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Title

Measuring the Capacity of Active Video Games for Social Interaction: The Social Interaction Potential Assessment Tool

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Abstract

Active Video Games (AVGs) have been designed and promoted for family centred leisure in the home. However, few studies have investigated their capacity to facilitate psychosocial outcomes. This study aimed to establish a reliable system to rate the potential of AVGs to facilitate social interaction among players. A conceptual framework was developed to establish the core elements of the Social Interaction Potential Assessment Tool (SIPA). Four raters implemented the SIPA across five AVGs. ANOVAs were conducted to establish the ability of the SIPA to differentiate between AVGs and inter- and intra-rater reliability was tested. The overall SIPA could differentiate between AVGs social features. A significant difference was found for Social Facilitators and Pro-social Features, but not for Anti-social Features ($p < 0.05$). The overall SIPA exhibited excellent inter-rater (ICC = 0.92) and intra-rater (ICCs = 0.95 - 0.99) reliability. This study identified the core elements of AVGs that enable social interaction. The SIPA tool can assess AVGs' potential to facilitate social interaction among players. Subsequently, the SIPA rating can provide consumers with valuable information on which to base AVG purchasing decisions.

Keywords

Introduction

Electronic game use in children has been associated with obesity, poorer psychosocial health, less sleep time and musculo-skeletal injury (Foti, Eaton, Lowry, & McKnight-Ely, 2011; Straker, Abbott, Collins, & Campbell, 2014; Yang, Helgason, Sigfusdottir, & Kristjansson, 2013). Active video games (AVGs) that require body movement to control the game have developed into a separate genre of in-home gaming with potential to address some of the health concerns attributed to sedentary gaming. Laboratory studies show AVGs can increase energy expenditure and improve vascular function compared to sedentary gaming (Graves, Stratton, Ridgers, & Cable, 2008; Lanningham-Foster et al., 2009; Mills et al., 2013). There is also evidence that AVGs, when played at home, can positively impact on the physical health of children by increasing physical activity and reducing obesity, at least in the short term (Maitland, Stratton, Foster, Braham, & Rosenberg, 2013).

There is considerable evidence for negative psychosocial effects on children as a result of playing violent video games (Anderson et al., 2010; Greitemeyer & Mügge, 2014). Conversely, video games can provide opportunities for positive social interactions with other players, through team formation and in-game collaboration. These pro-social behavioural interactions are associated with pro-social outcomes (Greitemeyer & Mügge, 2014). Video games that encourage positive social interaction among players are beneficial to children's social skills development and overall socialisation (Boyle, Connolly, & Hainey, 2011; Inal & Cagiltay, 2007; Lieberman, 2006; Straker et al., 2014). Both parents and children report that video games can promote family social relationships, facilitate shared conversations and activities, and teach social skills such as collaboration and turn taking (De Vet, Simons, & Wesselman, 2012; Kutner, Olson, Warner, & Hertzog, 2008; Olson, 2010; Ulicsak & Cranmer, 2010). However, not all video games have pro-social capabilities and they may displace other leisure activities. Theoretically, this reduces social interaction and negatively affects the development of children's social skills (Plowman, McPake, & Stephen, 2010). Evidence suggests that parents are concerned by this (De Vet et al., 2012; Kutner et al., 2008). It is unclear whether video games that promote positive social interaction outweigh the negative aspects of more violent video games (Greitemeyer & Mügge, 2014).

AVGs are designed and promoted as a family centred leisure activity for communal use in the family home (Chambers, 2011). AVGs are a popular electronic gaming choice for families as

they create opportunities for social interaction with family and friends (De Vet et al., 2012). This is possibly due to AVGs shared similarities with traditional physical and recreational activities that are typically associated with developing friendship and team building (Mueller, Gibbs, & Vetere, 2009). Social interaction and game engagement has been shown to be greater among participants who played video games that required natural movement as opposed to the same game played with a traditional hand-held controller (Lindley, Le Couteur, & Berthouze, 2008). Furthermore, AVGs can facilitate social play even in networked or online environments (Mueller et al., 2009). Parents wish to gain more information about video games, including social interaction capabilities, before making a purchase (De Vet et al., 2012; Ulicsak & Cranmer, 2010). There is no published tool that assesses the social features of AVGs despite the rapidly rising number of games and gaming platforms available to consumers in this gaming genre.

Current government legislated rating systems classify video games based on age appropriateness (Australian Government, 2011; The Video Standards Council, n.d.). The Australian Classification Guidelines are designed to prevent children's exposure to violence and adult themes and as such rate movies and video games on the following criteria: themes, violence, sex, language, drug use and nudity (Australian Government, 2011). The current government rating systems are not tailored to AVGs and do not assess the positive outcomes of video games like social interaction. Presently, consumers are reliant on game makers to provide information on the features of game content and to make this available on game packaging and websites. However, video game information is limited due to lack of standardised guidelines on the assessment and provision of this information. In the absence of a specific and adequate video game rating system, this study aimed to develop a systematic process for rating the potential of AVGs to facilitate social interaction among children players and, to evaluate the reliability of a social interaction rating scale named, The Social Interaction Potential Assessment (SIPA).

