RUNNING HEAD: Prejudice reduction using video games

Playing Well With Others: The Role of Opponent and Intergroup Anxiety in the Reduction of Prejudice Through Collaborative Video Game Play

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**Abstract**

Recent work on the social effects of video gaming has moved away from the view they are detrimental, and has instead demonstrated how they may be a force for good. One example is how collaborative intergroup play can reduce prejudice between groups. However, this literature is at a nascent stage, and many of the intricacies of such a mechanism are unknown. Previous work has predominantly used attitude scales and ignored other measures. Factors such as the role of the opponent in games and what may be the mechanism behind any effects has likewise received little attention. In this laboratory study, participants played collaborative games with an outgroup member, or alone. Their opponent was also reported to be computer-controlled, or controlled by another person. Following play, intergroup anxiety was reported, and participants wrote a short passage of prose regarding the outgroup as well as rating on attitude scales. Analysis demonstrated that playing with outgroup members was indeed an effective method of increase the positivity towards outgroup members, reflected in both scale and prose measures. Anxiety was also found to be a significant mediator; however it was less clear whether a human opponent moderated any effects. Further ideas of how these findings could be developed are then discussed.

KEYWORDS: videogames; prejudice; intergroup; anxiety; contact

**Public Policy Relevance Statement**

Playing collaborative video games with individuals who belong to rival groups reduces subsequent prejudice towards that group as a whole. This is reflected in attitude measures, but also in the language used to refer to that group. The effect seems to be mediated by reducing anxiety about another group’s members, and does not seem reliant on playing against a human opponent. This offers a useful and efficient way to improve relations between rival groups.

**Introduction**

Video games have enjoyed unprecedented success in this millennium, rising from niche past time to multi-billion dollar industry (Anderton, 2017). In 2016, the video game industry generated $91 billion of revenue (Takahashi, 2013), and 63% of US households reported having at least one frequent gamer (Frank, 2016)

 Despite their popularity, video games have in the past been ascribed a certain amount of notoriety for their perceived ill effects on players. According to the literature some of these concerns seem to be valid. Playing video games has been linked with increased aggression in players (Barlett, Harris, & Baldassaro, 2007; Hollingdale & Greitemeyer, 2014). It has also been shown to decrease self-control (Harma, Aktan, & Cagiltay, 2015), and “betrayal” by computer controlled characters in game can reduce levels of trust in human interaction partners (Rothmund, Gollwitzer, Bender, & Klimmt, 2015). Video game players can show deleterious physical symptoms, demonstrating cardiac patterns which mimic high levels of stress (Hasan, Bègue, & Bushman, 2013). There is also a growing concern in the clinical population that playing video games may be addictive and lead to addict-like behaviours (Schmitt & Livingston, 2015)

However, recent research has demonstrated that playing games does not always have negative consequences. Playing video games can actually increase cooperation and helping (Greitemeyer & Cox, 2013; Greitemeyer & Osswald, 2010) and can decrease feelings of schadenfreude (Greitemeyer, Osswald, & Brauer, 2010). Even violent video games – which have traditionally been the bugbear of those who oppose gaming, particularly the tabloid media – can have a positive effect. Playing violent videogames can also increase subsequent pro-social behaviour, if they are cooperative (Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2016).

More recently, researchers have begun examining whether the positive aspects of gaming can be used to address ongoing societal problems. For example, *prejudice* between individuals belonging to different groups is one of the leading causes of conflict on a global scale (Fiske, 2002; Neuberg et al., 2014; Platow & Hunter, 2012; Schaller & Neuberg, 2008) and psychologists are keen to find solutions to assist with this. A robust method is to initiate *contact* between individuals in opposing groups (Allport, 1954; Pettigrew & Tropp, 2006). Contact involves individuals in opposing groups working together on a collaborative task. In doing so, prejudice towards each others’ groups as a whole is reduced. Numerous studies have shown the effectiveness of contact (Achbari, 2015; Alperin, Hornsey, Hayward, Diedrichs, & Barlow, 2014; Broad, Gonzalez, & Ball-Rokeach, 2014; Ellison, Shin, & Leal, 2011; Mähönen, Ihalainen, & Jasinskaja-Lahti, 2013; McKeown & Dixon, 2017; Shook & Fazio, 2008; Span, 2011)

