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Attachment, attraction and communication in real and virtual worlds: A study of Massively Multiplayer Online gamers.

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Abstract

Potential differences between relationships formed in online versus offline venues were explored using an online survey of massively multiplayer online gamers. Participants (N=1654) provided information about two or more relationships (kin, friends, and romantic relationships), indicating whether these had originated in online or offline venues. Attachment, attraction and communication were assessed for each relationship. Relationship security was predicted by attraction, but the effects of venue were limited to avoidance towards online romantic relationships. Personality, gaming motivation, age and sex all made negligible contributions to relationship security. Limitations, including the correlational nature of the data and the high proportion of male participants, as well as suggestions for how relationship research might proceed in an increasingly online world, are discussed.

Keywords

Online and offline; Attachment; Attraction; Communication; Relationship

1. Introduction

Of the many factors which affect happiness and wellbeing, the only necessary one appears to be good social relationships with others (Diener & Seligman, 2002). Whether filial, romantic, or affiliative, the relationships we have with others bind us together, providing support (Bifulco, Moran, Ball, & Bernazzani, 2002; Collins & Feeney, 2004; Mallinckrodt & Wei, 2005), shared experiences (Marvin, Cooper, Hoffman, & Powell, 2002), and a sense of belonging (Baumeister & Leary, 1995; Pistle, 1989).

While the study of relationships has typically focussed on people who meet and relate to one another 'in the flesh', the increasingly connected nature of the world means that many relationships are formed and maintained online. Indeed, one third of US marriages now commence there (Cacioppo, Cacioppo, Gonzaga, Ogburn, & VanderWeele, 2013). This proliferation of online relationships has both positive and negative consequences. On the positive side, geographically separated family and friends may, if able to access the internet, communicate cheaply and effectively in a variety of venues (email, VOIP, social media). In addition, the number of internet users provides unprecedented access to others, meaning the most unusual interests are likely to find an online home. On the negative side, the anonymity of much online communication makes establishing trust problematic and open to exploitation (Tang et al., 2012), suggesting online and offline relationships may differ in important ways. For instance, while estimates of the number of Facebook friends a person has varies, most put this at more than the 'Dunbar number' (Dunbar, 2010) of around 150 sustainable relationships. This suggests that online relationships might be more superficial than offline ones, providing less closeness and support, and indeed some have suggested that larger social networks may act as triggers for mild depression (Blease, 2015). It should be noted, however, that other data suggest that users of other social media (notably Twitter) graduate towards social networks of 100-200 (Gonçalves, Perra, & Vespignani, 2011), suggesting that online relationships may in fact facilitate the maintenance of optimal interconnectedness. While debates will continue about whether social media are a positive or negative force overall, it is becoming clear that specific effects are contingent upon personality characteristics as well as online-offline contexts/venues (Hu, Kim, Siwek, & Wilder, 2017).

Understanding the similarities and differences between online and offline relationships is of great importance for both relationship researchers and a broader understanding of relationships in an increasingly online world. Our interest in the question of how relationships might differ in terms of their venue of origin originates from two simple questions. First, are relationships with people who meet in physical venues different from those that are

formed in virtual ones, and second, in the context of other relationship-relevant variables, how well does venue of meeting predict relationship security?

1.1 Attachment theory and relationships

Attachment theory is one of a small number of theoretical frameworks in psychology that is cast within the grand theory model and also widely accepted and empirically productive (Waters, Corcoran, & Anafarta, 2005). In its original conceptualisation, attachment theory focused on the protective needs and behaviours of the child as motivated by the desire to seek and maintain proximity to the caregiver (Bowlby, 1969). Contemporary attachment research has adopted the lifespan perspective that Bowlby originally hypothesised, although the focus remains on the mechanisms individuals adopt to manage the conflicting motivations of safety-seeking and exploration though seeking support from others. As such, the insights offered by attachment theory have application to all relationships at all ages. Indeed, the notion of attachment has grown beyond the individual, being applied to groups and institutions (France, Finney, & Swerdzewski, 2010; Smith, Murphy, & Coats, 1999) and places (Lewicka, 2011; Ramkisson, Graham Smith, & Weiler, 2013; Scannell & Gifford, 2010).