Methods

This study comprised of two phases. Firstly, in the absence of any reference standard, the development of a conceptual framework for establishing the construct validity of the SIPA

tool constructs was undertaken. Secondly, reliability testing of the SIPA across five AVGs was performed.

The Development of a Conceptual Framework for the SIPA Tool

Conceptual models and research reports that included psychosocial constructs thought to contribute to social interaction during electronic gaming were sought within empirical literature. The evidence was reviewed for suitability and constructs subsequently selected for inclusion in the SIPA tool. A best available evidence approach was used so that results of all relevant AVG studies were included in the first instance. As there were few gaming studies that examined social interaction within AVGs specifically, these results were supplemented by those from studies of non-AVGs. For example, we found only one AVG study that examined social interaction between players online in different locations. Therefore, studies investigating the role of online features in facilitating social interaction during electronic gaming more broadly were also reviewed. Finally, the SIPA tool comprised of three overarching constructs namely Social Facilitators, Pro-social Features and Anti-social Features (see Figure 1).

Figure 1. Conceptual Framework of The Social Interaction Potential Assessment Tool for Active Video Games (SIPA)

Review of Existing Gaming Frameworks. Existing electronic gaming frameworks have identified social interaction as a crucial factor in enjoyment, motivation to play and game design. The Mechanics, Dynamics and Aesthetics (MDA) framework for game design proposed that electronic games had eight potential roles including sensation, fantasy, narrative, challenge, discovery, expression, submission and fellowship, with the game providing a social framework for players (Hunicke, LeBlanc, & Zubek, 2004). The Gameflow model of enjoyment for real time strategy games also included social interaction as one of eight contributing elements (Sweetser & Wyeth, 2005). Specifically, games were judged on how well they supported and created opportunities for social interaction through competition and cooperation and team play, chat functions, multiplayer modes, online services, options to create and share game content and communities in and outside of the

game (Fu, Su, & Yu, 2009; Sweetser, Johnson, & Wyeth, 2012; Sweetser & Wyeth, 2005). Similarly, Yee (2006) identified social factors to motivate online game play including casual chat, helping others and making friends; relationships including disclosure and support; and teamwork through collaboration, group play and group achievements (Yee, 2006). To design playful learning based electronic games, Hong et al. (2009) outlined six principles, including creating opportunities for collaboration and competition, with subsequent social interaction an important element in enjoyment (Hong et al., 2009). Heeter (2009) proposed that different players were motivated by different features of electronic game play and presented player types along two axis, pro-social / anti-social and intrinsic / extrinsic achievement orientation, within a palette of play styles and learning (Heeter, 2009).

Facilitators of Social Interaction and Game Play.

Multiplayer Options in the Same Physical Location. Social interaction in electronic gaming is contingent on the number of people who are participating, or are present during play (Stenros, Paavilainen, & Mayra, 2009). In AVGs the number of players listed on the packaging commonly refers to the number of people that can play the game together in the same physical location. Single player electronic games generally do not provide for direct communication between people, while games that allow multiple players in the same location promote simulated and natural social interactions (Zagal, Nussbaum, & Rosas, 2000). Participation in multiplayer games can occur concurrently whereby players participate simultaneously, or synchronously where players take turns to participate (Zagal et al., 2000), and even single player games can offer the possibility of non-simultaneous play (Stenros et al., 2009). Two or more players provides opportunities for different social interactions around competition, cooperation and collaboration. However, larger numbers of players in the same location can initiate negative social interactions within and around the game, detracting from the social experience (Stenros et al., 2009). Multiplayer options, different types of participation and the resultant social interaction between players, are all facilitated by the elements and rules within each electronic game (Zagal et al., 2000).

Online Capacity. In addition to social interaction within the immediate physical setting, AVGs can offer opportunities to play with others via the internet (Biddiss & Irwin, 2010). This is often referred to as 'online multiplayer' or 'networked multiplayer' on AVG packaging. Mueller et al. (2009) found that adult players in a networked table tennis game

exhibited multiple types of social interaction with players in another physical location across the course of play (Mueller et al., 2009). While most studies of AVGs have focused on locally based group play, creating social bonds and making friends with geographically remote peers are major motivations for participation in multiplayer online games (Przybylski, Rigby, & Ryan, 2010; Yee, 2006) and there is evidence of the importance of online features in facilitating these types of social interactions in electronic gaming more generally (Lazzaro, 2004; Sweetser et al., 2012). Even single player games can include some form of social interaction via internet sharing features such as highest scores, social media posts and achievement downloads (Stenros et al., 2009).

Enjoyment and Maintenance of Play. Review level evidence shows that group AVG play is likely to encourage social interaction and thereby assist to maintain participation in AVG play (Barnett, Cerin, & Baranowski, 2011; Biddiss & Irwin, 2010). In experimental studies of children playing Dance Dance Revolution, those in multiplayer groups recorded more play time and less drop out that those playing alone (Chinapaw, Jacobs, Vaessen, Titze, & van Mechelen, 2008), and those participating with parents, siblings and friends were more likely to sustain participation (Paez, Maloney, Kelsey, Wiesen, & Rosenberg, 2009). Additionally, teens participating in an AVG intervention indicated that playing with friends and receiving support from peers and family helped to maintain participation (Madsen, Yen, Wlasiuk, Newman, & Lustig, 2007). Furthermore, for electronic games, group play has been found to be more emotional, exciting and fun than playing alone as players enjoy interacting with others, watching others play and talking about the game (Ballard, Visser, & Jocoy, 2012; Lazzaro, 2004).

