtual worlds and increase our understanding of it, indicating the need to distinguish between the impactful diversity generated by real world minorities and the diversity created by fictional races. Due to robust research on intergroup contact hypothesis to date, its preliminary confirmation for contact with characters in video games sets new perspectives for future research on the influence of games on players' attitudes.

Footnotes

1. Participants who played the most popular games differed significantly from players who played less popular titles and were excluded from the analysis. On average, respondents that played the most popular games were younger ($t(39) = 5.86$, $p < .001$, $\eta^2 = .11$), less educated ($t(3) = 29.7$, $p < .001$, $\eta^2 = .06$) and lived in smaller cities ($t(4) = 11.56$, $p < .001$, $\eta^2 = .03$). More of them were male ($t(2) = 3.12$, $p = .04$, $\eta^2 = .004$) and they were more prejudiced toward all analysed minorities ($t(72) = 1.61$, $p < .001$, $\eta^2 = .06$ for generalised social distance).

Acknowledgement

The study reported in this paper was conducted as part of a National Science Centre Poland grant Preludium "Attitude Change as a Consequence of Outgroup Contact in Virtual Realities" No.2016/23/N/HS601590.

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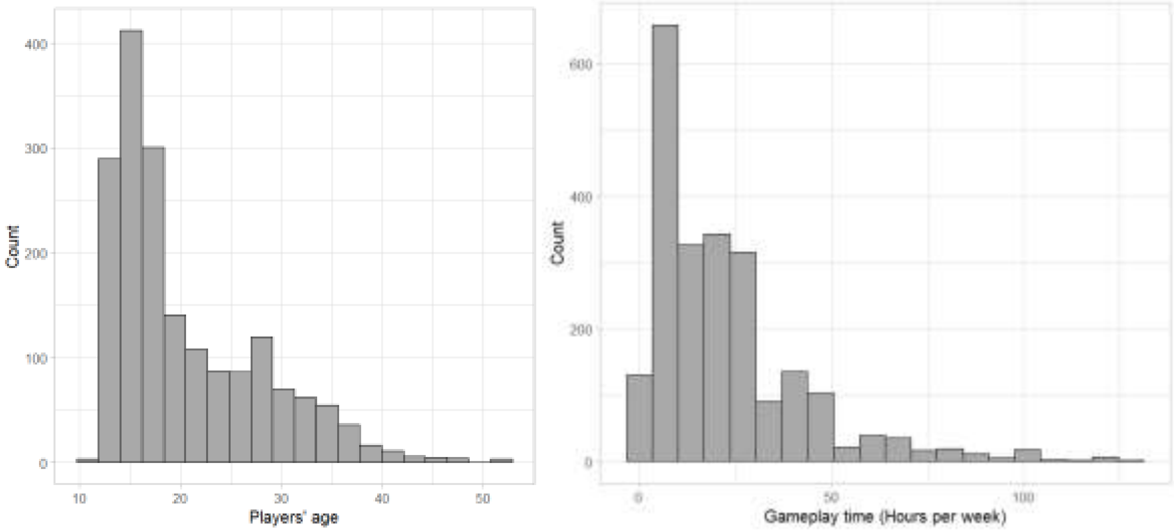
Appendix

1. Additional Information About the Participants

Figure 1. *Histograms of the Players' Age and Hours They Play per Week*.



2. Games

Table 1A. *List of Games Evaluated by the Judges With: the Count of Players who Chose the Game as the One Played the Most the Previous Month, Genre (as Evaluated by the Judges, Two Genres Stated Where the Judges Differed) and the Presence of Minority Characters (for Those Minorities Players' Social Distance Was Evaluated and Hispanic Characters, Added as They Were the Only Additional Group Frequently Seen by the Judges)*.