Since its inception, work on contact has been further expanded. In particular, it has become apparent that a member of the outgroup need not actually be physically present for contact to be effective. Researchers have shown that *imagining* contact with an outgroup can be an work as a way of increasing positive relations between two groups (Cameron, Rutland, Turner, Holman-Nicolas, & Powell, 2011; Crisp & Turner, 2009; Stathi, Cameron, Hartley, & Bradford, 2014). As well as this, contact via *electronic medium* (Tynes, Giang, & Thompson, 2008) is also efficacious in reducing prejudice. These findings greatly expand the potential applications of contact to those who are geographically dispersed. However, in order for contact to have the most impact, parties involved need to feel motivated to engage in the collaborative task presented to them (Cernat, 2011; Halperin et al., 2012; Lemm, 2006; Ron, Solomon, Halperin, & Saguy, 2017). Although contact is effective, many contact tasks are mundane or not intrinsically motivating in themselves. This can attenuate their usefulness.

Thus, *video games* may be the perfect method of fostering contact in a collaborative environment. Video games are designed with the specific aim of being enjoyable and engaging, meaning players should be motivated to take part in the collaborative endeavour they present. Most games also allow those who are not geographically proximal to interact, with infrastructures set up to facilitate gaming over the Internet. Previous work has shown support for the idea of gaming as means of facilitating contact (Stiff & Bowen, 2016; Velez, Mahood, Ewoldsen, & Moyer-Gusé, 2012). In this paper, we aim to replicate these findings (in keeping with the current “replication crisis” in psychology – Anderson & Maxwell, 2017; Lilienfeld, 2017) and to also expand them to gain further understanding of this effect.

**Going beyond scale measures of prejudice**

The extant literature on prejudice and prejudice reduction is somewhat limited in that it tends to focus on attitude measures (via Likert scales) or behaviour change. In this paper, we examine an additional element – how *language* and prejudice may be interlinked.

According to self-categorization theory, ingroup members will use derogatory language towards outgroups as a way of strengthening ingroup identity (Branscombe & Wann, 1994; Moscatelli & Rubini, 2011; Tajfel, Billig, Bundy, & Flament, 1971; Tajfel & Turner, 1979). Using particular linguistic terms is a powerful method of demarking group boundaries (Cherny, 1999; Porter, Rheinschmidt-Same, & Richeson, 2016), with ingroups often using slang and terminology that is peculiar to themselves (Tamburrini, Cinnirella, Jansen, & Bryden, 2015). Moreover, Ng (2007) has suggested that language and prejudice are often hard to disentangle. Prejudice may be explicitly stated in language through the use of derogatory slurs. But, it can also manifest in the subtle use of words that can imply inferiority without the speaker intending to promote prejudiced views. That is, a speaker’s language may have prejudicial components even when they are not intending to impart prejudiced rhetoric. This is similar to the work by Guerin (2003) who argues that casual racism – i.e. racism that is intended as a form of social bonding through sharing a taboo rather than the actual endorsement of those values – is still problematic and can lead to biased behaviour.

So, when referring to outgroup members, the language that ingroup members used may contain derogatory and/or prejudicial components. These components may not be deliberate, conscious attempts to degrade the outgroup; rather, they may have been assimilated into a person’s cognitive representation of that outgroup and are manifested automatically. Casual language regarding the outgroup may be considered an *implicit* measure of an individual’s prejudice towards that outgroup. Implicit attitudes cannot usually be consciously accessed by the holder, and tend to give a truer representation of the holder’s feelings towards a target (Carruthers, 2017; Mattavelli, Avishai, Perugini, Richetin, & Sheeran, 2017). This makes them extremely useful in measuring whether any intervention has actually had an effect as they are not subject to social desirability like e*xplicit* attitude measures.

Thus, if our video games-based contact has truly reduced prejudice towards the outgroup, we would hope that language used regarding the outgroup would reflect this as well. Change made at the deeper, cognitive representation level should be manifested in that language, and not subject to social desirability in the same fashion as explicit attitude measures. Surprisingly, this area is understudied. Taylor and Usborne (2007) have suggested that although prejudice and language use do seem to be linked, there is a dearth of literature that looks at the two together. Other researchers have echoed this (e.g. Collins & Clément, 2012; Pitts & Watson, 2012). One study by Wright and Tolan (2009) does seem to lend support to this idea; in their work, college students wrote reflective essays following encounters with outgroup members. Content analysis indicated high levels of diversity awareness following these encounters, suggesting their were viewing the outgroup more favourably. However, this study did not systematically compare students who had had contact with those that had not, and did not take any more detailed measures.