Pro-social Features. *Cooperation and Competition.* Several gaming frameworks assert that cooperation, competition and team play stimulate social interaction and motivation to play electronic games (Heeter, 2009; Sweetser & Wyeth, 2005). Studies demonstrate that game play experience can be enhanced by cooperation and competition that promotes social interaction and enjoyment (Adachi, Hodson, Willoughby, Blank, & Ha, 2016; Ballard et al., 2012; Lazzaro, 2004; Staiano, Abraham, & Calvert, 2013). Furthermore, playing cooperatively as part of a team may negate the anti-social effects of violent video games (Greitemeyer, Traut-Mattausch, & Osswald, 2012). Playing competitively has been identified as a strong motivation for playing video games, especially for boys (Olson, 2010) and a facilitator of maintenance of AVG play (Madsen et al., 2007). Although, competitive

games can increase aggression in both the short (Adachi & Willoughby, 2011) and long term (Adachi & Willoughby, 2016). Both cooperation and competition can be incorporated into the same game through the inclusion of rules and features to promote or inhibit these (Zagal et al., 2000).

Altruism. Playing games with pro-social elements can have pro-social effects, such as increasing cooperation and helping behaviours, and can be negatively related to anti-social effects, although this has been investigated by very few studies (Greitemeyer & Mügge, 2014). Children exposed to pro-social video games scored more highly on helping behaviours, cooperation and sharing, and empathy; and were less likely to be hostile and approve of aggression, with effects remaining over one month (Gentile et al., 2009). These findings are applicable across different ages and socioeconomic groups (Harrington & O'Connell, 2016). Adults who played a video game requiring them to exhibit altruistic behaviours through saving lives and rescuing people were more likely to exhibit empathy in a subsequent task, compared to those who had played a neutral game (Greitemeyer, 2010).

Anti-social Features. *Violence.* Anti-social players like to frustrate and harm others, with the most common anti-social feature of video games involving intentionally harming a character in game play to progress in the game (Heeter, 2009). A review of the effects of violent video games concluded that there is strong evidence to suggest that playing these games can lead to increased aggression, and decreased empathy and pro-social behaviour (Adachi & Willoughby, 2016; Anderson et al., 2010; Greitemeyer & Mügge, 2014). However, the negative effects of video games are not universally supported as the theories relating violent video games to aggression have been criticised for being too simplistic and not accounting for other influences in the 'real world' environment (Ballard et al., 2012; Ferguson & Kilburn, 2010).

Bullying and Stereotypes. Other anti-social features found in electronic games, include sexual and racial stereotypical characters, and bullying where players purposefully undermine a partner or opponent from progressing in a game (Heeter, 2009). While commonly featured within violent video games, sabotage is possible in many multiplayer games. In sports games, for example, anti-social behaviour may include scoring an own goal, undermining other players' scoring opportunities or performing poorly. Analysis of characters in games has found females are underrepresented and more likely to be portrayed with revealing

clothing and unrealistic body shapes (Downs & Smith, 2010; Gabbiadini, Riva, Andrighetto, Volpato, & Bushman, 2016; Mou & Peng, 2009). Similar analysis of race representation found minority groups were also underrepresented (Burgess, Dill, Stermer, Burgess, & Brown, 2011; Mou & Peng, 2009). Studies on the portrayal of villains and aggression show mixed results, with one study finding non-white males were more likely to be portrayed as aggressive (Burgess et al., 2011) and another finding no difference (Mou & Peng, 2009).

SIPA Tool Development

The SIPA tool was based on three core conceptual framework constructs of social interaction: Social Facilitators, Pro-social Features and Anti-social Features. Social Facilitators were measured via the following elements: multiplayer options (the number of players the AVG was designed to engage and the game play format); online capacity (online gaming features); and enjoyment (as rated by 10-15 year olds). Pro-social Features were assessed against criteria describing game play elements capturing: cooperative play (features that necessitate, encourage and allow cooperation); competitive play (features that necessitate, encourage and allow competition); and altruism (requirements to help others to achieve). Anti-social Features were measured by: violence (type and targets of violence, and weapons used); bullying (verbal and physical) and stereotypes (racial and sexual). While maintenance of play was identified as a Social Facilitator in the conceptual framework, this element could not be assessed within the SIPA tool.

The three core constructs and their elements were allocated a weighted score based on the strength and direction of the relationship to evaluate social interaction (Table 1). For each element, individual item scores were allocated a weighted score that was matched to the answer levels. For example, since the evidence on the relationship between electronic games with cooperative play elements and social interaction was positive and comparatively strong, the element of cooperative play was allocated 10 points (maximum score) within the Pro-social Features construct. The two items within the cooperative play element were allocated a score of six and four to reflect their relative importance for facilitating cooperative play. The first item assessing the number of games within the exer-game that could be played cooperatively had four ordinal response options so the answer levels were allocated zero (no games), two (~25% of games), four (~50% of games) or six (~75% of games or more) points.

