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Let's play together: Effects of video-game play on intergenerational perceptions among youth and elderly participants

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ABSTRACT

In this paper, we report on a longitudinal study that investigates the effects of video-game play on intergenerational perceptions amongst youths and the elderly after participating in a program involving regular interaction sessions over two months. Each pair of participants, consisting of one youth and one elderly, was randomly assigned to either the *video-game* condition ($n = 38$, 19 from each age group) or the *non-video-game* condition ($n = 36$, 18 each). Attraction, intergroup anxiety, attitudes, and game enjoyment were measured through pre-test and post-test surveys to investigate changes in perceptions. Results showed that participants in the video-game condition reported more positive changes in intergroup anxiety and attitudes, compared to participants in the non-video-game condition. Mediation analyses showed that specific attraction towards their interaction partner mediated the effects of video-game play on attitudes and intergroup anxiety towards the general members of the other age group. In addition, the results showed that game enjoyment played an important role in developing positive intergenerational perceptions only for the elderly, but not for the youth participants in the video-game condition. We discuss implications with respect to options to enhance intergenerational perceptions and communication for youth and elderly cohorts in today's hyper-ageing society.

1. Introduction

The United Nations. (2009) has projected that worldwide, the number of people aged 60 years and above will increase from 739 million in 2009 to 2 billion by 2050. In more developed countries, the proportion of elderly is expected to grow from 22% today to 33% in 2050. The phenomenon of a hyper-ageing society is not limited to developed countries, and many developing nations are also facing this challenge. The proportion of elderly in developing countries is expected to more than double from 9% today to 20% in 2050.

The likelihood of the youth having to interact with the elderly through their daily activities would increase as population ages. Younger cohorts may have to provide support to a larger proportion of older people in near future at the current pace of aging. In this regard, communication and interactions between youths and the elderly are expected to play a more essential role in an aging society. However, research has shown that perceptions between the two cohorts are less-than-harmonious (Giles, Ryan, & Anas, 2008; Giles & Williams, 1994). Youths view communication with the elderly as less than satisfactory and problematic (Hummert, 2010; Williams & Giles, 1996), while the elderly feel patronized and prejudiced by ageist sentiments (Giles & Gasiorek, 2010; Giles et al., 2008). The negative perceptions prevalent in both Eastern and Western cultures (Giles, McCann, Ota, & Noels, 2002) has motivated researchers to explore various methods to bridge the perceptual gap between the two age groups. For instance, studies examined how participation from different age groups in various leisure activities might have a significant impact on intergenerational perceptions (e.g., Hebblethwaite & Norris, 2010). With the rapid development of digital technology, the potential of video games as a leisure activity for intergenerational interactions has been gaining attention in recent years. Studies have also shown an increasing number of elderly playing video games (De Schutter, 2011; Pearce, 2008) and the positive effects of video-game play on the subjective well-being of the elderly (Jung, Koay, Ng, Wong, & Lee, 2009; Shubert, 2010; Theng, Chua, & Pham, 2012). The potential of video-game play as a new context of intergenerational leisure activity is worth exploring. However, most intergenerational game studies have been concerned with game-design elements (Khoo, Merritt, & Cheok, 2009; Mahmud, Mubin, Shahid, & Martens, 2010) or the impact of such video games in family contexts (e.g., Aarsand, 2007; Voida & Greenberg, 2011). There have been relatively few empirical studies that examined the effects of different interaction types including video-game play on changes in intergenerational perceptions among strangers in a field setting.

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Therefore, the purposes of our study are to investigate: (1) the effects of video-game play, as compared to daily routine activities, on intergenerational perceptions when strangers from two age groups (i.e., youth and elderly cohorts) regularly interact with each other; and (2) how different age groups respond to such an intervention program.

In general, the study of intergenerational perceptions has two broad perspectives. Researchers generally approach the issue from the *intergroup* perspective or from the *family* perspective. Williams and Harwood (2004) advocate that the two approaches could be synthesized to each other and explore how intergenerational issues interact across different contexts. As such, we reviewed the literature on the two perspectives in the following sections to provide a better understanding of issues with respect to intergenerational perceptions.

1.1. Intergenerational research: intergroup approach

A significant portion of prior research has tended to take an intergroup perspective to explain negative perceptions and communication between the two age groups (Harwood, Giles, & Ryan, 1995; Willaims & Nussbaum, 2001). For instance, studies in the US have demonstrated that youths view communication with the non-family elderly as less than satisfactory and problematic (Hummert, 2010; Williams & Giles, 1996). Many youths report that they often feel patronized by the elderly who seem overly-nurturing and yet convey unfavourable stereotypes about their age group (Giles & Williams, 1994). In addition, the elderly could be perceived by youths as non-accommodative, authoritarian, dismissive and inattentive to the concerns of others (Coupland, Nussbaum, & Coupland, 1991; Giles et al., 2003). As a result of such negative perceptions, youths are often conversationally avoidant of the elderly (Ryan, Kwong See, Meneer, & Trovato, 1992). At the other end of the age spectrum, many elderly also feel being patronized and prejudiced by ageist sentiments (Giles & Gasiorek, 2010; Giles et al., 2008). This issue of less-than-harmonious intergenerational perceptions is not culturally specific but has been found to be applicable across cultures from the West to the East (Giles et al., 2002; McCann, Ota, Giles, & Caraker, 2003).