1.2 Attachment and the move to the level of representation

As individuals mature and become more autonomous, there is a 'move to the level of representation' in attachment (Main, Kaplan, & Cassidy, 1985), whereby the psychological aspects of relationships come to assume greater importance. Physical proximity is replaced by psychological proximity, in other words, that which is more representational, and much that is central to close relationships starts to be played out cognitively and over wider expanses of time and location (Crowell et al., 2002). This is reflected in adult attachment research where mental representations of relationships become important targets of assessment (Main, 2010). However, context and environment have also long been important to attachment research (Ainsworth, 1969; Main et al., 1985), and moving this level of investigation to online venues may be a useful way of broadening attachment theory. If attachments are considered to 'bridge gaps in space and time' (Ainsworth, 1969, p.2), then research into online venues, where this gap is at its greatest, is key. The ultimate move to the level of representation may therefore be those close relationships formed online.

The empirical study of attachment typically rests upon two dimensions of attachment-related anxiety (AR-anxiety) and attachment-related avoidance (AR-avoidance) (Brennan, Clark, & Shaver, 1998). An individual's attachment to another person can be described in terms of how AR-anxious and how AR-avoidant the

relationship is for them. 'Secure' attachments result from low scores on both dimensions, and have been associated with a number of positive outcomes including physical and psychological health, wellbeing, and adjustment (Baumeister & Leary, 1995). While attachment style does not appear to affect the number of friends one has, it may be related to disclosure and satisfaction, both of which are greater with offline friends (Buote, Wood, & Pratt, 2009). AR-anxious styles are linked to greater levels of interpersonal electronic surveillance (checking on current or ex-partners using social media; Fox & Warber, 2014), and AR-avoidant styles to less surveillance (Marshall, Bejanyan, Di Castro, & Lee, 2013).

There are therefore several reasons to suggest that an attachment framework is useful in understanding relationships formed online. First, the framework is broad, lifespan-relevant, and empirically supported. Second, as relationships become more representational than physical, online venues offer significant opportunities to satisfy social and relational needs. Third, there is evidence that attachment as modelled by the dimensions of anxiety and avoidance affects aspects of online behaviour.

1.3 Other proximity-seeking factors

In addition to the attachment system, two sets of factors play an important role in the maintenance of proximity. Both communication and interpersonal attraction involve either physical and/or psychological proximity seeking; both develop within the context of closeness, and both wane in relationships without proximity. Thus, communication and attraction are two key components of adult close relationships, and the interplay of attachment with these components is important to relationship satisfaction (Collins & Read, 1990; Feeney, 1994; Hazan & Shaver, 1987).

There are a priori reasons to assume that attraction and communication work in different ways for online and offline relationships, as the normal 'gating' function of physical appearance is generally not available (Cooper & Sportolari, 1997; McKenna, Green, & Gleason, 2002). The absence of physical factors such as appearance, body language, gaze, and voice quality has several effects on attraction and communication. Shyness is lessened online (Hammick & Lee, 2014), potentially leading to disinhibition (both positive and negative; Casale, Fiovaranti, & Caplan, 2015; Lapidot-Lefler & Barak, 2015). A collection of self-relevant effects such as esteem, beliefs, and perceived support all appear to be enhanced online (Valkenburg, 2017). However, many studies have observed no differences between online and offline venues, including effects of authenticity (Reinecke & Trepte, 2014), similarity (Rodrigues, Lopes, Alexopoulos, & Goldenberg, 2017), and bullying (Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014).

1.4 A move to online games

Over the past twenty years, use of the internet has become so ubiquitous that internet users are as heterogenous as the general population. Indeed, they are the general population. People use the internet in different ways for different reasons, and capturing this variety in a research context is a significant challenge. Accordingly, it can be useful to limit the population under investigation. To this effect, we focussed our research on people who play Massively Multiplayer Online games (MMOs). A typical MMO involves thousands, perhaps tens or hundreds of thousands of players interacting, and for the purposes of this study, relating, in a perpetual virtual world. MMOs are social environments, and attachment research tells us of the importance of the consistency and responsiveness of the social environment to an individual's attempts to establish security-promoting closeness (Hazan & Shaver, 1987; Main et al., 1985).

In MMOs, players are largely free to do whatever they wish, and encounter various allies, opponents, and challenges which may be determined by the game's designers or by other players. Many of the greatest challenges cannot be overcome by individuals working alone, making cooperation a key mechanic (Barnett & Coulson, 2010). MMOs therefore involve exploration (adventuring, acquiring wealth and prestige, fighting), and safety-seeking (grouping together, spending time in safe areas). As a result, there are many formal and informal means of communication and social organisation, all of which are entirely optional. A player may spend all her time exploring the world, or speaking with other players, or battling against or with them, or any combination of these. Indeed, for MMOs to be commercially viable they need to be able to offer outlets for all the motivations players bring to the game with them.