This iterative process of allocated weighted scores continued across the other two constructs (Social Facilitators and Anti-social Features) and their inherent elements.

To ensure content validity, the refinement of the SIPA tool items and scoring process included reviews by research staff, an external expert on child development and a paediatric exercise scientist with expertise in active video gaming. Subsequently, the SIPA tool was pilot tested on two occasions across three AVGs, with feedback from raters used to enhance the final SIPA tool (see Tables 1, 2 and 3).

Table 1

The SIPA Tool: Social Facilitators constructs and elements, with corresponding items, response options and scores

Questions	Answer Levels	Score
Multiplayer		**0-10**
How many players is the exer-game designed for overall?	1; 2 ; 3; 4 or more	0-2
How many games and mini-games within the exer-game are designed for at least two players?	None; Some; All or almost all	0-2
How many games and mini-games within the exer-game are designed for at least four players?	None; Some; All or almost all	0-2
If 2 players were playing this exer-game, would they play the games and mini-games together, at the same time or by taking turns?	Always at the same time; Always by taking turns; Sometimes at the same time and sometimes by taking turns; The game isn't designed for two players but they could alternate playing the game; Two players would not play this exer-game	0-2
If 4 players were playing this exer-game, would they play together, at the same time or separately by taking turns?	As above	0-2
Online Capacity		**0-5**
Is it possible to play cooperatively with other online players?	Yes/No	0-1
Is it possible to play competitively against other online players?	Yes/No	0-1
Is there potential to select or restrict online players to play with or against?	Yes/No	0-1
Is voice chat or communication with the other online players possible?	Yes/No	0-1

Can the game results and/or pictures be uploaded and shared online?	Yes/No	0-1
Enjoyment (Child)		**0-5**
Please rate how you feel at the moment about the physical activity you have been doing …		
a) I enjoy it … I hate it;	Rate 1-7	
b) I dislike it … I like it	Rate 1-7	
c) It's no fun at all … It's a lot of fun	Rate 1-7	
d) I feel good physically while doing it … I feel bad physically while doing it	Rate 1-7	
e) I am very frustrated by it ... I am not at all frustrated by it	Rate 1-7	[a] 0-5
TOTAL SOCIAL FACILITATORS		**0-20**

[a] Score /35 reduced

Table 2

The SIPA Tool: Pro-social Features constructs and elements, with corresponding items, response options and scores.

Questions	Answer Levels	Score
Cooperation		**0-10**
How many games and mini-games within the exer-game can be played with another player cooperatively?	None; ~25% ; ~50%; ~ 75% or more	0-6
For games and mini-games that can be played cooperatively…		0-4
a) are the cooperating players shown on the screen at the same time?	Never; Sometimes; Always or almost always	
b) do the teams progress to higher levels or gain achievements?	Never; Sometimes; Always or almost always	
c) is there social interaction between cooperating player characters or avatars?	Never; Sometimes; Always or almost always	
d) are the team scores (or times) displayed while playing the games and mini-games?	Never; Sometimes; Always or almost always	
e) are team scores (or times) shown at the end of the games and mini-games?	Never; Sometimes; Always or almost always	
f) are the all-time highest team scores (or best times) shown at the end of the games and mini-games?	Never; Sometimes; Always or almost always	
Competition		**0-6**
How many games and mini-games within the exer-game can be played competitively i.e. competing against another player to win?	None; ~25% ; ~50%; ~ 75% or more	0-4
For games and mini-games that can be played competitively…		0-2

a) are the competing players shown on the screen at the same time?	Never; Sometimes; Always or almost always
b) do the competing players progress to higher levels or gain achievements?	Never; Sometimes; Always or almost always
c) is there social interaction between competing player characters or avatars?	Never; Sometimes; Always or almost always
d) are the competing player scores (or times) displayed while playing the games and mini-games?	Never; Sometimes; Always or almost always
e) are the competing player scores (or times) shown at the end of the games and mini-games?	Never; Sometimes; Always or almost always
f) are the all-time highest player scores (or best times) shown at the end of the games and mini-games?	Never; Sometimes; Always or almost always

		Score
Altruism		**0-4**
Do the games and mini-games…		0-4
a) require players to help other player characters or avatars to be able to progress to higher levels or gain achievements?	Never; Sometimes; Always or almost always	
b) require players to help other non-player characters to be able to progress to higher levels or gain achievements?	Never; Sometimes; Always or almost always	
TOTAL PRO-SOCIAL FEATURES		**0-20**

Table 3

The SIPA Tool: Anti-social Features constructs and elements, with corresponding items, response options and scores.