Some of the more commonly accepted explanations for the discriminatory and negative perceptions between different age groups are Social Identity Theory (Tajfel, 1978) and Social Dominance Theory (Sidanius & Pratto, 1999). According to these theories, individuals see themselves and those around them as members of different groups. Through comparison of their own group's position in society with that of other groups, individuals attempt to identify a sense of higher status for themselves and their own group. Such an attempt to achieve higher status would often lead to favouritism towards their own group and discrimination against other groups. In the context of intergenerational perceptions, interaction with members from the other age group may make individuals' identification with their own age group highly salient, which results in discrimination against the members of the other age group.

Another explanation is that of stereotype development and activation. As widely accepted, the social world is complex, and individuals form stereotypes of people they come across so as to categorise and organise their social world. Hummert, Garstka, Bonneson, and Strahm (1994) found that the elderly are associated with certain traits and stereotypes. Although these stereotypes could be either positive or negative, any apparent negative trait that the elderly might exhibit could lead to the formation of negative stereotypes. Such negative stereotypes could then lead to problematic communication between the two age groups (Hummert, 1994).

With the potential gulf between the two age groups established, we turn to the theory that guides many studies that focus on bridging of the gulf. Researchers taking on the intergroup approach predominantly used Allport's (1954) contact hypothesis, subsequently developed as the Intergroup Contact Theory by various scholars (Gaertner, Dovidio, & Bachman, 1996; Islam & Hewstone, 1993; Pettigrew, 1998), in order to bridge the apparent gulf between the youth and elderly groups. According to Intergroup Contact Theory, individuals belonging to one group could change their perceptions towards individuals in the other group when certain situational factors such as equal status, common goals, intergroup cooperation and support from authorities are met (see Allport, 1954 for details). Researchers who address developments to the theory propose that the change will also be affected by individual's intrinsic factors such as experiences and personality characteristics. This theory has been applied in many studies that explored attitudes towards different prejudices such ethnicity, homosexuality, disabled persons and also the elderly (Pettigrew, 1998). In the comprehensive review of studies that applied contact hypothesis, Pettigrew (1998) identified an important dimension of time and stages for attitude changes. As members of two different groups interact, the first stage involves the reduction of anxiety. Over time, prolonged interaction may then lead to "liking without generalisation" (Pettigrew, 1998; p. 77) as interactants dissociate the individual from the stereotypical group. Lastly, it may progress to "reduced prejudice with generalisation" (p. 77) as interactants focus more on the similarities between the individual and the group.

In summary, perceptual changes between different groups are not assured by mere contact or interactions but depend on a series of factors, while such possible changes in perceptions are not instantaneous but are expected to develop progressively over time from the specific individual to the general group.

1.2. Intergenerational research: family approach

Within the family context, studies examining the relationship between the two age cohorts mainly focus on the grandparent–grandchild relationship and have investigated the multiple roles that family members from each age cohort play (Broderick, 1993). For example, the grandparent could play the role of a caregiver, a friend or even a parent-like-figure, depending on various factors such as different life values and living arrangements. The roles that a grandparent and grandchild could take on are also fluid as families are not static but could change overtime. Recent studies have suggested that the grandparent role could provide positive connotations associated with old age and mitigate the general negative stereotypes associated with old age (Harwood & Lin, 2000). It has also been found that the level of contact with grandparents could moderate perceptions about older adults among youths (Harwood, Hewstone, Paolini, & Voci, 2005).

In addition to studies on grandparent–grandchild relationship, research on family communication has examined the effects of joint participation in leisure activities on relationship satisfaction and bonding. The positive impact of leisure activities in relationship building has been well-documented in the contexts of peer and family relationships (Orthner & Mancini, 1990; Zabriskie & McCormick, 2003). For example, Zabriskie and McCormick (2003) found that participation in various types of leisure activities influence the perception of family satisfaction differently for different age groups. The authors suggest that adults (i.e., parents) tend to be more satisfied with family life when they are more involved in "balance" activities that are less commonly done and provide novelty to life while youths appear to be influenced by "core" activities done on a regular basis, easily accessible and providing stability in life.

1.3. Video games and intergenerational issues

There are many studies that focus on bridging relationships between the two age groups based on both the intergroup and family communication perspectives (Aday, Sims, & Evan, 1991a, 1991b; Chapman & Neal, 1990). Many of these studies were examined within an educational context with older adults visiting or mentoring school-going youths on a regular basis, or vice versa with school-going youths visiting institutions for the elderly. With the advent of technology, the use of digital technology, such as video games, as a new context to bridge such gulf has been gaining attention recently. In fact, a recent study by Voida and Greenberg (2011) described their observation of intergenerational video-game play in the family context qualitatively. They reported that the context of video-game play allows players to share experiences and take on different roles flexibly, and thus provides developmental benefits for both generations.