In the current work, we manipulate contact with outgroup members so such a comparison can be made, to see if language used to refer to the outgroup changes following contact via video game play. We expect that any intervention to reduce prejudice should cause the language individuals use to change in line with their attitudes. That is, participants’ language when referring to outgroup members should be more positively orientated and contain less deleterious references to the outgroup if they have played with a member of that outgroup, compared with if they have played alone.

**Opponent effects – does who you play matter?**

Video games often involve a competitive element, with players attempting to defeat an opponent. That opponent may be controlled by the computer, but it some situations it may be controlled by another human player. For example, *World of Warcraft* involves players-versus-computer (PVC) combat where teams of up to 50 people work together in order to “kill” enemy creatures controlled by the computer. However, there is also a player-versus-*player* (PVP) option where users fight against other human users. Most first person shooting games (e.g. Call of Duty) have options to complete a “campaign” against computer-controlled opponents, or to engage in skirmishes with other players across the globe. Non-violent games – such as *Mario Kart,* a popular racing game – also usually have both PCV and PVP options for players.

If video games are to be used as an effective means of prejudice reduction, a number of issues raise themselves regarding whether the type of opponent (computer- or human-controlled) moderates any change in players’ attitudes that take place. First, if human-controlled opponents are required in order to effectively facilitate prejudice reduction, this may present a considerable logistical issue when implementing this intervention. That is, as well as organising the ingroup and outgroup, the intervener will also need a third party to act as an opponent. By contrast, if playing collaboratively is just as effective when the opponent is computer-controlled, this will be a much more efficient method of using this intervention.

Second, the type of opponent may influence engagement and motivation to complete the task, which we have previously reported as being important to contact strategies. Weibel, Wissmath, Habegger, Steiner, and Groner (2008) found that participants who played against human opponents showed greater enjoyment of the game, more engagement, and heightened experience of “flow” compared with a non-human opponent. Similarly, players tend to show greater physiological arousal (Lim & Reeves, 2010) and emotional responses (de Melo, Gratch, & Carnevale, 2015) when interacting with humans rather than computer-controlled agents. This suggests that the experience of playing against a human opponent is more profound and persuasive compared with a computer-controlled one, meaning it will lead to greater prejudice reduction.

Third, the presence of a third human “group” in the form of an opponent may cause the redefinition of social identity boundaries between the ingroup and outgroup players. A consequence of this may be that ingroup and outgroup members form a *superordinate* identity against the opponent identity (Brewer, 2000; Reysen & Katzarska-Miller, 2017). This may enhance the contact effects already in play. By contrast, a computer-controlled opponent does not possess a real identity, and so this enhancement will not take place. It should be noted that a more pessimistic hypotheses may be that the presence of another tangible outgroup exacerbates feelings of hostility between the ingroup and outgroup (see Crisp, Hewstone, & Rubin, 2001). However, we believe this is unlikely given that the ingroup and outgroup participants will be working together for a common cause against their opponent.

**Mediators and moderators of prejudice reduction**

A final concern of this paper is to ascertain the mechanism of any effect that is present. One prominent factor in the contact literature cited as facilitating prejudice reduction is a decrease in *intergroup anxiety;* the ambiguous and unsettling feeling when working with members of an outgroup (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Paolini, Hewstone, Cairns, & Voci, 2004). The reduction in this aversive feeling consequently manifests as a reduction in prejudice towards the outgroup as a whole.

 Intergroup anxiety is not just exclusive to direct contact; studies using imagined contact also demonstrate its key mediating role in prejudice reduction (Kuchenbrandt, Eyssel, & Seidel, 2013; Lee & Cunningham, 2014). There is no reason to suppose that contact via video games will be any different. Thus, we expect it will also have a role when using video game play to facilitate contact. Any prejudice reduction effects should be at least partially mediated by a reduction in intergroup anxiety.

 We also intend to examine some other variables that may be important in this intervention. As we have already said, contact is most effective when participants are motivated and engaged with a task. Generally, individuals are more well-disposed towards others when they have previously undertaken a pleasant experience (Clark, Oullette, Powell, & Milberg, 1987; Vrugt & Vet, 2009; Yang & Chang, 2010). To this end, we have measured participants enjoyment of playing the game to ascertain whether this may be important. If participants have particularly enjoyed playing the game, this may make them more amendable towards the outgroup, and will enhance the prejudice reducing effects.