These motivations can be usefully classified using Yee's three-factor theory of player motivation (Yee, 2006; Yee, Ducheneaut, & Nelson, 2012). Players engage in virtual worlds for *Social* reasons, to *Immerse* themselves in place and narrative, and to *Achieve* power, prestige and notoriety. Any individual brings a mix of these motivations to their gameplay. MMOs permit players to love and hate, make peace or war, cooperate or fight, buy sell and trade, and more or less all the activities of life which do not require the presence of a physical body. Crucially, none of these activities is essential to the enjoyment of the game, and social relationships therefore emerge from activity and immersion in the virtual world rather than being a necessary feature of it. Although MMO players may have been historically perceived as somewhat different or unusual, other than the fact that they play MMOs they are fairly representative of the general population (Possler, Klimmt, Schlütz, & Walkenbach, 2017).

To investigate attachment, attraction and communication in online and offline relationships, we developed an online survey which asked players to report on their own relationships in terms of our primary variables. We were also interested in what players bring to their experiences in terms of personality and motivation. Our main aim was to examine how attachments in relationships which commenced in online and offline venues might differ, with a secondary aim to examine how attraction and communication also differed by venue.

2. Method and Materials

2.1 Participants

1654 participants completed the survey (1399/85% men). Age ranged from 18 to 58 (average 43.9 years; SD, 8.4). Participants were drawn from 69 nationalities, predominantly from the US (814, 49%), Canada (155, 9%) and the UK (143, 9%). They were mainly employed (794, 48%) or students (522, 32%), with the most frequent level of completed education being high school (829, 50%) and bachelor's degree (643, 39%). The total number of individual attempts at the survey was 3486, representing a completion rate of 47%.

2.2 Materials

Participants provided demographic information, and then completed a series of questionnaires outlined below.

2.2.1 Personality

The 10-item personality inventory (TIPI; Gosling, Rentfrow, & Swann, 2003) was used to assess the Big Five personality dimensions (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism). The scale uses a 7-point Likert type scale from disagree strongly to agree strongly (example item, "I see myself as critical, quarrelsome"). Scores on the scale evidence moderate reliability coefficients (0.40 - 0.73), as expected with two items per dimension, but show good test-retest and validity. We had no specific predictions about the effects of personality, but included it as a pervasive characteristic accounting for unique variance in most psychological domains, including the ones of interest here (motivation, Vasalampi et al., (2014); attachment, Young, Simpson, Griskevicius, Huelsnitz, & Fleck, (2017); attraction, Carter, Campbell, & Muncer, (2014); and communication, de Vries, Bakker-Pieper, Konings, & Schouten, (2013)).

2.2.2 Gaming motivation

The 39-item version of the Player Motivation Scale (Yee, 2006) measures three elements of gameplay motivation. *Social* motivation covers reasons such as socializing, generating and maintaining relationships, and playing as part of a group. *Achievement* motivation covers reasons such as character advancement, mastery of game mechanics, and competition with other players. *Immersion* motivation includes discovery, escapism, and personal narratives. The scale uses a 5-point Likert type scale from not at all important to extremely important (example item, "How important is customizing your character to make them look distinctive, stylish, and unique?"). Test scores have good reliability (all coefficients > 0.70), and the three subscales are moderately positively correlated.

2.2.3 General attachment style

The 9-item Relationships Structures questionnaire (ECR-RS; Fraley, Heffernan, Vicary, & Brumbaugh, 2011) measures general AR-anxiety and AR-avoidance. The scale uses a 5-point Likert type scale from strongly disagree to strongly agree (example item "I usually discuss my problems and concerns with others.") Test scores show good reliability ($\geq .85$).

2.3 Specific relationships

Following these questionnaires, participants were asked to provide data on two important relationships in their lives (and were invited to provide data on up to an additional eight if they desired). For each relationship, participants were asked to select whether the relationship was with a parent, a sibling, another family member, a spouse, a partner, or a friend. For each identified relationship, the following variables were measured.

2.3.1 Attachment

The ECR-RS was tailored to each specific relationship. Participants provided a nickname for the relationship (e.g. "Bob") which was used to modify ECR-RS items. For example "I usually discuss my problems and concerns with others" became "I usually discuss my problems and concerns with Bob".

2.3.2 Attraction

The 12-item Interpersonal Attraction Scale (McCroskey, McCroskey, & Richmond, 2006) measures three elements of attraction. *Social* attraction assesses how popular and friendly the person is. *Physical* attraction assesses appearance. *Task* attraction assesses the person's reliability, trustworthiness, and effectiveness at performing tasks. The scale uses a 5-point Likert type scale from strongly disagree to strongly agree (example item, "If I wanted to get things done I could probably depend on him/her.") Test scores

have good reliability (coefficients ranging from .66 to .95 across studies).