In addition, there has been growing interests within the computing community in the design and development of video games for intergenerational play in recent years. Various researchers (Khoo et al., 2009; Mahmud et al., 2010) have designed and prototyped video games that are meant to be played by the two different age groups. However, in spite of growing interests and attention paid in this area, few studies have directly investigated whether playing video games together with members from different age groups is beneficial for developing positive intergenerational perceptions. Importantly, Flora and Segrin (1998) had found that activities allowing more opportunities to exhibit social skills and interactions result in higher relationship satisfaction while video games as a facilitator for social interaction is still debatable. Therefore, in order to address the gap in the current literature, we aim to investigate the effectiveness of video-game play, as compared to daily routine activities, on intergenerational perceptions when strangers from youth and elderly cohorts regularly interact together. The context of video-game play can naturally provide situational factors for positive changes in intergenerational perceptions, suggested by Intergroup Contact Theory and research on shared leisure activities: Video-game play allows players help each other to achieve simple common goals and equal status from taking on different roles flexibly, relatively easily compared to traditionally used daily activities for intergenerational bonding (e.g., watching television programmes, chitchatting, or playing card games). Trepte, Reinecke, and Juechems (2012) and Huvila, Ek, and Widén-Wulff (2010) found that co-gaming can be a source of social capital and beneficial for social support. Aarsand (2007) too argues that the video game could be a resource for both generations to "enter and sustain participation in activities" (p. 251), thereby allowing sustained social interactions.

To summarise, studies have demonstrated that less-than-harmonious intergenerational perceptions are pervasive, which can be improved via continued positive contacts such as shared leisure activities. Based on our literature review, sustained positive interactions can improve general perceptions of dissimilar groups. Thus, we propose the following hypotheses with respect to the effects of video-game play on inter-generational perceptions:

H1. Participants will show a more positive change in intergroup anxiety (i.e., less anxiety) towards the other age group in general when the youth and elderly participant play video games together, compared to when they interact via daily routine activities.

H2. Participants will show a more positive change in attitudes towards the other age group in general when the youth and elderly participant play video games together, compared to when they interact via daily routine activities.

According to Pettigrew (1998), changes in intergenerational perceptions may take two steps: from (1) perceptions towards particular interactants to (2) perceptions towards general members of the other age groups. Hence, we propose the following hypotheses to examine the each of the two steps:

H3. Participants will show a more positive change in attraction towards their particular interaction partner who belongs to the other age group when the youth and elderly participant play video games together, compared to when they interact via daily routine activities.

H4. Attraction towards the particular interaction partner will mediate the effects of interaction on intergroup anxiety and attitudes towards the other age group in general.

We also see that there is potential for video games as a novel enjoyable leisure activity that may stimulate positive perceptions towards the members of the other age group. However, there have not been enough quantitative studies exploring the effects of video games as a facilitator for social interaction. This lead to our research question:

RQ. What is the role of game enjoyment on intergenerational perceptions when the youth and elderly participants play video games together?

2. Methods

2.1. Participants

A 2 (interaction types: video-game play vs. nonvideo-game play) × 2 (changes over time: pre-test vs. post-test) mixed factorial analysis of variance design with interaction as a between-subject factor and changes as a within subject factor was used to test the hypotheses in a field setting. A total of 53 elderly participants with an average age of 76 were initially recruited from two senior-activity centres located within residential estates in Singapore (see Table 1 for their demographics). Senior-activity centres are common in Singapore and provide a convenient meeting point for the elderly in a residential estate to socialise. Many of the elderly members in these centres belong to the lower socio-economic status group and typically live alone or with other elderly people in government rental apartments. The centres arrange regular activities such as karaoke sessions, handicraft lessons or bingo games to facilitate socialization. These social interactions for the elderly members are usually confined to within their own age groups with only a few youths visiting these centres from time to time. The elderly participants received supermarket shopping vouchers of S$30 (about US$25) at the end of the study as a token for participation. A corresponding 53 volunteer youth participants, with an average age of 17, were recruited from two junior colleges and a polytechnic. The youth participants received credits from their

Table 1
Demographics of participants.

	Video game		Nonvideo game	
	The youth	The elderly	The youth	The elderly
Male	7	1	5	3
Female	12	18	13	15
Age range, mean and SD	16–18	60–86	16–19	60–89
	M = 16.74	M = 75.42	M = 17.67	M = 76.50
	SD = 0.65	SD = 8.15	SD = 0.84	SD = 7.33
Total number	19	19	18	18

schools for their participation as a form of community service activity. Youth participants had the option of participating in other forms of community service should they be unwilling to participate in the study.