 We also intend to examine the *strength* of participants’ social identity as a moderator of prejudice reduction. Participants with a strong social identity endorse the norms and boundaries of their group as a means of increasing distinctiveness (Bizman & Yinon, 2001; Tajfel & Turner, 1979). Those who strongly identify with a group are more likely to show ingroup favouritism (Montoya & Pittinsky, 2016) and outgroup prejudice (Gabarrot & Falomir-Pichastor, 2017) compared with low identifiers. So, high identifiers are much more entrenched in the attitudes of the ingroup, and in the derogation of the outgroup. This suggests they may be harder to “persuade” when it comes to prejudice reduction strategies. High identifiers may be *less* influenced by collaborative play with an outgroup member, because they endorse the ideologies and group permeability so much more than low identifiers.

 An alternative outcome is also possible. The Social Identity Model of Deindividuation Effects (Postmes, Spears, & Lea, 1998; Spears, Lea, Corneliussen, Postmes, & Haar, 2002) suggests that group members are more likely to conform to group norms if they have a stronger social identity. So, if reducing prejudice towards the outgroup somehow manifested as a group norm in our experimental scenario, this would mean a stronger social identity would lead to *greater* prejudice reduction. By measuring strength of social identity in our participants, we can examine if this is the case.

**A summary of the current work**

In this study, participants play a casual video game either on their own, or with an outgroup member. In addition, the opponent in the game is systematically varied to either be human- or computer-controlled. Subsequent to play, participants rate their attitude towards the group, indicate their anxiety regarding interacting with outgroup members, and express their feelings towards the outgroup in a short written paragraph. We make the following hypotheses:

H1: Participants will show more positive attitudes towards the outgroup when they have played with an outgroup member, compared with after playing alone.

H2: Participants will write more positively about the outgroup after playing with an outgroup member, compared with after playing alone.

H3: The effects of playing with an outgroup partner will be greater when playing against a human opponent, compared with playing against a computer-controlled opponent.

H4: Attitude change effects (H4a) and changes in language (H4b) will be mediated at least partially by reduced intergroup anxiety.

H5: Enjoyment of the game will moderate (increase) the prejudice reduction effect of cooperative play

H6: Participants’ social identity will moderate the prejudice reduction effect.

**Method**

**Participants**

Eighty participants (60 female) attending a west-midlands university in the UK took part in this study. Mean age was 19.6 years old (SD = 5.00). Participants took part either for course credit, or voluntarily (i.e. they did not receive compensation).

**Design**

A between-subjects experiment was used. There were two independent variables: play partner (with outgroup member vs. alone) and opponent type (human- vs. computer-controlled). Participants were rotated orthogonally through the four conditions this created.

The main dependent variables were participants’ attitude towards the outgroup following play, and the positivity of their prose written regarding the outgroup following play. Intergroup anxiety was measured as a mediator. Strength of social identity towards the ingroup institution and enjoyment of the game played were measured as moderators.

**Materials**

Participants played on a standard Windows computer using a keyboard and mouse. In all conditions, participants played the game *Worms Armageddon.* This is a simple game wherein cartoon worms battle one another on a side-view two-dimensional landscape with comical weapons. Gameplay is turn-based; once a player’s turn is finished, they cannot move or operate their worm until their next turn. Each turn is also time-limited. Players only have around three minutes to take their turn before it ends automatically, regardless of their actions.

 Following play, participants responded to all DVs via an online survey, hosted by Smartsurvey.co.uk. Participants first responded to the intergroup anxiety scale (Stephan & Stephan, 1985; Voci & Hewstone, 2003). This asks participants to imagine mixing socially with members of the outgroup, on their own (i.e. with no other ingroup members), and to indicate how happy, awkward, self-conscious, confident, relaxed, and defensive they would feel in this case (on a 1 to 5 scale, with higher responses indicating greater expression of that feeling). Participants then indicated their agreement with the following items, to measure their attitude towards the outgroup: “I would be happy to work with someone from [outgroup institution] on a future task”, “I have positive feelings about [outgroup institution]’s students”, “I would happily become friends with a [outgroup institution] student”, “I believe that [outgroup institution]’s students are an unpleasant group of people” (reverse coded), “I like [outgroup institution] students”, “I can see that all [outgroup institution]’s students are individuals, with their own personalities”, “[outgroup institution] students aren’t really that different from [ingroup institution] students”, “[outgroup institution] students have a diverse range of interests and ideas”, and “just because one [outgroup institution] student acts a certain way, it doesn’t mean any others would”. Responses were on a 1 to 4 scale, with a higher score indicating a more positive attitude.

Participants were also asked: “how enjoyable/difficult/entertaining did you find the game?”, responding on a 1 to 4 scale with a higher score indicating a more positive perception of the game. Social identity was measured by responding to the item “I identify with [ingroup institution]”, from 1 to 7 with a higher score indicating more agreement/stronger social identity (Postmes, Haslam, & Jans, 2013).