2.3.3 Venue and Communication

Participants identified whether the person had originally been met in an online or an offline venue (for kin relationships, information about original meeting was not requested as it was assumed the vast majority had started offline). Additional responses covered how much time participants spent communicating with the other person per week, what proportion of this was online (defined as asynchronous communication such as emails, online messaging systems, social media, and in-game chat), and what proportion of asynchronous communication took place within online games.

2.4 Procedure

An online survey tool (www.qualtrics.com) was used to collect data. Participants were recruited through links on MMO websites, discussion boards and online forums, and provided with a link to the survey where the survey's purpose and ethical approval was outlined. After providing informed consent participants completed the initial demographic measures followed by the TIPI, the Player Motivation Scale, and the ECR-RS. They were then asked to identify at least two and up to ten personal relationships for which they completed the ECR-RS, the Interpersonal Attraction Scale, and the measures of communication. Finally, participants were provided with contact details for the researchers, debriefed, and thanked for their time.

2.5 Statistical analyses

Alpha was set to .05 in all analyses. Post hoc tests used Bonferroni corrections. T-tests and chi-square were used for completer analyses and initial investigation of sex differences. ANOVA was used to compare relationships which commenced in physical and online venues. To predict attachments to others, hierarchical multiple linear regression (hMLR) was used. For the regressions, AR-anxiety and AR-avoidance were regressed separately for each domain of relationship (kin, romantic relationships, friends). Predictor variables were entered in theoretically motivated blocks. General AR-anxiety and AR-avoidance, as well as whether the relationship commenced in a physical or virtual venue were entered in the first block, personality (as a general source of unique variance) in the second, sex and age in the third, attraction in the fourth, communication in the fifth, and motivation in the sixth block.

3. Results

3.1 Completer analysis

A comparison of completers and non-completers revealed that completers were older than non-completers (43.9 years vs 34.8 years respectively; $t(3484) = 17.20, p < .001$). Women who started the survey were significantly more likely to complete it than men (68% vs 45%; $\chi^2 = 74.35, p < .001$). No other comparisons reached statistical significance.

3.2 Reported relationships

In total, completers provided data on 3421 relationships (mean number of relationships reported was 2.1). These consisted of 742 kin (defined as siblings, parents, or other family members); 711 romantic relationships (RRs: either partners or spouses) of whom 206 (29%) were first met in online venues; and 1968 friends, of whom 759 (39%) were first met in online venues.

3.3 Sex differences

A series of independent samples t-tests was performed to examine sex differences across all variables for completers (see Table 1). Men were 1.3 years older than women, and were less open, less agreeable, less neurotic, and more extraverted. Men were more achievement motivated and less socially and immersion motivated, their general attachments were less anxious, and their median level of completed education was lower. Effect sizes (η_p^2) ranged from .001 to .05, and sex was consequently retained as an independent variable in all analyses.

Table 1.

Completer data.

Variable	Women	Men	Sig
N	255	1398	-
Age (years)	42.8	44.1	.016
Highest completed education (median)	Bachelor's degree	High School	.016
Personality			
Openness	5.25	5.03	.008
Conscientiousness	4.81	4.70	.237
Extraversion	2.85	3.17	.003
Agreeableness	4.98	4.45	<.001
Neuroticism	3.89	3.04	<.001
Motivation			
Achievement	2.64	3.05	<.001
Immersion	3.57	3.15	<.001
Social	3.44	3.30	<.001
General attachment-related Anxiety	3.22	2.78	<.001

General attachment-related Avoidance	2.89	3.03	.055
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3.4 Venue and relationships

A series of 2x2 ANOVAs with sex and venue as independent variables were performed on the primary measures. Each analysis was performed separately for RRs and friends. Because participants were free to report on whichever relationships they desired, there was no requirement to select both a romantic relationship and a friend, and therefore analyses were performed separately on these two categories resulting in different Ns (705 RRs, 1385 friends). Kin were precluded from these analyses due to venue not being measured for this relationship domain.

3.4.1 Attachment

For RRs, there were no significant effects of sex or venue, and no interaction. For friends, there was a main effect of sex ($F(1,1381)=4.05$, $p=.044$, $\eta_p^2=.003$), a main effect of venue ($F(1,1381)=18.32$, $p<.001$, $\eta_p^2=.01$), and a significant sex x venue interaction ($F(1,1381)=4.88$, $p=.027$, $\eta_p^2=.01$). Inspection of the interaction revealed that women, but not men, have more anxious attachments to friends met online than offline (M for women meeting friends online=2.5, offline=2.0).