We randomly assigned 25 pairs with each pair consisting of one youth and one elderly participant to the video-game condition, while 28 pairs to the non-video-game condition. The pairs of one condition did not know about the other condition throughout the study in order to prevent any data contamination. At the end of six interaction sessions over two months, 19 pairs remained in the video-game condition, and 18 pairs in the non-video-game condition. Dropouts mainly came from the youth participants due to their lack of spare time or changes in school commitments. Some elderly participants also discontinued participation because of hospitalisation or family commitments. Similar to reports in other elderly gaming studies (Mahmud et al., 2010; Voida & Greenberg, 2011), there were more female elderly participants than male elderly participants.

Although the elderly participants were more comfortable with various Chinese dialects, such as Teochew, Hokkien or Cantonese, they were also conversant in basic Mandarin. This is typical of most elderly folks in Singapore as public mass education was only implemented about two generations ago. Many elderly people thus did not attend formal schools or received limited years of education in schools that did not have a common language of instruction or syllabus. The briefing and surveys for the elderly, as well as gaming sessions, were conducted mostly in Mandarin with the presence of research assistants who were fluent in Chinese dialects and helped translate whenever needed across both game and non-game conditions.

2.2. Procedure

After briefing and gaining consent from all participants, participants completed a pre-survey. Then, participants were paired based on the match of their schedules. The interaction sessions were scheduled once a week over two months. Each interaction session lasted about 30 min. Once paired, the two participants remained in the pair for all six interaction sessions. At the end of the sixth session, the participants were asked to complete the same survey for pre and post comparisons.

For the video-game condition, we selected Nintendo Wii game titles since previous studies suggest that game titles that require only simple repetitive actions are of a better fit for the elderly (De Schutter, 2011; Voida & Greenberg, 2011). Specifically, the game titles included "Wii Sports," "Cooking Mama," and "Wii Party" and consisted of many mini games that were short and mostly just required simple, uni-directional control. These are selected as they have low learning curves and could be picked up quickly within the limited duration of each session. We acknowledge that different types and genres of games may appeal to different people and thus offered options to the participants rather than dictating an exact title. After completing the pre-survey, each pair then proceeded to play games on the Wii console for about 30 min. For every pair, we suggested that they would start off with the bowling game within "Wii Sports" as it does not require many buttons to play, allows players to play at their own pace and most elderly could pick it up easily. This also allows the elderly to familiarise themselves at a comfortable pace with video game play and the game controller.

Instead of playing video games, the participants in the non-video-game condition were simply asked to interact with each other at the senior centres for the same amount of time. The activities were not prescribed but suggested based on routines of intergenerational activities at the centres such as co-watching television programmes, chitchatting, playing card games or making handicrafts. In sum, the youth participants were asked to join in the daily activities that the elderly participants might possibly be doing at the centres.

2.3. Measures

Changes in intergenerational perception were measured with three different concepts commonly used in intergroup research. One of such concepts is *Intergroup anxiety* (Stephan & Stephan, 1985). It was measured by asking participants to indicate how they would feel if they were in a room filled with the members of the other age group and were the only person belonging to their own age group. Participants were asked to respond to the five items of *awkward, confident, self-conscious, relaxed and happy* on a five-point Likert scale. Higher scores indicated less intergroup anxiety (the reliability alpha was .79 for the pre-test and .77 for the post-test).

General attitudes towards the other age group were measured by 10 pairs of bipolar adjectives on a five-point Likert scale adopted from Hawkins' study (1996) on students' attitudes towards elderly persons. The 10 item-pairs included "foolish-wise", "boring-interesting", "inactive-active." Higher scores indicated more positive attitudes towards the other age group (the reliability alpha was .83 for the pre-test and .91 for the post-test).

Interpersonal attraction was measured using the social dimension of attraction scale described in McCroskey, McCroskey, and Richmond (2006). We adopted 12 Likert-type items on a five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5); for example: "I think he/she could be a friend of mine" and "He/she is easy to get along with." Higher scores indicated greater interpersonal attraction towards their interaction partner (the reliability alpha was .88 for the pre-test and .88 for the post-test).

Game enjoyment only from the video-game play condition was measured by eight Likert-type items on a five-point scale, adopted from Ryan, Mims, and Koestner (1983); for example: "I enjoyed playing the game very much" and "I thought the game was boring". Higher scores indicated greater game enjoyment (the reliability alpha was .94 for the pre-test and .92 for the post-test).

3. Results

Table 2 shows a full correlation matrix, means, and standard deviations of the measured variables. We used a 2×2 mixed factorial ANOVA to test the first three hypotheses (H1, H2, H3) regarding video-game play. The mediation analysis was conducted to test H4 regarding the mediation effect of interpersonal attraction. Finally, the correlation analysis and post hoc analysis were used to answer the research question.