Questions	Answer Levels	Score
Violence		**0-10**
What level of violence occurs during the exer-game?	None; Low; Medium; High	0-4
During the exer-game, do the player characters or avatars in the game enact violence towards any of the following characters? … a) Humans in a Sports Context; b) Humans outside of a Sports Context; c) Animals; d) Mythical/Fantasy Creatures; e) Buildings/Property	No -violence is not depicted; Yes - violence is depicted; If violence depicted … ▪ including realistic blood and/or injury; ▪ including realistic death; ▪ rewarded or required to progress in the game (for each)	[a] 0-4.5
During the exer-game do the player avatars in the game use any of the following as weapons of violence? … a) Guns; b) Knives c) Transportation; d) Humans body; e) Makeshift weapons; f) Explosives	Yes/No (for each)	0-1.5
Bullying and Stereotypes		**0-5**
During the exer-game …		0-3

a) do the player characters or avatars physically bully other avatars or characters?	Yes/No	
b) do the player characters or avatars verbally bully other avatars or characters?	Yes/No	
c) do the non-player characters in the game bully other avatars or characters?	Yes/No	
Does the exer-game …		0-2
a) reinforce any racial stereotypes?	Yes/No	
b) reinforce any sexual stereotypes?	Yes/No	
TOTAL ANTI-SOCIAL FEATURES		**0-15**

[a] Summed to max. of 4.5

AVG Rating Procedure

Four research staff assessed and rated five Xbox 360 Kinect AVGs for social interaction potential. Games were selected to provide a variety of game play experiences and included Kinect Rush, Kinect Sports Season 2, Just Dance 2014, Sonic Free Riders, and Carnival Games in Action. Each rater assessed five games during one day then repeated the assessment process 14 days later. The order of games was counterbalanced so that each rater commenced the testing session with a different AVG. Assessments were completed between December 2013 and February 2014.

Assessments were conducted at the University of Western Australia - Active Video Gaming Laboratory. The laboratory resembled a home environment with a 92cm high definition television, Microsoft Xbox 360 Kinect, television cabinet, rug and couch. Each rater was teamed with a post-graduate student "partner" to play the AVG during the assessment process. This allowed the rater to experience the multiple player components of the AVG and assess the social aspects of each AVG. Written instructions were provided to each rater prior to the first assessment day outlining the assessment protocol and the role of the assessor and partner. Raters were provided with five SIPA tools plus individual game assessment forms to record notes about the games within each AVG. Two Xbox Live online profiles were created to access online features.

The assessment protocol required the rater and partner to play each AVG for 75 minutes in order. The time allocation was determined from the pilot testing phase to allow enough time for the rater to experience a range of game components. At the end of the game play period,

the rater explored the online features of the game, reviewed the AVG cover for additional information from the manufacturer and completed the SIPA.

Enjoyment was measured as part of a larger AVG study. Children aged 10 to 15 years (n = 22, 39, 55, 22, 55 for games 1 to 5 respectively) played each AVG for 15 minutes and then rated their enjoyment of the game on the PACES Physical Activity Enjoyment Score (Kendzierski & DeCarlo, 1991) modified for active video gaming (Graves et al., 2010).

Analysis

Item scores were summed to provide element, construct and overall SIPA scores. For enjoyment, PACES scores (out of 35) were averaged across children and converted to a score out of five. Anti-social Features scores were reversed so that games with less violence scored higher. One-way repeated measures ANOVA using the Greenhouse-Geisser correction were conducted on all element, construct and overall SIPA scores (except for enjoyment) to compare differences between games. A one-way ANOVA was used to compare differences in enjoyment between games. To provide each AVG with final element, construct and overall SIPA scores, the four rater scores at Time 1 were averaged.

Both inter-rater and intra-rater reliability were assessed using intraclass correlation coefficients (ICC). A consistency type two-way random effects model was used to determine inter-rater reliability, and a consistency type one-way random effects model was selected for intra-rater reliability (Hallgren, 2012). Average measures ICCs with 95% confidence intervals were reported. ICCs were rated using cut-off points with <.40 being poor, .40 to .59 being fair, .60 to .74 being good, and .75 to 1.0 being excellent (Cicchetti, 1994). Significance level was set at $p < 0.05$ for all analyses. Data were analysed using SPSS Statistics Version 19.

Results

Descriptive Statistics and Between Game Differences

The overall SIPA scores for the five AVGs ranged from an average of 22.57 (*SD* = 1.02) / 50 for Carnival Games in Action to 34.81 (*SD* = 0.80) / 50 for Kinect Sports Season 2 (Table 4). The Social Facilitators construct ranged from an average of 7.82 (*SD* = 0.29) / 20 (Carnival Games in Action) to 14.72 (*SD* = 0.48) / 20 (Kinect Sports Season 2) with higher scores

driven by offering an online gaming option. Kinect Rush scored the highest for Pro-social Features ($M = 14.34$, $SD = 2.09$ / 20), differentiated by its altruistic features. Carnival Games in Action also scored the lowest in Pro-social Features ($M=5.50$, $SD = 0.20$ / 20). Just Dance did not exhibit and Anti-social Features, and no games scored less than $M = 7.81$ ($SD = 1.55$) / 10 in this category.

ANOVA results determined that the mean element, construct and overall SIPA scores differed statistically ($p < 0.05$) between AVGs for all scores except the element of violence ($p = 0.18$) (Table 5).