3.4.2 Attraction

Women found their RRs more socially attractive than men did ($F(1,701)=5.71$, $p=.017$, $\eta_p^2=.01$; M women=4.7, men=4.5), but none of the other analyses of attraction to RRs reached significance. For friends, there was a main effect of venue ($F(1,1381)=40.13$, $p<.001$, $\eta_p^2=.03$), with friends met online being seen as less socially attractive (M online=4.1, offline=4.4).

3.4.3 Communication

Participants spent an equal amount of time communicating with RRs regardless of venue, but for friends there was an effect of venue ($F(1,25.67)$, $p<.001$, $\eta_p^2=.02$) with more communication reported with online friends (M online=9-12 hours per week, offline=5-8 hours). Unsurprisingly, for both RRs and friends, a greater proportion of communication happened online for those who had met online (for RRs $F(1,701)=99.58$, $p<.001$, $\eta_p^2=.12$; M online=49%, offline=22%; for friends $F(1,1381)=248.86$, $p<.001$, $\eta_p^2=.15$; M online=90%, offline=55%).

When considering the proportion of online communication which took place in MMOs, with RRs women reported this to be higher than men

($F(1,701)=9.65$, $p=.002$, $\eta_p^2=.01$; M women=20%, men=11%), and both sexes spent more of their online communication in-game with RRs they had met online ($F(1,701)=12.43$, $p<.001$, $\eta_p^2=.02$; M online=19%, offline=10%). With friends, there was a significant sex by venue interaction ($F(1,1381)=8.00$, $p=.005$, $\eta_p^2=.01$) with men communicating more with offline friends in-game than women (M women=13%, men=28%).

3.5 Predicting the nature of relationships

To determine whether the security of relationships could be predicted, six hierarchical multiple linear regressions (hMLRs) were performed on the AR-anxiety and, separately, AR-avoidance, towards kin, RRs, and friends. In each analysis, general AR-anxiety and AR-avoidance, as well as venue (omitted for the analyses of kin relations) were entered as block 1; personality (5 variables) as block 2; age and sex as block 3; attraction (3 variables) as block 4; communication (3 variables) as block 5; and player motivation (3 variables) as block 6. See table 2 for intercorrelations between variables. For all analyses, tolerances were above .65.

Table 2.

Intercorrelations between outcome and predictor variables.