3.1. Intergroup anxiety

Consistent with H1, there was a significant positive change in intergroup anxiety between pre-test ($M = 3.30$, $SD = 0.88$) and post-test ($M = 3.54$, $SD = 0.70$), $F(1,72) = 9.98$, $p < .01$, $\eta^2 = .12$. In

Table 2
Mean, standard deviation, and correlation matrix of the measured variables from the post-survey.

Measured variables	*M*	*SD*	1	2	3	4
1. Attraction	4.03	0.47	–	.45**	.52**	.34*
2. Intergroup anxiety	3.54	0.70		–	.49**	.32*
3. Attitudes	3.87	0.58			–	.03
4. Game Enjoyment	3.97	0.62				–

All the variables are measured using a five-point scale.
* $p < .05$, two-tailed.
** $p < .01$, two-tailed.

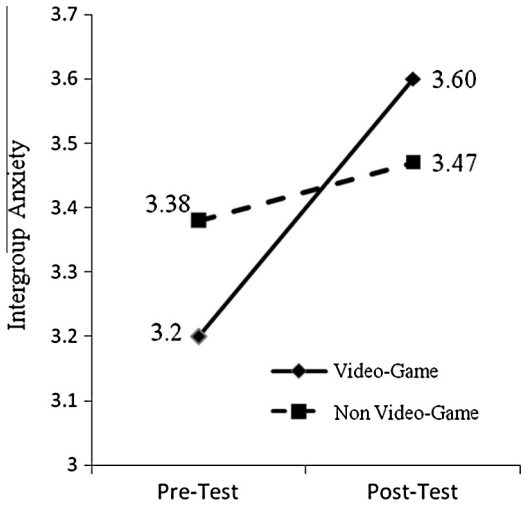

Fig. 1. Intergroup anxiety as a function of interaction types and changes over time. *Note*: Higher scores in intergroup anxiety indicate less anxiety towards the members of the other age group in general.

general, participants felt less anxiety towards the members of the other age group over two months. In addition, such a change was mainly driven by participants in the video-game play condition ($M_{difference}$ = 0.4), not by participants in the nonvideo-game play condition ($M_{difference}$ = 0.09), $F(1,72) = 4.04$, $p < .05$, $\eta^2 = .05$ (see Fig. 1 for the interaction effect). Thus, H1 was supported.

3.2. General attitudes towards the other age group

The results showed that a significant positive change in attitudes between pre-test ($M = 3.54$, $SD = 0.60$) and post-test ($M = 3.87$, $SD = 0.58$), $F(1,72) = 33.59$, $p < .01$, $\eta^2 = .32$. Similar to the results about intergroup anxiety, the pattern of a significant interaction effect showed that such a change was mainly driven by participants in the video-game play condition (mean difference = 0.52), not by participants in the nonvideo-game play condition (mean difference = 0.13), $F(1,72) = 11.56$, $p < .01$, $\eta^2 = .14$ (see Fig. 2). Thus, H2 was also supported.

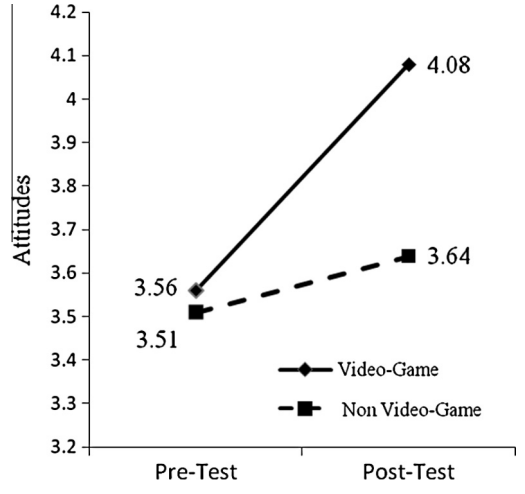

Fig. 2. Attitudes as a function of interaction types and changes over time. *Note*: Higher scores in attitudes indicate more positive attitudes towards the members of the other age group in general.

3.3. Attraction towards the Interaction partner

With respect to interpersonal attraction, participants in the video-game play condition showed greater attraction towards their interaction partner ($M = 4.08$, $SD = 0.50$) than participants in the nonvideo-game condition ($M = 3.82$, $SD = 0.41$), $F(1,72) = 7.29$, $p < .01$, $\eta^2 = .09$. There was also a significant positive change in attraction between pre-test ($M = 3.87$, $SD = 0.48$) and post-test ($M = 4.03$, $SD = 0.47$), $F(1,72) = 12.18$, $p < .01$, $\eta^2 = .15$. However, there was no significant interaction between interaction types and changes over time, $F(1,72) = 0.51$, *n.s.* Taken together, participants in the video-game condition did not show a more positive change in attraction than participants in the nonvideo-game condition although participants in both conditions showed greater attraction towards their interaction partner over two months. Thus, H3 was not supported.