Participants’ short text response was also recorded via this survey. Analysis of the text supplied by participants was performed using LIWC2007, a semantic analysis tool which can extract and quantify the positive and negative aspects of supplied text (Pennebaker, Booth, & Francis, 2007; Tausczik & Pennebaker, 2010). The tool has been used in a number of other studies to efficient quantify the emotions expressed in writing (see Fernández-Cabana et al., 2015; Jones, Wojcik, Sweeting, & Silver, 2016; Robinson, Navea, & Ickes, 2013; White, Abu-Rayya, Bliuc, & Faulkner, 2015 for just a few examples of previous uses).

**Procedure**

Participants were sat at a computer and instructions were read aloud by an experimenter. They were told they would be playing a video game, and the aim of the experiment was to look at differences in play styles between different kinds of people. In the outgroup member condition, participants were told they would be playing with a member of another local university, which is known to have a friendly but entrenched rivalry with the ingroup institution. To test the potency of this, 30 individuals (who did not take part in this main study) were approached at random on campus regarding the outgroup institution. They were asked to indicate to what extent they agreed with the statements “[outgroup institution] is our biggest rival”, and “[outgroup institution] is not as good as [ingroup institution]”, on a scale from 1 (strongly disagree) to 5 (strongly agree). All students surveyed either agreed or strongly agreed with both statements, indicating that the intergroup animosity was considerable.

In the alone condition, participants were told they would be playing by themselves. They were then told who would control their opponent– either the computer, or another human. In the human-opponent condition, participants were told that they would receive no identifying information about who this person was, and that they may attend the ingroup or outgroup institution, or may not attend university at all. That is, they could be anyone. In the computer-controlled condition, participants were told they would be playing against the game’s AI. In fact in both conditions, participants played against the computer.

 Participants were given a 5-minute practice session, playing alone against one other computer controlled opponent. If they were happy with how to play the game after this, they then began the main experimental round, playing for 10 minutes or until the game ended naturally, whichever came first.

 For the main session, the experimenter edited the names of the characters to reflect the condition. When playing with an outgroup partner, the participant’s worm was labelled as “[ingroup institution] student, and the partner as “[outgroup institution] student”. Both worms had the same colour label, indicating they were in the same team. In this condition the participant’s opponent was another team of two worms (i.e. four worms played in total), both of which shared a different colour label indicating they were in a different team. Computer-controlled opponents were labelled as “COM 1” and “COM 2”, and human opponents were labelled as “OPP 1” and “OPP 2”. When playing alone, the same labels and colour schemes were used to indicate the different teams, but participants only had one opponent (i.e. two worms played in total). Labels for their opponent did not contain a number in this condition (i.e. “COM” rather than “COM 1” was used).

 After play, participants were directed to the online survey with the main measurement variables. Upon completion, participants were fully debriefed as to the nature of the study, thanked, and dismissed. No participants voiced any indication that they had been aware their partner or opponent were fictitious. This study received ethical approval from the institution, and researchers complied with APA ethical statements throughout the course of the data collection.

**Results**

**Individual difference measures**

Participants’ responses to the items regarding how enjoyable/difficult/entertaining they found the game α=.72) were averaged to form a single item. Two 2 (play partner: outgroup member vs. alone) x 2 (opponent type: human vs. computer) ANOVAs were performed on this item, and then on participants’ strength of social identity. Neither produced any significant main effects or interactions (all Fs<1.18, ns) indicating there were no differences between conditions.

 T-tests were run using gender as an IV on participants’ attitude towards the group, language score index (see below) and feelings of intergroup anxiety. None were significant (all t’s<1.01).

**Attitude towards outgroup**

The items measuring attitude towards the outgroup (α=.87) and enjoyment of the game (α=.72) were averaged to form a single attitude measure and enjoyment measure respectively. A 2 (play partner: outgroup member vs. alone) x 2 (opponent type: human vs. computer) ANCOVA with social identity and game enjoyment as covariates and attitude towards outgroup as the DV was calculated. Levene’s test for homogeneity of variance was non-significant (Levene’s (3, 76)=1.32, ns)

 This yielded a significant main effect of play partner (F (1, 74) = 31.18, p<.01, partial eta = .30). Participants expressed a more positive attitude towards the outgroup when they had played with an outgroup member than when they had played alone (M = 3.51, SD = .33 vs. 3.08, SD=.36 respectively). Opponent type was not a significant main effect (F (1, 74) = .88, p=.35). The interaction was also not significant (F (1, 74) = 2.30, p=.13, partial eta=.03), but examination of the means seemed to suggest attitude towards the outgroup was more positive when playing against a human opponent (M = 3.60, SD=.25), compared with a computer opponent (M=3.42, SD=.38).