Table 4
Overall SIPA scores for Active Video Games tested

SIPA Constructs and Elements	Game 1 - _Kinect Rush_ [a]_M(SD)_	Game 2 - _Kinect Sports Season 2_ [a]_M (SD)_	Game 3 - _Just Dance 2014_ [a]_M (SD)_	Game 4 - _Sonic Free Riders_ [a]_M (SD)_	Game 5 - _Carnival Games in Action_ [a]_M (SD)_
SOCIAL FACILITATORS					
Multiplayer / 10	5.13 (0.25)	7.38 (0.63)	9.63 (0.48)	7.50 (1.08)	4.75 (0.29)
Online / 5	0.00 (0.00)	3.50 (0.58)	3.00 (0.82)	4.00 (0.82)	0.00 (0.00)
Children's Enjoyment / 5	4.07 (0.67)	3.84 (0.75)	2.85 (0.36)	3.23 (0.97)	3.07 (0.37)
Total Social Facilitators / 20	9.20 (0.25)	14.72 (0.48)	14.47 (0.75)	14.73 (1.68)	7.82 (0.29)
PRO-SOCIAL FEATURES					
Cooperation / 10	9.44 (0.55)	5.06 (0.69)	3.63 (2.68)	6.06 (1.80)	0.00 (0.00)
Competition / 6	0.91 (1.81)	5.34 (0.19)	5.50 (0.37)	4.38 (1.79)	5.50 (0.20)
Altruism / 4	4.00 (0.00)	0.75 (0.50)	0.00 (0.00)	0.25 (0.50)	0.00 (0.00)
Total Pro-social Features /20	14.34 (2.09)	11.16 (1.07)	9.13 (2.84)	10.69 (2.05)	5.50 (0.20)
ANTI-SOCIAL FEATURES					
Violence / 10	8.06 (1.75)	8.94 (0.77)	10.00 (0.00)	7.81 (1.55)	9.25 (0.96)
[b]Bullying and Stereotypes / 5	Removed	Removed	Removed	Removed	Removed
Total Anti-social Features / 10	8.06 (1.75)	8.94 (0.77)	10.00 (0.00)	7.81 (1.55)	9.25 (0.96)
OVERALL SIPA SCORE / 50	**31.60 (3.42)**	**34.81 (0.80)**	**34.60 (3.50)**	**32.73 (4.23)**	**22.57 (1.02)**

[a] Mean (Standard Deviation) of 4 rater scores at Time 1
[b] Bullying and Stereotypes category removed from SIPA after reliability testing, leaving violence as sole measure of Anti-social Features

Table 5

ANOVA table for Active Video Games testing showing mean differences in SIPA scores

SIPA Constructs and Elements	[b]df	F	p
Multiplayer	1.26, 3.77	33.97	*0.005*
Online	1.54, 4.62	46.60	*0.001*
Enjoyment	4, 191	[a]27.32	*0.000*
Total Social Facilitators	1.52, 4.56	61.94	*0.001*
Cooperation	1.28, 3.84	35.76	*0.004*
Competition	1.04, 3.13	9.90	*0.048*
Altruism	1.98, 5.95	126.82	*0.000*
Total Pro-social Features	2.32, 6.97	16.76	*0.002*
Total Anti-social Features	1.30, 3.90	2.71	0.181
OVERALL SIPA SCORE	1.78, 5.33	12.63	*0.010*

Significant p values italicised (p < 0.05); [a] One-way repeated measures ANOVA used for all scores except Enjoyment where one-way ANOVA was used; [b] Greenhouse-Geisser correction used for all scores except Enjoyment

SIPA Reliability

Inter-rater reliability for Social Facilitators (multiplayer options, online capacity) and Pro-social Features (cooperative play, competitive play, altruism) were excellent (ICCs = 0.90 to 0.99). In contrast, Anti-social Feature measures performed poorly with violence, and bullying and stereotypes, recording non-significant ICCs of 0.63 and -0.30 respectively (Table 6).

Intra-rater reliability, for the constructs of Social Facilitators and Pro-social Features and their elements, were also excellent (ICCs = 0.90 to 1.00). The only exceptions were rater 4's online capacity element and rater 1's competitive play element. For violence, ICCs were either good or excellent (ICCs = 0.55 to 0.85) but did not reach statistical significance.

Bullying and stereotypes elements showed mixed reliability and limited variance in answers. Therefore, the element of bullying and stereotypes was removed from the final overall SIPA, leaving violence as the sole indicator of Anti-social Features. The overall SIPA score

displayed excellent inter-rater reliability (ICC = 0.92, 95% CI [0.67, 0.99]) and intra-rater

reliability among all raters (ICCs = 0.95 to 0.99).

Table 6

Inter-rater (Time 1) and Intra-rater (Time 1 and Time 2) reliability statistics for the elements,
constructs and overall SIPA score