No.	Franchise	"The game I played the most" (count)	Type	No. of judges who saw characters that are						
				Black	Asian	Hispanic	Jewish	Roma	Eastern European	Muslim
1	League of Legends	307	MOBA*	2	0	0	0	0	1	0
2	Counter-Strike	305	Shooter	2	0	0	0	0	0	1
3	Witcher	115	RPG*	0	0	0	0	0	0	1
4	Grand Theft Auto	72	Action / RPG	2	1	2	0	0	0	0
5	Overwatch	71	Shooter / MOBA	2	2	2	1	0	2	1
6	FIFA	56	Casual	2	2	2	1	0	2	2
7	Battlefield	46	Shooter	2	0	0	0	0	0	2
8	PlayerUnknown's Battlegrounds	39	Shooter	2	2	2	0	0	0	1
9	Minecraft	37	Adventure / Strategy	0	0	0	0	0	0	0
10	Elder Scrolls	36	RPG	2	0	1	0	0	0	1
11	Rainbow Six	32	Shooter	1	0	0	0	0	0	0
12	World of Tanks	30	Action / Shooter	0	0	0	0	0	0	0
13	World of Wacraft	27	MMORPG*	2	1	1	0	0	0	0
14	Heroes of the Storm	23	MMORPG / MOBA	2	2	1	0	0	1	0
15	Fallout	23	RPG	2	0	2	0	0	0	0
16	Euro Truck Simulator	23	Casual	0	0	0	0	0	0	0
17	Hearthstone	22	Strategy / Casual	0	0	0	0	0	0	0
18	Dark Souls	21	RPG	0	0	0	0	0	0	0
19	Assassin's Creed	21	Adventure	2	0	0	0	1	0	1
20	Paladins: Champions of the Realm	21	MMORPG / MOBA	2	0	0	0	0	0	0
21	Gothic	18	RPG	1	0	1	0	0	0	0
22	Hereos of Might and Magic	18	Strategy	2	0	0	0	0	0	0
23	Total War	16	Strategy	1	0	1	0	1	1	1
24	Osu	15	Arcade	0	0	0	0	0	0	0
25	Mass Effect	14	RPG	2	1	1	0	0	0	0
26	Sims	14	Casual	2	0	2	0	0	0	0
27	Team Fortress	14	Shooter / MOBA	2	1	0	0	0	0	0
28	Rocket League	14	Casual / Arcade	0	0	0	0	0	0	0
29	Call of Duty	14	Shooter	1	0	0	0	0	0	0
30	Diablo	14	Action / RPG	1	0	0	0	0	0	0
31	Guild Wars	13	MMORPG	2	1	1	0	0	0	0
32	Dying Light	12	Action	2	0	1	0	0	0	1
33	Dishonored	12	Action / RPG	2	0	0	0	0	0	0
34	Gwent	12	Strategy	0	0	0	0	0	0	0
35	Clash series	12	Strategy	0	0	0	0	0	0	0

36	Civilization	12	Strategy	1	0	0	0	0	1	0
37	StarCraft	11	Strategy	2	0	0	0	0	0	0
38	Terraria	11	Casual / Strategy	2	0	1	0	0	0	0
39	Horizon Zero Dawn	11	Action / Adventure	2	0	1	0	0	0	0
40	Dota	10	MMORPG / MOBA	2	0	0	0	0	0	0
41	Far Cry	10	Shooter	2	1	1	0	0	1	0
42	Fortnite	9	Shooter / MOBA	2	2	2	0	0	0	0
43	XCOM	9	Strategy	1	2	0	0	0	0	0
44	Dragon Age	9	RPG	1	0	1	0	0	0	0

Note. * Abbreviations: RPG – Role Playing Game, MMORPG – Massive Multiplayer RPG, MOBA – Multiplayer Online Battle Arena.

3. Evaluation of Games by Independent Judges

The evaluation of the 44 most popular games was conducted by two independent judges. The judges were chosen based o convenience and their familiarity with games and games' assessment: a 27-year-old male working as a games' tester and a 35-year-old female game designer. Both judges were avid players, already familiar with most of the games. The judges were compensated financially for their work.

Each of the judges assessed each of the 44 games. For each game, the judges watched online playthrough videos and accessed an online wiki of the game, reading about the characters that appear in its virtual world. After familiarizing him- or herself with a game this way, the judge filled an online questionnaire about it.

3.1. Variables Provided by the Independent Judges

The questionnaire asked about the genre the game belonged to, allowing judges to choose from a list of nine genres (action, shooter, adventure, role playing game, strategy/management, massively multiplayer online RPG, massively multiplayer online battle arena, arcade and casual). The answers to the question were reliable across the judges' evaluations (with Pearson Chi-square = 164.22; $p < .001$). However, they were not unanimous which prevented us from including game genre in the analysis (see Appendix, Table 1A).