Variable	Relation- ship type	Variable																	
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 AGE	Kin	-.085*	-.097*	-.038	-.088*	.055	.211**	.025	-.008	.097*	.212**	.045	.036	-.137**	-.105**	-.018	.122**	-.073	.014
	RR	-.049	-.044	.011	-.086*	.047	.244**	.089*	.023	.015	.259**	-.032	.179**	-.070	.178**	-.071	-.015	.308**	.088*
	Friend	-.139**	-.102**	-.043	-.105**	.062*	.211**	.040	-.027	.048	.197**	.029	.080**	-.070**	.030	-.135**	.215**	.106**	.093**
2 Openness	Kin		.177**	.304**	.095*	-.210**	.021	.265**	.134**	-.252**	-.164**	-.179**	-.078*	.214**	.127**	.112**	.034	.038	.000
	RR		.025	.250**	.110**	-.181**	.011	.177**	.148**	-.180**	-.106**	-.129**	-.072	.123**	.093*	.119**	.006	-.016	.026
	Friend		.120**	.319**	.089**	-.251**	.029	.238**	.140**	-.229**	-.178**	-.171**	-.191**	.128**	.053	.145**	.009	-.005	.022
3 Conscientiousness	Kin			.131**	.030	-.309**	-.010	.144**	-.037	-.154**	-.207**	-.089*	-.140**	.062	.058	.029	-.014	.084*	.006
	RR			.029	.030	-.312**	.033	.006	-.129**	-.056	-.142**	-.113**	-.177**	.117**	.095*	.086*	.045	-.105**	-.051
	Friend			.088**	.048	-.260**	.048	.076**	-.035	-.100**	-.116**	-.069*	-.061*	.033	-.004	.107**	-.032	-.039	-.012
4 Extraversion	Kin				-.038	-.199**	.121**	.236**	-.078*	-.452**	-.239**	-.288**	-.147**	.230**	.111**	.134**	.071	.022	.020
	RR				-.073	-.204**	.207**	.181**	-.128**	-.367**	-.226**	-.147**	-.159**	.102**	.181**	.099**	.089*	-.136**	-.062
	Friend				-.011	-.244**	.141**	.209**	-.083**	-.384**	-.222**	-.192**	-.151**	.111**	.045	.071**	.033	-.045	.053*
5 Agreeableness	Kin					-.112**	-.170**	.175**	.148**	-.193**	.024	-.058	-.011	.085*	.059	.005	.045	.034	-.011
	RR					-.086*	-.176**	.237**	.176**	-.187**	.022	-.168**	-.080*	.051	.096*	.154**	.068	.045	.130**
	Friend					-.124**	-.181**	.213**	.095**	-.255**	-.009	-.141**	-.044	.071**	.121**	.129**	-.051	-.013	-.017
6 Neuroticism	Kin						-.068	-.088*	.164**	.230**	.424**	.170**	.235**	-.084*	-.099*	-.082*	-.015	-.057	-.059
	RR						-.102**	.028	.231**	.128**	.440**	.083*	.283**	-.030	-.128**	-.151**	-.037	.161**	.063
	Friend						-.087**	-.051	.195**	.168**	.455**	.060*	.285**	-.105**	.033	-.065*	.024	.058*	-.033
7 Achievement motivation	Kin							.235**	-.106**	.034	-.005	-.037	-.042	-.069	-.020	.047	-.004	-.006	.047
	RR							.130**	-.204**	.023	-.020	.059	.070	-.002	.077*	-.045	.034	-.009	.000
	Friend							.234**	-.062*	.014	-.004	.009	-.023	-.046	-.046	-.046	.147**	.088**	.166**
8 Social motivation	Kin								.312**	-.301**	.015	-.159**	-.035	.071	.123**	.069	.135**	-.024	-.011
	RR								.300**	-.302**	.087*	-.199**	-.024	.079*	.090*	.055	.055	.116**	.121**
	Friend								.322**	-.358**	.053*	-.340**	-.034	.094**	.117**	.142**	.151**	.138**	.108**
9 Immersion motivation	Kin								-.025	.257**	-.070	.105**	.038	.056	.030	.118**	.034	-.001	
	RR								.020	.312**	-.022	.158**	-.012	-.083*	-.103**	-.002	.140**	.195**	
	Friend								-.030	.263**	-.126**	.105**	.015	.095**	.039	.109**	.118**	.028	
10 AR-avoidance	Kin										.250**	.448**	.189**	-.241**	-.125**	-.213**	-.144**	.069	.035
	RR										.186**	.455**	.201**	-.181**	-.205**	-.216**	-.101**	.018	-.005
	Friend										.176**	.459**	.201**	-.180**	-.079**	-.142**	-.110**	.024	-.026
11 AR-anxiety	Kin											.194**	.347**	-.171**	-.072	-.037	.027	-.008	-.047
	RR											.144**	.567**	-.130**	-.057	-.180**	-.059	.263**	.167**
	Friend											.042	.525**	-.146**	.096**	-.115**	.072**	.095**	-.004
12 Relationship- specific avoidance	Kin												.333**	-.557**	-.244**	-.540**	-.168**	-.022	-.003
	RR												.346**	-.476**	-.383**	-.485**	-.367**	.011	.006
	Friend												.244**	-.366**	-.268**	-.391**	-.165**	.019	.098**
13 Relationship- specific anxiety	Kin													-.267**	-.025	-.262**	-.023	-.032	.026
	RR													-.313**	-.057	-.246**	-.152**	.210**	.094*
	Friend													-.327**	.138**	-.199**	-.032	.043	.009
14 Social attraction	Kin														.148**	.365**	.166**	.147**	.182**
	RR														.211**	.386**	.274**	-.091*	-.022
	Friend														.069*	.371**	.085**	-.119**	-.140**
15 Physical attraction	Kin															.166**	-.030	.050	.056
	RR															.296**	.153**	-.009	-.051
	Friend															.175**	.043	-.021	-.126**
16 Task attraction	Kin																.071	.009	-.092*
	RR																.268**	-.016	-.101**
	Friend																.022	-.011	-.086**
17 Amount of	Kin																	-.266**	.064

communication	RR		-.116**	.052
	Friend		.106**	.233**
18 % of communication which happens online	Kin			.322**
	RR			.255**
	Friend			.424**
19 % of online communication which happens in-game	Kin			
	RR			
	Friend			

* p < .05; ** p < .01

The results of the hMLRs are shown in table 3. The expected relationships between general and specific attachment emerged, and greater levels of attraction were associated with more secure attachments (although physical attraction towards friends was associated with greater AR-anxiety). Critically, venue appeared as a significant predictor in only 1 of the 6 final models, where relationships with RRs were slightly more AR-avoidant when they had been met online.