SIPA Constructs and Elements	Possible Score	Inter-rater Reliability [a] ICC (95% CI)	Intra-rater Reliability [a] ICC (95% CI)
Multiplayer	10	*0.97 (0.88, 1.00)*	*R1: 0.99 (0.89, 1.00)*
			R2: 1.00 (0.98, 1.00)
			R3: 0.98 (0.83, 1.00)
			R4: 0.98 (0.83, 1.00)
Online	5	*0.98 (0.91, 1.00)*	*R1: 0.92 (0.39, 0.99)*
			R2: 0.95 (0.61, 0.99)
			R3: 1.00 (1.00, 1.00)
			R4: 0.74 (-0.96, 0.97)
Children's Enjoyment	5	*NA*	NA
Total Social Facilitators	**20**	*0.98 (0.93, 1.00)*	*R1: 0.97 (0.81, 1.00)*
			R2: 0.98 (0.87, 1.00)
			R3: 0.99 (0.96, 1.00)
			R4: 0.91 (0.31, 0.99)
Cooperation	10	*0.97 (0.89, 1.00)*	*R1: 0.90 (0.18, 0.99)*
			R2: 0.96 (0.73, 1.00)
			R3: 0.98 (0.84, 1.00)
			R4: 0.99 (0.96, 1.00)
Competition	6	*0.90 (0.58, 0.99)*	R1: 0.42 (-3.32, 0.94)
			R2: 1.00 (0.99, 1.00)
			R3: 1.00 (0.98, 1.00)
			R4: 1.00 (0.99, 1.00)
Altruism	4	*0.99 (0.97, 1.00)*	*R1: 0.97 (0.74, 1.00)*
			R2: 0.98 (0.88, 1.00)
			R3: 1.00 (1.00, 1.00)
			R4: 0.98 (0.86, 1.00)
Total Pro-social Features	**20**	*0.94 (0.75, 0.99)*	*R1: 0.90 (0.25, 0.99)*
			R2: 0.95 (0.66, 1.00)
			R3: 0.97 (0.75, 1.00)
			R4: 0.98 (0.82, 1.00)
Violence	10	0.63 (-0.52, 0.96)	R1: 0.85 (-0.13, 0.98)
			R2: 0.55 (-2.33, 0.95)
			R3: 0.83 (-0.24, 0.98)
			R4: 0.79 (-0.58, 0.98)
[b] Bullying & Stereotypes	5	-0.30 (-4.37, 0.85)	*R1:1.00 (1.00, 1.00)*
			R2: No variance
			R3: 0.43 (-3.22, 0.94)
			R4: -0.25 (-8.24, 0.87)
Total Anti-social Features	**10**	0.63 (-0.52, 0.96)	R1: 0.85 (-0.13, 0.98)

			R2: 0.55 (-2.33, 0.95)
			R3: 0.83 (-0.24, 0.98)
			R4: 0.79 (-0.58, 0.98)
			R1: 0.95 (0.66, 1.00)
			R2: 0.96 (0.73, 1.00)
			R3: 0.99 (0.92, 1.00)
Overall SIPA Score	**50**	*0.92 (0.67, 0.99)*	*R4: 0.96 (0.70, 1.00)*

ICCs with significant p values italicised ($p < 0.05$); [a] Intra-class Correlation Coefficients (ICC) and 95% Confidence Intervals; [b] Removed from Anti-social Features and Overall SIPA

Discussion

This study aimed to develop a valid and reliable method of evaluating the potential of active video games to facilitate social interaction among players. The study is the first to identify the core elements that enable social interaction in AVGs and capture these elements in a coherent conceptual framework. The resultant SIPA tool proved to be reliable in assessing features of AVGs that facilitate social interaction during game play. Inter- and intra-rater reliability ICCs were excellent for the overall SIPA score and constructs of Social Facilitators and Pro-social Features. However, Anti-social Features were less reliable both, within and across raters. Previous studies focused on classifying anti-social features of video games, including violence, racial and sexual stereotyping, and profanity, through content analyses (Haninger & Thompson, 2004; Ivory, Williams, Martins, & Consalvo, 2009; Smith, Lachlan, & Tamborini, 2003). No systematic analyses of social interaction potential could be found for AVGs nor was there any comprehensive evaluation of psycho-social constructs like social facilitators or pro-social features. The SIPA tool was also able to successfully discriminate between the social interaction potential of the five AVGs assessed in this study to demonstrate this form of construct validity in the absence of any reference or gold standard criterion. Overall, the SIPA tool appears to offer a relatively rapid and reliable measure of AVG social interaction potential.

The SIPA was constructed to provide both, an overall assessment of social interaction potential of AVGs, and information about individual constructs. While the overall SIPA scores from four of the five AVGs tested were similar, the constructs and elements showed greater variation. Some parents view certain elements of games such as violence and online play, as more tolerable than other parents (De Vet et al., 2012; Kutner et al., 2008), and these

views may be influenced by the age of the child (Nikken, Jansz, & Schouwstra, 2007). Therefore, despite limited variation in the overall SIPA score, for consumers the construct and element scores are a valuable aspect of the SIPA as they distinguish between elements that may be more individually relevant depending on family structure and personal views.

AVGs rarely comprise of a single situation or game play scenario. To retain player interest, games frequently have complex stories, different game play levels and mini-games within the one AVG. Some games, like Kinect Sports Season 2 and Carnival Games in Action, have an overall theme while comprising multiple sub-games that are independent of each other. In rating AVGs for their social interaction potential, we only allowed 75 minutes to rate each of the five games in this study as pilot testing indicated this was enough time to experience a wide range of sub-games within each AVG. The excellent reliability results both within and between raters for pro-social features, and multiplayer and online capacity, suggest that the AVGs tested in this study had relatively consistent requirements across sub-games in terms of these options. The study findings were consistent across all four raters and suggest that potential social interaction can be evaluated by assessing the entire game or a sample of sub-games.