3.4. Mediation effects of attraction

The measures from the post-test were used for the mediation analysis. The results of bootstrapping (Preacher & Hayes, 2004) showed the significant mediation effect of attraction on intergroup anxiety (95% confidence interval [*CI*], −0.38 to −0.06) and attitudes (95% confidence interval [*CI*], −0.33 to −0.06). The results of the Sobel test also confirmed the significant mediation effects of attraction on intergroup anxiety ($z = -2.35$, $p < .05$) and attitudes ($z = -2.36$, $p < .05$). Thus, H4 was supported. The interaction types, together with the mediating variable of attraction, accounted for 20% of variation for intergroup anxiety ($R^2 = .20$), 32% of variation in attitudes ($R^2 = .32$).

3.5. Post-hoc analysis: game enjoyment and comparisons between the elderly and youth groups

In order to provide a clearer understanding of the positive effects of video-game play on intergenerational perception, we conducted a post hoc analysis that examined the relationships between game enjoyment and the other three perception variables. Only participants from the video-game condition were included in this analysis. The results of zero-order correlation showed a significant association of game enjoyment with attraction and intergroup anxiety (see Table 2). Participants who enjoyed playing video-games tended to develop greater attraction towards their game partner from the other age group and feel less anxiety about being together with the members of the other age group. It is interesting to note that the associations were significant only for the elderly participants, not for the youth participants although there was no significant difference between the two age groups in terms of game enjoyment ($M = 3.98$, $SD = 0.59$; $M = 3.97$, $SD = 0.66$, respectively).

In addition to game enjoyment, there were some differing patterns of results between the elderly and youth participants (see Tables 3 and 4 for the comparison of complete results between the two groups). The elderly participants showed more positive general perceptions towards the youth participants. Specifically, the elderly participants showed less intergroup anxiety ($M = 3.92$, $SD = 0.80$) and more positive attitudes ($M = 4.30$, $SD = 0.43$) towards the members of the other age group than the youth participants ($M = 3.28$, $SD = 0.74$; $M = 3.87$, $SD = 0.76$, respectively), $F(1,70) = 13.89$, $p < .01$, $\eta^2 = .17$; $F(1,70) = 19.52$, $p < .01$, $\eta^2 = .22$, respectively. Another interesting observation is that the youth participants reported a more significant change in their attitudes ($M_{difference}$ = 0.68) than the elderly participants ($M_{difference}$ = 0.37), $F(1,70) = 8.25$, $p < .01$, $\eta^2 = .10$.

Table 3
ANOVA results from the elderly participants ($n = 37$).

Dependent variables	Means and standard deviations				*F* values and effect sizes		
	Video game		Nonvideo game		Main effects		Interaction
	Pre-test	Post-test	Pre-test	Post-test	Interaction types (I)	Pre/post difference (D)	I × D
Attraction	4.01 (0.45)	4.21 (0.39)	3.87 (0.27)	3.98 (0.16)	4.07 $\eta^2 = .10^{*}$	6.46 $\eta^2 = .16^{*}$	0.44 $\eta^2 = .01$
Intergroup anxiety	3.40 (1.18)	3.92 (0.80)	3.74 (0.64)	3.76 (0.40)	0.15 $\eta^2 = .00$	4.90 $\eta^2 = .12^{*}$	4.48 $\eta^2 = .11^{**}$
Attitudes	3.93 (0.65)	4.30 (0.46)	3.77 (0.31)	3.74 (0.31)	6.86 $\eta^2 = .16^{*}$	7.86 $\eta^2 = .18^{**}$	10.01 $\eta^2 = .22^{**}$

* $p < .05$, two-tailed.
** $p < .01$, two-tailed.

Table 4
ANOVA results from youth participants ($n = 37$).

Dependent variables	Means and standard deviations				*F* values and effect sizes		
	Video game		Nonvideo game		Main effects		Interaction
	Pre-test	Post-test	Pre-test	Post-test	Interaction types (I)	Pre/post difference (D)	I × D
Attraction	3.94 (0.57)	4.14 (0.59)	3.64 (0.51)	3.79 (0.52)	3.91 $\eta^2 = .10^{*}$	5.58 $\eta^2 = .14^{*}$	0.13 $\eta^2 = .00$
Intergroup anxiety	3.0 (0.61)	3.28 (0.74)	3.02 (0.81)	3.19 (0.49)	0.03 $\eta^2 = .00$	5.15 $\eta^2 = .13^{*}$	0.35 $\eta^2 = .01$
Attitudes	3.19 (0.48)	3.87 (0.76)	3.25 (0.53)	3.54 (0.44)	0.65 $\eta^2 = .02$	29.19** $\eta^2 = .46$	4.55 $\eta^2 = .12^{*}$

* $p < .05$, two-tailed.
** $p < .01$, two-tailed.

4. Discussion

In general, the results imply that video games can be an effective facilitator to enhance intergenerational perceptions when members from different age groups are paired to play video games together as a novel leisure activity, as compared to daily routine activities used to facilitate intergenerational bonding. We will discuss the implication of our results in the following subsections in order from a particular perception to general perceptions and comparisons between youths and the elderly.