Table 3.

Hierarchical multiple regression on attachment-related anxiety and avoidance towards kin, romantic, and friendship relationships.

	Attachment related anxiety towards kin	Attachment related avoidance towards kin	Attachment related anxiety towards Romantic relationship	Attachment related avoidance towards Romantic relationship	Attachment related anxiety towards friend	Attachment related avoidance towards friend
	β	β	β	β	β	β
Step 1 General anxiety General avoidance Venue ¹	.28	.26	.50 .08	.30	.45 .07	.33
Step 2 Openness Conscientiousness Extraversion Agreeableness Neuroticism	.09		-.06		-.07	.05
Step 3 Age Sex				-.06	-.05	
Step 4 Social attraction Physical attraction Task attraction	-.15 -.20	-.36 -.11 -.32	-.20	-.24 -.18 -.22	-.22 .13 -.08	-.19 -.16 -.22
Step 5 Amount of communication Online communication In-game communication			.08	-.18		-.09 .09
Step 6 Social motivation Immersion motivation Achievement motivation		-.07	.09			-.15
Total R ² N	.20 (model 4) 659	.54 (model 6) 659	.42 (model 6) 705	.52 (model 6) 705	.36 (model 4) 1385	.41 (model 6) 1385

Note. Only significant predictors ($p < .05$) from the best model for each DV are presented, where the best model is taken as the most complex model making a significant increase in the R² of the previous model.

¹ Omitted in analyses for kin relationships.

² Total R² is for the best-fit model.

4. Discussion

The results reported here illustrate some of the complex associations between attachment, attraction and, to a lesser extent, communication in relationships formed both online and offline. Below, we present a discussion of the major findings in addition to limitations of the research and areas for further study.

4.1 Venue

Perhaps the most important aspect of these findings relates to venue and to the general absence of evidence to suggest that it affects relationships. While more fine-grained measures of relationship quality might reveal subtle differences, the overall pattern here is that it generally does not appear to matter whether people meet online or offline. Offline romantic relationships were slightly more AR-anxious than online ones, but this effect was small, and did not appear for any of the other attachment-related measures in other domains. Women were more anxiously attached to online friends, and online friends were generally seen as less socially attractive, effects which are discussed below.

4.2 Communication and play-time

Contrary to previous research which suggests women MMO players spend more time playing than men (Williams, Consalvo, Caplan, & Yee, 2009; Williams, Yee, & Caplan, 2008), there was no overall difference in time spent playing. However, women spent a greater proportion of time communicating in-game, suggesting that the ways in which time is spent in-game may be important to consider when assessing the impacts of virtual worlds. This effect may be a specific example of a general preference for electronic communication among women (Kimbrough, Guadagno, Muscanell, & Dill, 2013), or a specific preference for personal discussions with gaming friends (Cole & Griffiths, 2007). Taken that players' subjective estimates of time spent playing are rather inaccurate (Williams et al., 2009), it may be in future more useful to ask specific questions about what people spend their time doing rather than rely on reports about how much time they spend playing.

For both romantic relationships and friends, a greater proportion of communication happened online for those who had met online, and both sexes spent more time communicating in-game with romantic relations they had met online. These results can be interpreted in terms of Bowlby's (1973) 'internal working model' which suggests that our models of relationships depend not just on who we are attached to, but where the attachment originates. Thus suggests that relationships which start online tend to remain online, and offers a potential way to investigate how the internal working model develops over time.

Women reported higher levels of AR-anxiety towards friends met online than men, despite spending more time communicating with them in-game. While this

may be a feature of the slightly higher levels of general AR-anxiety observed for women in this sample, it may reflect the 'out of sight, out of touch' phenomenon (Kalmijn & Flap, 2001) where the physical absence of online friends generates greater AR-anxiety, and increased communication is an attempt to mitigate this.

4.3 Attraction

Interestingly, online friends were reported as less socially attractive than offline friends, despite being communicated with more. It may be that offline friends have been known longer (length of relationship was not measured), but it may also reflect participants' stereotyped views of other players. To the extent that MMOs are still not perceived as mainstream activities, even among players themselves, friends made online may not be perceived as socially attractive as they fit a socially inept (and therefore unattractive) stereotype. This is in contrast with physical and task attraction, which may be easier to infer from repeated interactions, and the availability of online photographic images.