The Anti-social Features of violence, bullying and stereotypes were less reliable with the latter category being removed from the final SIPA tool due to poor reliability. This inconsistency for both inter- and intra-rater reliability may indicate less regularity in the portrayal of, or the requirements for violence within the AVGs tested. Alternatively, there may be a difference in rater perceptions of what constitutes violence. This notion is supported by another study which found ratings of violence in video games, varied with age, gender and parental status (Funk, Flores, Buchman, & Germann, 1999). Additionally, four of the tested games in this study were rated G (General Classification) and scored relatively low on the violence element. Future studies should select AVGs with G, PG and M ratings to provide greater variation for testing the reliability of anti-social features.

Considerations for Future Use

Electronic gaming literature indicates that online features can support social interaction although how this may occur or how it can be assessed in AVGs is poorly understood. Given online features are present in many AVGs, and online gaming has the capacity to provide both positive or negative social affects (Sublette & Mullan, 2012), the online capacity

element was included in the SIPA. As children and young people spend more time indoors (Karsten, 2005), online capacity may be an increasingly important facilitator of social interaction, particularly for those children whose mobility is constricted by parental fears for safety or family circumstances (Barnett et al., 2011; Foster, Villanueva, Wood, Christian, & Giles-Corti, 2014), or impaired due to mental health conditions (Wilkinson, Ang, & Goh, 2008) or physical disabilities (Johnson & Klaas, 2007). The Xbox 360 Kinect system used in this study has built-in parent controls that can restrict online features and limit play with unknown players. Ideally, the SIPA should only assess AVGs for game consoles that include adequate parental controls or it should include the capacity to measure these online control features. This is so to maximise the potentially positive and minimise the potentially negative consequences of online gaming.

Raters also had difficulty in assessing whether games had the capacity to facilitate play with/or against others online. While several of the games indicated online play was available, raters found that other online players were not always available. This may have been because some of the games tested were older or not as popular compared to other games. While this could be overcome by coordinating play with friends, it may have detracted from the assessment of the online capacity to facilitate social interaction.

Limitations and Research Directions

There were several limitations to this study. Games were selected to provide a range of game play experiences (sport, dance, adventure, racing and games). However, a larger number and wider variety of games may have provided greater variation in the overall SIPA scores and potentially more robust results. For example, all games tested were rated either G or PG and as such mostly contained low levels of violence. Also, while high ICC results showed adequate confidence intervals, a larger sample size would have increased the statistical power of the study for lower ICCs. The raters who conducted the SIPA were all female and gender differences have been found in preferences for types of electronic gaming, with mothers preferring AVGs, educational and music games and fathers preferring fighting and strategy games (Ulicsak & Cranmer, 2010). Additionally, individual factors, including gender and age, may also influence perceptions of what constitutes violence, competition and other constructs.

Two Xbox Live online profiles were created for this study and used by each rater and partner to assess online capacity of the AVGs. By using the same two profiles throughout the testing, new game content was unlocked more quickly than it otherwise would have been. This was chosen to reflect how the game may be played over a longer period of time at home. However, it may have had implications for the content played by each rater. For example, Pixar Rush contained three levels within each of the five sub-games. The second and third levels were only unlocked after successfully completing level one and therefore raters commenced the sub-games at different levels with potentially different game characteristics on offer.

Much of the evidence drawn upon for this study comes from the larger body of electronic gaming research. Generally, there is a lack of research into the mechanics of AVGs that may contribute to enjoyment, extended play time and health benefits (Mellecker & McManus, 2013). Further research is required to determine the social benefits of playing AVGs and whether these benefits differ from other electronic games; how social interaction may vary depending on who the game is played with, where players are located (together at home vs online in multiple locations) or who is watching (Mueller et al., 2009); and how much and what type of social interaction is required for positive social outcomes. Future iterations of the SIPA should look to draw upon AVG specific evidence as it becomes available. Also worthy of further investigation is the potential for interaction between violence, collaboration and competition, to determine whether the potentially negative effects of violent video games may be abated by opportunities for positive social interactions.

Conclusion

The conceptual framework and resultant SIPA tool represent a significant development in the assessment of the positive social interaction potential of AVGs. Overall the SIPA tool exhibited good inter- and intra-rater reliability. The SIPA tool can also differentiate between the overall social interaction potential, social facilitators and pro-social features of AVGs, based on the sample of games tested. This SIPA study is the first to rate the pro-social features and the overall potential of AVGs to facilitate social interaction. When used to systematically assess AVGs, it may be able to provide parents with valuable information on which to base purchasing decisions. However, the SIPA only assesses potential to facilitate

positive social interaction. Children still require other people to play AVGs with, and parents may play a particularly important role in guiding the social interactions experienced during game play into meaningful social skill development.

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Highlights

- A framework for the social interaction potential of active video games is presented
- The SIPA tool can differentiate between games by social interaction potential
- The SIPA tool exhibits excellent inter- and intra-rater reliability
- The rating provides valuable information for consumers making purchasing decisions

Conceptual Framework for AVG Features that Enable Social Interaction

Social Facilitators	Pro-Social Features	Anti-Social Features
Multiplayer Options	Cooperative Play	Violence
Online Capacity	Competitive Play	Bullying
Enjoyment	Altruism	Stereotypes
Maintenance of Play		