4.1. Video games and attraction towards the particular interaction partner

The result showed that all participants reported greater attraction towards their interaction partner over time, regardless of their interaction types. Although participants who played video games together did not show changes in attraction to a greater degree, compared to participants who did daily routine activities, this result is in line with Pettigrew's Intergroup Contact Theory. The pairs of one youth and one elderly participant regularly spent time together by engaging in shared activities in either the video-game and non-video-game conditions over two months. During the regular contact hours, the pairs of strangers from different age groups would have been able to understand each other better, which resulted in greater attraction towards their interaction partners at the end of the program. The elderly participants were mostly retirees staying alone or with other elderly people. Given the routine of their daily lives, the six sessions of visits by their youth partners over two months might be an anomaly. Unless the interactions were not cordial, such a spike in contact hours would likely lead to some positive changes in perceptions, at least towards the particular interaction partner. In a similar vein, the youth participants would have restricted interactions with the elderly mostly to their own grandparents. Even if interactions at the senior-activity centres were mundane everyday activities, the interactions were still longer and deeper than what the youth participants are used to be exposed to.

To summarise, our findings imply that increased contact hours via shared activities are likely to help the members of different age groups develop particular perceptions such as attraction towards their interaction partners positively even when such shared activities are mundane. In this regard, it is important to provide as many opportunities as possible for different age groups to engage in various shared activities together on a regular basis.

4.2. Video games, general attitudes and intergroup anxiety

The results also showed that the positive changes over time in general perceptions such as attitudes and intergroup anxiety were reported by participants only in the video-game condition (see Figs. 1 and 2). These findings imply that when members from different age groups are paired to play video games together, they tend to develop not only positive perceptions towards their particular play partners, but also positive general perceptions towards the members of the other age group as spill-over effects. This two-step process of changes in general perceptions was confirmed with the significant result of the mediation analysis in that attraction was a significant mediating factor for the effects of video-game play on general attitudes and intergroup anxiety. These findings also support Pettigrew's (1998) notion that liking without generalisation would be required before changes in perceptions towards the general out-group.

It is interesting to note that participants in the non-video-game condition did not show any significant changes in both attitudes and intergroup anxiety in spite that they reported greater attraction towards their interaction partner. The important difference between attraction and the other two intergenerational perceptions of attitudes and intergroup anxiety is the object of these perceptions: a particular individual of the other age group vs. general members of the other age group. Taken together, the findings imply that daily routine activities can be effective to enhance perceptions towards particular interactants via increased contact hours and forms of shared activities. Nevertheless, such particular perceptions enhanced by daily routine activities may not be strong enough to lead to positive changes in general perceptions towards the other age group.

One plausible explanation for the stronger effects of video-game play on general perceptions is its novelty. For example, playing video games is not commonly seen as a regular activity for the elderly. By situating the interaction that portrays the elderly as readily accepting new digital technology, it can help break down

negative stereotypes that the youth may have of the elderly (c.f., Diffusion of Innovations by Rogers, 1995). Such a pleasant expectancy violation can have a strong impact on general perceptions towards the other age group. In fact, the results of our post hoc analyses showed that the youth participants reported a significantly greater degree of changes in their attitudes, as compared to the elderly participants. On the other hand, the elderly participants probably received much help from their youth partner to play video games since video-game play was new to most of them. As the elderly participants started to enjoy video games via cooperation (i.e., help) with the youth partner, they were likely to develop attraction towards the youth partner, which, in turn, might have resulted in more positive attitudes and less anxiety in general by learning that interacting with youths could be enjoyable and entertaining.

Playing video games can provide the context for common goals and intergroup cooperation that are key factors for successful intergroup interactions (see Sherif, Harvey, White, Hood, & Sherif, 1961) since video games usually set ready and instantaneous goals for the players. Coupled with the fact that the goals and needs for cooperation are situated in a leisure context, the stakes may not be high and both age groups could easily work towards common goals together. In social interactions involving the elderly and youths, social norms dictate that the elderly be given more respect and a higher status due to experience and age (Sung, 2001). However, the context of video games introduces a natural status within the games - that of an expert and novice. Youths can take the role of experts in playing video games, and this change of status in the context of video games may be accepted well without much resistance for both age groups. The mutual respect from the two age groups could allow them to interact with each other on more negotiated or balanced ways. As such, the context of video games could provide essential situational factors, as stipulated by intergroup contact theory, such as common goals, intergroup cooperation, as well as equal status for developing positive intergenerational perceptions.

4.3. Video games, balance and core leisure activities

The results showed that the more participants enjoyed video games, the greater attraction and less intergroup anxiety they reported. Although we did not examine the effects of video-game contents on intergenerational perceptions, this finding suggests that the contents of video games may also influence the quality of contact. Since some games may be unsuitable and too difficult for the elderly, we carefully selected commercially available video-game titles suitable for the elderly, but not necessarily designed to facilitate intergenerational interactions. We mediated the issue of game suitability by offering a small range of games that are easier to pick up but acknowledge that understanding the specific game elements that could better facilitate social interactions would be beneficial. As such, it would be interesting to investigate how different types of video games (e.g., genres: music games or exercise games; characteristics: competition or cooperation) can influence individual's game experiences and perceptions towards the game partner for future research.