4.4 Predictors of attachment

Unsurprisingly, general AR-anxiety and AR-avoidance predict the anxiety and avoidance we feel about specific relationships. This is in line with previous research examining relationships between general and domain-specific attachments (Sibley & Overall, 2008). We had no specific hypotheses about personality, and while there were a small number of personality predictors, these were not consistent across relationship categories. Similarly, the demographic variables of age and sex had little effect on the regression models.

Attraction, on the contrary, plays an important role in predicting attachment. With one exception, the greater the social, physical and task attraction, the more secure the relationship in terms of both low anxiety and low avoidance. Weightings are slightly higher for social and task attraction than for physical attraction, suggesting that the companionate and utilitarian elements of relationships are more important in determining how safe others make us feel (Hazan & Shaver, 1987). One exception to this general pattern arose with physical attraction towards friends, where greater AR-anxiety was associated with greater perceived physical attraction. Whether this arises from a fear of abandonment, is some proxy for romantic attraction (in that friends rated as more attractive may be objects of romantic intentions), or is due to some other effect, cannot be inferred from these results.

Communication and motivation made sparse and inconsistent contributions to predicting attachment. Communication affected AR-avoidance rather than AR-anxiety, but these effects only held for overall amount of communication. There was little evidence to suggest that player motivation exerted anything other than very minor influences on attachment.

4.5 Limitations and future research

There are several limitations with this research which affect the generalisability of its findings. First, the sample was composed of people who play MMOs, and while the sample was large and diverse, it should be born in mind that MMO players may not be representative of the wider population. While MMO players are not distinct from the general population in many ways (Possler et al., 2017; Williams et al., 2008), they tend to spend large amounts of time in virtual worlds, and this may make the ways in which they form and react to relationships unrepresentative. To the extent that MMO players are used to forming (and dissolving) online relationships as a central feature of the games they play, they may increasingly come to normalise online relationships. MMO players may be therefore be 'ahead of the curve' with regard to online relationships, and attachment theory is likely to have much to say about this specific population given their familiarity with relationship processes of disruption, separation and loss, as well as attachment.

Second, women were somewhat underrepresented in the sample, despite evidence that they constitute an increasing proportion of MMO players (Williams et al., 2008). We do note, however that the size of the sample means that questions of statistical power were not an issue here, increasing our confidence that there were few type 2 errors.

Third, in addition to being predominantly male, our sample mainly hailed from the US, Canada and the UK. The results therefore should not be extrapolated to other cultures, particularly those where online activity is a lesser or greater part of everyday life, and where different cultural norms about relationships, and perhaps romantic relationships in particular, hold sway.

Fourth, we did not request information about the role which players typically adopt in MMOs. The effect of player specialisation in MMOs means that groups attempting major challenges (those which are impossible to complete on one's own) generally adopt some version of the KIP framework (Barnett & Coulson, 2010) where different players are responsible to dealing damage to opponents (Kill), drawing the attention of opponents and absorbing damage (Irritate), and keeping everyone alive (Preserve). While there do not appear to be sex differences in role preference (contrary to popular belief), choice of role does appear to be affected by personality, and may pervade a great deal of how MMO players behave online (Bean & Groth-Marnat, 2016).

Finally, due to the length of the online survey, the amount of information elicited about relationships was limited. We did not measure where people met, whether they were same sex or opposite sex relationships, the length of relationship, and relationship satisfaction. In particular, while the data on communication allow us to infer that RRs spent a considerable amount of time in face to face communication, we did not measure for other potentially important variables such as co-habitation.

4.6 Conclusion

Virtual worlds blur the distinction between what is physically and psychologically 'real'. Games provide experiences which are visceral as well as emotional, and these genuine experiences are likely to become ever stronger with the inexorable march of graphical, haptic, and immersion technologies. In tandem with the increasing permeability of offline and online experiences, relationships straddle these shifting boundaries, allowing new forms of romance and friendship to form and develop within existing frameworks and implicit models, but also to generate new ones. The decades-old view of relationships as being forged through propinquity and homogamy is losing its currency in online worlds where physical presence and appearance are no longer limiting factors. Classical attachment theory sees relationships as developing throughout the lifespan, with one of the important transitions being the 'move to the level of representation' (Main et al., 1985) where the infant's primary need of physical proximity is gradually supplanted by a need for psychological proximity. As adults we feel safe when we know someone holds us in their mind rather than their arms. Online relationships, with their greater and often exclusive focus on psychological rather than physical proximity may offer more mature grounds on which to build secure and healthy relationships. The results reported here contribute to an emerging understanding that offline and online relationships are very similar. What is now required is a more in-depth examination of the specific ways in which online and offline relationships may or may not succeed for specific individuals in specific online venues.

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