 Social identity (F (1, 74) = 1.68, p=.20) and enjoyment of the game (F (1, 74) = 1.87, p=.18) were not significant as main effects. Custom models specifying interactions for these variables with the main IVs demonstrated homogeneity of regression slopes. Therefore, we conclude that social identity and enjoyment of the game do not moderate any prejudice reduction effects caused by collaborative video game play.

**Writing about the outgroup**

Using LIWC2007, the positive and negative emotional content of participants’ writing regarding the outgroup was extracted. LIWC2007 works by parsing the text entered and comparing each word to those in its pre-defined dictionary. It can then quantify various aspects of the text and provide quantitative data that represents those aspects. For example, if a user wrote, “I hate going to work, it’s terrible”, the words “hate” and “terrible” would be recognised as possessing a negative valence, and this passage would receive a score of 2 for that metric. By contrast is a user wrote “I love going to work”, “love” would be parsed as a positive word. For this study, we used these two metrics - positively and negatively valenced words - as our language measure.

As participants wrote difference amounts, the negative emotional content was subtracted from the positive emotional content to standardise scores. This left a single index, where a higher score indicated more positivity overall. This was then entered into a 2 (play partner: outgroup member vs. alone) x 2 (opponent type: human vs. computer) ANCOVA with social identity and game enjoyment as covariates. Levene’s test for this analysis was non-significant (Levene’s (3, 76)=1.07, ns

 This yielded a significant main effect of play partner (F (1, 74) = 10.12, p<.01, partial eta=.12). Again, participants were more positive when they had played with an outgroup member (M=3.48, SD=2.92) compared with playing alone (M=1.65, SD=2.25). The main effect of opponent type was bordering on significant F (1, 74) = 3.73, p=.06, partial eta=.05). This suggested that having a human opponent led to more positive emotions towards the outgroup (M=3.10, SD=2.58) compared with a computer opponent (M=2.04, SD=2.84).

The interaction was not significant F(1, 74)=.82, ns). Social identity (F (1, 74) = .38, ns) and enjoyment of the game (F (1, 74) = .81, ns) were not significant as main effects. Custom models specifying interactions for the covariates with the main IVs demonstrated homogeneity of regression slopes. This again suggests that strength of social identity and enjoyment of the game do not moderate changes in language following collaborative video game play with an outgroup member.

**Mediation of effects by intergroup anxiety**

The items measuring “happy”, “confident”, and “relaxed” were reverse coded. Items were then averaged (α=.72 with “happy” removed), creating a single measure, with a higher score indicating *more* anxiety. Variables were analysed using the PROCESS regression macro (Hayes, 2017) with 5000 bias-corrected bootstrapped samples. This analysis produces a measure of the *indirect effect* of the predictor on the outcome variable via the mediator. For mediation to have taken place, the confidence interval produced by this analysis should *not* contain zero. This is an advancement from the casual steps approach outlined by Baron & Kenny (1986) in that it does not require the *direct effect* of the predictor drop significantly (or drop to non-significance) compared with the *total effect* (see Hayes, 2009; Preacher & Hayes, 2008 for more on the advantages of this approach). However in the interest of accessibility we have also included a representation of this more traditional conceptualisation in the figure below.

 For participant’s attitudes towards the outgroup, analysis supported mediation (indirect effect = .19, SE=.09 CI [.044, .386]). Examination of the coefficients indicated that playing with an outgroup partner did indeed lower intergroup anxiety, and accordingly increased favourability of attitudes towards the outgroup - see figure 1.

The same analysis was also performed on the language used regarding the outgroup. This did *not* support the idea that the increase in positivity of language used when referring to the outgroup following collaborative play was a result in the reduction of intergroup anxiety (indirect effect=-.31, SE=.61, CI[-.97, 1.47 ]). Given that a main effect of play partner was found in the previous analysis, It may be that another mediator which was not measured in this study could be operating (see below).

---Insert Figure 1 here---

**Discussion**

Overall, we found support for our main hypothesis. Playing collaboratively with an outgroup member did indeed increase favourability towards that outgroup (H1). This was expressed both in terms of explicit attitude measures, and *implicitly* through the language (H2) used to describe the group. It should be noted that this favourability was to the outgroup in general, not just to their play partner.