Another interesting result with respect to game enjoyment is that its significant association with attraction and intergroup anxiety was found only among the elderly participants. In a similar vein, we found dissimilarities between the two age groups in terms of their general intergenerational perceptions. That is, the elderly participants showed more positive attitudes and less anxiety towards the youth. A plausible explanation for the dissimilarities between the two age groups is the typology of the balance and core activities (Zabriskie & McCormick, 2003). While it may appear that the context of playing video games could potentially be conducive for interactions as a form of shared leisure activity, the perception towards video-games as a form of leisure may not be the same for the two age groups. Youths may take to it with ease and see it as a form of "core" leisure activity since many of them play video games on a regular basis. On the other hand, the elderly may see it differently as "balance" leisure activity since it is a novel activity to them. Differences on how they view the leisure activity might impact on how they perceive the interaction and, in turn, the perceptions of the other age group influenced by the leisure activity.

In other words, the elderly participants probably considered video games as the balance activity since video-game play was likely to be less common and novel for them. As a result, the elderly participants might be satisfied with their experience with the balance activity of video-game play. On the other hand, video-game play, although may appear as a core activity for youths, may not be viewed as so by the young participants since it is played in an unfamiliar context. For the youths, these sessions may come across stronger as ad hoc community service since there were no expectations of sustained participation. Since Zabriskie and McCormick (2003) suggest that core activities focusing on stability tend to influence relationship perceptions of youths more strongly than balance activities, playing video games over a longer period of time may have a different impact on youths. More research on video-game play with respect to the length of the play is needed to provide a clearer understanding for this matter.

4.4. Limitations and future research

There are a few limitations in our study. First of all, we should be cautious not to over-generalise our findings from a relatively small sample size. In addition, there were some drop-outs during the field experiment. Although reported as changes in school commitments, there could be different reasons that may contribute to self-selection bias (e.g. those people who felt comfortable interacting with members from the other age group participated in our study). However, since we randomly assigned participants to the video-game and non-video-game conditions and compared pre- and post- results, there is no reason to suspect that self-selection bias influenced participants only in the video-game condition. As reported in Section 2.1, there were more female than male elderly participants. Although we cannot rule out the possibility of gender effect, we believe this would not affect the result significantly since the gender difference was not due to a disproportionate dropout of male participants but a lack of male volunteers from the beginning, which also reflects the male/female ratio in the elderly population. In addition, the low number of male participants was across conditions. To put together, we were able to set up the direction of causality in examining the effectiveness of video-game play on intergenerational perceptions via a carefully designed field experiment in spite of its trade-off in generalisability. We believe that our study is a good start point to investigate cost-effective tools, including video games that can facilitate positive changes in intergenerational perceptions and calls in more research in various contexts and cultures.

Secondly, we cannot fully eliminate the possibility that the significant changes in intergenerational perceptions could be exaggerated due to the Hawthorne effect (see Adair, 1984). The youth and elderly participants were probably aware of attention and monitoring from researchers although we did our best to have them exposed to a natural interaction program. Such awareness could have made them put more effort in interactions and resulted in more significant changes. However, the relatively less significant positive changes in the non-video-game condition at least validate the greater effectiveness of video-games over other daily routine activities on intergenerational perceptions as both groups received the same amount of attention during the intervention program. We

suggest that future research addresses this issue further with more natural settings and a longer time frame.

5. Conclusion

Our results support the potential of video-game play in developing positive intergenerational perceptions as a means of shared leisure activities when individuals from different age groups are paired to interact together. Although the selected video-game titles are not purposefully created for such an intergenerational context, the video-game titles served their purpose well for intergenerational perceptions. Going forward, it will be interesting to investigate whether video games specifically designed to facilitate intergenerational interactions could result in synergetic effects on positive intergenerational perceptions. Various genres of video games may be able to satisfy both youths and the elderly with different needs for shared activities.

It is important to note that we are not championing video games for intergenerational relationship. We took video-game play as a form of shared leisure activities in which individuals from different age groups can potentially engage in without much resistance. Barker, Giles, and Harwood (2004) stated that people communicating with older people would be able to improve their everyday communications by adjusting their responses to be contextually fitting. In line with the statement, we support the potential of video games in creating conducive contexts for the two different age groups. Shared activities among youths and the elderly can be deployed effectively for positive changes in their intergenerational perceptions. Furthermore, if those activities are novel and enjoyable, they are likely to perform better as socializing agents. We believe that this study sheds lights on the existing body of knowledge regarding the bridging of the intergenerational gap by empirically demonstrating that video-game play could be conducive for both youths and the elderly in fostering positive intergenerational perceptions towards each other.

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