Next, the questionnaire required each judge:

a) to state whether the gameplay featured any **interactions with NPCs** or characters controlled by other players.

b) to state whether the game featured each of the minorities for which players' social distance was measured. The questionnaire included a list of the same minorities for which we measured players' social distance. For each of them, the judges were asked if the minority appeared in the game (answering with a "yes" or "no" for each group in each game).

c) to **list all other minorities** present in the game (minorities that are present in the real world and fictional minorities e.g., goblins, separately) in order to acquire a complete list of minorities and be able to assess the entirety of intergroup contact in each game. The judges were presented with blank textboxes to manually name all minorities.

d) for each of the indicated or listed minorities, the judges were to estimate, what **percentage of characters** seen by the players belonged to each of the minorities. The judges used a slider with the scale from "0 - not present in the game" to "100% of the characters in the game" to do so (with numerical representation and an option to enter the value using numbers).

e) to estimate the **quality of contact** with each of the indicated or listed minority. The assessments were made with a slider that represented a 7-point Likert scale (with the score visible) ranging from 0 – completely negative to 6 – completely positive. The judges received the following description of contact quality, based on the optimal conditions defined by the intergroup contact hypothesis (Pettigrew & Tropp, 2006): "Assess the players' contact with characters that are [minority name]. If that contact is always negative (players fight with these characters, the characters strive o prevent players from reaching their goals) move the slider to the left. If the contact is entirely positive (such characters always support the players) move the slider farthest to the right."

The judges were unanimous in their answers in regards to a) whether gameplay featured interactions with in-game characters. Their evaluations of the presence of minorities in the games – or more accurately, the design of the most popular games as evaluated by them (b and c) – posited problems that did not permit us to conduct analyses about the relationships between prejudice in-game contact with each of the minorities separately in the article. The minorities were not always easily identifiable and in case of some games the judges' evaluations differed. Moreover, the minorities that we named and for which players' social distance was measured were rarely featured in the games (moreover, one judge did not notice any Jewish characters, the other any Roma characters in any of the games).

Table 2A. *Correlations of the Independent Judges' Evaluations of the Presence of each of the Minorities for Which Players' Social Distance was Measured.*

Group	**Correlations of judges' observations (Pearson's R)**	**Significance**
Black characters	.65	<.001
Asian characters	.65	<.001
Eastern European characters	.42	<.005
Muslim characters	.23	.18
Jewish characters	*Not computed due to lack of observations of one of the judges.*	
Roma characters		

For the minorities the judges listed themselves (c) the judges often disagreed as to the classifications and divisions in the game world, i.e., they were less than unanimous as to what defines a minority in the game. For example, where one judge defined real world minorities presented in a game based on nationality (e.g., listing the Irish, Scots, Scandinavians) the other saw religion as the key to identifying minorities (e.g., the heretics or pagans). Fictional minorities followed a similar pattern e.g., where one judge saw one minority of elves, the other listed three separate races of elves and when one judge used in-game names for races, the other used a pop-culture equivalent (e.g., demons or spirits). Instead of attempting to map the groups from one judge evaluations to the second judge's evaluations, we decided to compute aggregate measures for each game that is the count of minorities present in a game and the percentage of minorities in the society (for real-world and fictional minorities). To assess the reliability across the judges' evaluations we have calculated the interclass correlation coefficient (ICC) in the two-way mixed model, checking for consistency. Their reliability across the judges' evaluations is presented in Tables 3A–4A (for descriptive statistics see Table 7A).

Table 3A. *Reliability of the Judges' Evaluations of Minority Group Counts.*

	Interclass Correlation Coefficient	Significance (*p*)
Number of real-world minorities in the game world	.73	<.001
Number of fictional minorities count in the game world	.53	<.001

Table 4A. *Reliability of the Judges' Evaluations of the Population.*

	Interclass Correlation Coefficient	Significance (*p*)
Percentage of characters representing real world minorities in the game world	.51	<.001
Percentage of characters that belong to fictional minorities in the game world	.83	<.001
Percentage of characters representing the majority group in the game world	.79	<.001

3.2. Hirshman-Herfindahl Diversity Index and Game-Wide Contact Quality

Next, we computed a joint measure of the number of minorities in a game and their percentage of the population, the Hirschman-Herfindahl diversity index (HHI) for each game with the formula HHI = 1 - $\sum_{i}^{k} s_i^2$, where s_i is the share of the group in a population and k is the number of groups (Schaeffer, 2013). We computed a separate diversity index for the real-world and fictional minorities for each game, for each of the judges. The diversity indices proved reliable across the judges' evaluations (see Table 5A), more reliable than each of the separate measures of minorities group counts and population percentages considered separately. Effectively, the judges differed on what minorities were present in the game (their names and what differentiated them e.g., nationality or religion) but they were consistent in their evaluations of how diverse a game is. Due to this and because diversity was a fitting measure for our subject, we decided to include the diversity index in the analysis carried out in the article.

Table 5A. *Reliability of the Judges' Evaluations of World Game Diversity (Hirshmann-Herfindahl Indices, HHI)*.