 Support was less forthcoming for some other hypotheses. No significant main effects or interactions for the type of partner were found (H3), indicating that playing against a human was no more efficacious in reducing prejudice than playing against the computer. From a practical point of view, this is actually the most desirable finding. For gaming to be used as an effective prejudice reduction measure in the real world, it needs to be resource efficient. If it necessitated finding a third party who was willing to be the opponent for the target groups to play against, this would increase the burden on the implementer. That it does not means that simply pitting players against a computer-controlled opponent will be effective in reducing prejudice between their groups.

 The mechanism of the attitude change we found has been somewhat illuminated, but other variables appear to factor into the model as well. When looking at attitude scale measures, levels of prejudice were mediated by a reduction in intergroup anxiety (H4a). Such an effect was not found for language measures (H4b) suggesting another variable may be important (see below).

 These findings further demonstrate the usefulness of contact in the reduction of prejudice. Moreover, they support the idea that purely experiential contact is sufficient for the effect to occur. In our study participants did not communicate with their outgroup partner (indeed, there was no partner to communicate with), and yet were still more favourably disposed towards the outgroup afterwards. This work also extends previous studies on the pro-social effects of video games by showing that casual, simple games can also lead to positive consequences. Previous work has tended to use intense, fast-paced games where players are playing simultaneously. By contrast the game used here would be considered “casual” and used a turn-taking style such that players did not actually play “together” in the strictest sense. Nevertheless, it still had a pronounced effect on their feelings for the outgroup.

 Our study did not find support for the idea that social identity would moderate the effectiveness of this intervention in prejudice reduction (H6). Again, this may actually be a useful finding when applying this work to the real world. Anyone using gaming to attempt to bridge relations between groups should not be too concerned that it will not be effective on “hardliners”. In fact, we cannot rule out the possibility that social identity may have an effect, as participants in this study tended to be high identifiers. It may be then that low identifiers are even *more* susceptible to prejudice reduction effects than high identifiers. Deliberately diversifying the strength of identity to probe this further may be a valuable component of future studies.

 On a similar note, enjoyment of the game did not seem to moderate the effectiveness of game play (H5). Our remarks for this are the same as those for social identity. That is, although this points to a strength of the research as it may seem that enjoyment “doesn’t matter” for this intervention to be effective, in fact video games are *designed* to be a pleasant experience. Thus, participants overall tended to rate whatever game they played as enjoyable. It may be interesting to attempt a replication of this study with individuals who have espoused strongly negative views of gaming to see if the effect still holds.

*Future work on this topic*

This paper has extended the work in both prejudice reduction and the use of pro-social video games. We have demonstrated an easily implementable prejudice reduction strategy that can be used between groups. Moreover, as physical proximity was not necessary for this intervention to work, it could be used with groups who are geographically dispersed to a considerable degree. Online gaming is designed so that players all over the world can interact, so deliberately setting up intergroup encounters would not be difficult. We have also demonstrated that a computer-controlled opponent is sufficient for the two groups to compete against. From this, there are a number of avenues we wish to pursue to further expand this field.

 A drawback of the findings in the current work is that we have not included a condition where participants play with an *ingroup* partner. Therefore, we cannot conclusively say that the prejudice reduction effects we have found are the result of playing with an outgroup member. It is possible that simple the act of playing with another person is sufficient to cause prejudice reduction, perhaps by increasing general feelings of affiliation to everyone (including outgroup members). We have found in this study that participants’ attitudes were mediated by changes in intergroup anxiety, demonstrating the importance of reducing the “strangeness” of the outgroup; something that could not happen if participants only played with ingroup members. Furthermore, we did measure enjoyment of the game and this did not differ between outgroup-partner and playing-alone conditions. So, it is hard to imagine what the unique contribution of an ingroup-partner condition would be. Nevertheless, the lack of this condition does mean we cannot definitively say that social play with *any* partner would cause the prejudice reduction effects seen here. This kind of condition should be included in any future studies to narrow down this explanation.

 We would also like to re-examine further implicit measures of attitude change in subsequent studies. It is possible that participants were somewhat influenced by social desirability in their text responses. Participants were assured of the anonymity of their responses, and the brief for the text was fairly benign, asking them only to write a few thoughts regarding the outgroup. Nevertheless, we may like to use some truly implicit measures in other work, such as an *implicit association test* (Carruthers, 2017; Greenwald, McGhee, & Schwartz, 1998)*.* With this, participants attitudes are provided by their response latencies, something that is very hard to change consciously. Use of this paradigm would help support the findings in this paper.

 Most previous work on gaming as contact has used intense, simultaneous play type games (e.g. *Halo, Call of Duty -* Greitemeyer & Osswald, 2010). The current work is novel in that is uses a much more casual, turn-taking type game, which is still effective. We would like to remove the immediacy of the gaming experience still further, by examining turn-taking games that may take place over several days. For example, the Scrabble-esque game *Words With Friends* allows players to take their turn at their convenience. There is no time limit for when a player must have their turn; consequently games may last several days or weeks. Will this dilute the contact experience? Or will being in a sustained engagement over a longer period time *enhance* feelings of contact, and *increase* the effectiveness of collaborative game play?

 The majority of our participants were female, and gender differences in gaming behaviour have been found in previous work. Ohannessian (2018) has reported that males that play video games tend to have lower anxiety than females. As intergroup anxiety was a mediating variable in the current work, it would be advisable to account for anxiety-vulnerability by recruiting more males, and explicitly examining gender as a variable. The role of opponent is also linked with gender differences. Playing against a member of the opposite gender has been shown to increase stress in players, particularly in males (Vermeulen, Núñez Castellar, & Van Looy, 2014). So, this could be included as a factor, varied alongside type of opponent (human vs computer). Finally, performance on a game has been shown to affect female’s enjoyment of it, but not males (Hopp & Fisher, 2017). As both of these aspects were included in the current work (albeit they were found to be null), a subsequent study which includes gender into the design would help investigate their effects more clearly.

 We also wish to ascertain the generalisability of the effects observed in this study. First, to what extent are any changes in attitudes *culturally bound?* Western society often shows markedly different manifestations of socially driven behaviour compared with East-Asian cultures, such as those of Japan. Many aspects of cooperation and pro-sociality are different across these cultures because of the individualistic vs collectivistic social norms. For example, in experimental mixed-motive games, Japanese participants tend to be more cooperative overall compared with American counterparts, and also be more trusting of their partners(Krockow, Takezawa, Pulford, Colman, & Kita, 2017). Japanese participants also tend to react more strongly to interpersonal trust violations(Kuwabara, Vogt, Watabe, & Komiya, 2014). Given the sizeable “gaming culture”(Mihara et al., 2016) found in east Asia, this issue worth studying.

Second, is gaming as a means of reducing prejudice as effective for all ages? Research suggests children may display attitudes akin to what we would call “prejudice”. Children around the age of 5 display preferences for their ingroup, and a dislike of the outgroup(Aboud, 2003). Furthermore, this can be seen in children’s explicit *and* implicit attitudes (Vezzali, Giovannini, & Capozza, 2012). Prejudice reduction strategies appear to be effective in children and contacthas been shown to work (Stathi et al., 2014). However, this area is still underexamined, and the challenge of stimulating the *motivation* of those engaged in contact activities is further exacerbated with children, who are likely to suffer from low levels of self-control and lose interest in tasks easily(Gagne, 2017).

 In subsequent work, we would like to include further measures to increase our understanding of what is actually happening through collaborative play. For attitude measures, reduction in prejudice was at least partially mediated by a reduction in intergroup anxiety. This mechanism did *not* seem to explain the effect of playing with an outgroup member on language use. Therefore, it may be some other mediator is in operation here. *Empathy* has also been shown to be important in prejudice reduction (Vescio, Sechrist, & Paolucci, 2003; Wright, Brody, & Aron, 2005), so including a measure of this would be useful. Furthermore, although we have attempted to broaden the measures used to examine prejudice by looking at language use, we have not looked at *behaviour* towards the outgroup. Behaviour is not always congruent with attitudes expressed by actors (Ajzen & Fishbein, 2005; Glasman & Albarracín, 2006), and so investigating whether ingroup members behave in a positive fashion towards outgroup members after play would be a great expansion of this work. This of course would also bring further social desirability issues which would need to be controlled.

 Finally, we have chosen an intergroup conflict here which is based on long-term animosity and rivalry between two local universities. The drive for distinctiveness between the institutions given their similarities, and their “realistic conflict” (Echebarria-echabe & Guede, 2003) in varsity sporting events means that this conflict is authentic and considerable. Moving forward, an obvious extension of this work is to look at other intergroup conflicts that are more ethnically-based, or that have given rise to more concerning consequences than losing sporting events, such as sectarian violence. If these effects can be replicated there, we have truly found a fantastic tool for reducing prejudice in the real world.

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