	Interclass Correlation Coefficient	Significance (*p*)
HHI including real world minorities only	.81	<.001
HHI including fictional minorities only	.96	<.001
HHI including all minorities	.86	<.001

To include contact quality in the same manner in the analysis, we computed an average contact quality for each of the games. All of these measures were computed for the minorities that are also present in the real world and for fictional minorities separately. Contact quality was reliable across the judges' evaluations with the ICC = .74 for contact with the real-world minorities and .89 for fictional ones (Table 6A).

Table 6A. *Reliability of the Judges' Evaluations of Average Contact Quality With Minority Groups*.

	Interclass Correlation Coefficient	Significance (*p*)
Contact quality with real world minorities	.74	<.001
Contact quality with fictional minorities	.89	<.001

Table 7A. *Descriptive Statistics for the Game-Level Variables*.

	N	***Min***	***Max***	**Mean**	***SD***
Average No. of featured real-world minorities	44	0.00	11.00	3.88	2.93
Average No. of featured fictional minorities	44	0.00	46.00	5.08	10.81
Average No. of all featured minorities (real-world and fictional)	44	0.00	48.50	8.95	10.93
Average percentage of real-world minorities in the game population	37	2.75	100.00	17.83	17.13
Average percentage of fictional minorities in the game population	28	2.00	79.00	21.21	17.82
Average percentage of all minorities in the game population (real-world and fictional)	39	5.63	43.42	18.60	10.31
Average contact quality with real-world minorities in game interactions	37	1.67	5.92	3.39	0.87
Average contact quality with fictional minorities in game interactions	28	0.00	5.00	1.97	1.37
Average contact quality with all minorities in game interactions (real-world and fictional)	39	0.00	5.27	2.67	1.02
Diversity index of the game world calculated for real-world minorities	39	0.00	0.86	0.48	0.23
Diversity index of the game world calculated for fictional minorities	28	0.00	0.89	0.53	0.31
Diversity index of the game world calculated for all minorities (real-world and fictional)	39	0.04	0.90	0.68	0.16

3. Multilevel Regression Analysis

Table 8A. *Multilevel Regression Analysis of in Game Contact on Minorities Acceptance*.

	Null Model	Fixed			Random model
		level 1 predictors	level 2 predictors Contact Quality	level 2 predictors HHI	
Intercept ***p***	3.07 (0.03) <.001	3.23 (0.07) <.001	2.87 (0.13) <.001	2.77 (0.10) <.001	2.51 (0.11) <.001
Level 1 predictors					
Hours of play per week ***p***		-0.003 (0.001) <.001	-0.003 (0.001) .005	-0.003 (0.001) .005	-0.004 (0.001) <.001
Socializing ***p***		-0.03 (0.01) .001	-0.04 (0.01) .001	-0.04 (0.01) .003	-0.04 (0.02) .022
Exploring ***p***		0.02 (0.01) .030	0.02 (0.01) .215	0.01 (0.01) .252	0.005 (0.01) .776
Level 2 predictors					
Contact Quality - real ***p***			0.12 (0.03) <.001	0.13 (0.03) <.001	0.13 (0.03) <.001
Contact Quality - fictional ***p***			0.03 (0.01) .051	0.03 (0.01) .041	0.02 (0.01) .035
HHI real ***p***				0.14 (0.07) .060	0.16 (0.08) .043
HHI fictional ***p***				0.03(0.07) .721	0.03(0.07) .636
Random part					
Within game variability σ_e^2 ***p***	0.49 (0.01) <.001	0.49 (0.01) <.001	0.47 (0.01) <.001	0.47 (0.02) <.001	0.46 (0.02) <.001
Between variability σ_e^2 ***p***	0.03 (0.01) <.001	0.02 (0.01) .025	0.005 (0.01) .318	0.003 (0.004) .536	0.002 (0.01) .409
Variance of slopes Hours $\sigma_{u_1}^2$ ***p***					0.000 (0.000) .166
Variance of slopes Socializing $\sigma_{u_1}^2$ ***p***					0.001 (0.004) .750
Variance of slopes Exploring $\sigma_{u_1}^2$ ***p***					0.001 (0.001) .232
Deviance	6552.098	6496.266	3582.03	3576.424	3570.706
S&B Chi2 ***p***		34.19 <.001	1582.88 <.001	20.87 <.001	65.13 <.001

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Editorial record: First submission received on February 19, 2020. Revisions received on November 5, 2020, May 10, 2021 and July 28, 2021. Accepted for publication on August 16, 2021.
Editor in charge: Lenka Dedkova

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