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Social exchange is in the game: Communication and resource flow in a Xbox gaming clan

by William T. Howe and Sun Kyong Lee

Abstract

This study examined the international social network of a bounded *Battlefield 4* gaming clan considering social exchange theory. We found that more central members of the clan contributed more time and money to the clan than others. In addition, central members of this clan revived other members in-game more often. This study extends social exchange theory from face-to-face interaction to the virtual world, by showing communicative factors that influence online gaming networks, and to game studies by offering results applicable to online gaming clans. This study also shows how gamers engage in various social exchanges and earn central positions within the network in return for their investment of time, money, and communication.

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Introduction

Members of the gaming clan we studied valued off-line behaviors and selfless acts in *Battlefield 4* more than winning. This may not make sense at first, if we think of gamers as isolated individuals, but in a clan setting we found that members that were more central or powerful members of the clan were not those that were the best at playing the game but rather best at building and maintaining relationships. A famous tagline for a game studio, Electronic Arts (EA), was "it' s in the game" (2017); this was shortened from the original "if it' s in the game, it' s in the game". The tagline was trying to convey the development of video games to the point that whatever experiences a user may have off-line could now be found in the game. In this study, we sought to find if elements of social exchange theory that exist in face-to-face relationships also exist in video games, an assumption that Parks (2009) stated should be examined.

McGonigal (2011) reported that 97 percent of youth in the United States are playing some form of video game. Researchers have also found that 25 percent of those that play video games are over the age of 50 and that the average American adult has spent 12 years of their life playing video games (Ledbetter and Kuznekoff, 2012). Video games have changed the way many individuals socially interact and as such, offer new venues in which traditional social theories can be tested. Social exchange theory is one such example, and helps both predict and understand the network structures of online gaming clans. Members of a gaming clan give time, financial, and informational resources to other clan members, and in exchange they receive companionship, teamwork, and relational satisfaction (McGonigal, 2011).

In a gaming clan some members are more essential, or central, to the clan than others. Central members can vary based on the formation of a network. Members that have a high number of connections may be more central in a formal network; however, members that bridge two different populations may be more powerful in other types of network (*e.g.*, informal). Based on social exchange theory, the current study explores the characteristics of members that are more central to the clan both in terms of the quantity of connections as well as the quality of connections. Once the central members are identified, the characteristics of these members can be analyzed and interpreted according to the tenets of social exchange theory. This study then furthers the understanding of network structures, by describing prototypical central figures as well as clarifying the social exchange elements that appear to be most relevant to these members.

Another reason a network approach is useful in this study is because many modern video game designers have realized the success of social networking sites and attempted to foster the same emphasis on communication and connections in video games. Most app-based video games are free to download and play, as a user simply needs a smartphone or tablet. Other platforms such as consoles and computer games do need a more significant financial investment, but they are also generally more engaging as they have better graphics, processors, and communication possibilities. The rise of video game popularity does not rest solely in the development of better graphics or more in-depth storylines, but by the ease of both developing connections and offering connections in a virtual world (Bogost, 2007).

Reports of video gameplay have yielded mixed results regarding whether they offer positive or negative contributions to an individual's interpersonal network. Lo, *et al.*(2005) found that the more individuals played video games online, the more social anxiety they had and the lower the quality of their interpersonal relationships were. However, Walther (1996) and others (Peña and Hancock, 2006) have found that computer-mediated communication (CMC) can rise to the level of hyperpersonal communication, or communication that transcends the intimacy of in-person communication. Several underlying mechanisms such as optimal self-presentation by message senders and feedback loops of the communication process lead to these outcomes. We propose that these findings are not at odds with each other but rather inform each other, when considered in a social network context. Individuals that are lone gamers or gamers that play

alone with no social support are probably more likely to experience social anxiety and less intimacy; conversely, members of gaming clans that play together with other gamers may form a strong bond and perhaps share experiences that transcend those of off-line relationships. On the homepage of the gaming clan we analyzed in this study, the clan explicitly says that the main goal of the clan is to offer a communal environment where individuals put the team ahead of themselves. This goal illustrates both the desired interdependence of this clan as well as the expectations of members to contribute to the network. Interdependence and contributions are two of the main elements of social exchange theory, and therefore this clan is a proper and logical space to examine the social exchange of gamers based on the social network approach.

Traditionally, video games were exclusive and only available to those with the economic ability to afford games and the desire to play games. However, examining *World of Warcraft*, Williams (2006) reported that there are over one million players that regularly play this game. Not only are players spending tremendous time in the virtual world, but they are interacting in the virtual world with individuals they may not meet offline. This positions video games as a place where all players are on an even field and age, race, gender, and sexual orientation do not matter, regarding your ability to play a game. Recent studies have found that although only a small percentage of females self-identify as gamers; 48 percent of females claim to play video games (McGonigal, 2011). Most gaming communities' only rule for joining is that the player is over the age of 18. With the opportunity to play video games available to most people the question now is what is driving individuals to spend time in the game playing as well as to spend time outside the game forming communities and friendships, and sharing information about the game.

If gamers are behaving in the same manner as those in off-line relationships, then they most likely engage in an exchange of resources. Perhaps the clearest illustration of this exchange can be seen in gaming clans where members are providing time, energy, and even resources for each other through the network of the clan. Video games offer a productive opportunity to examine social networks and the exchange of resources among members that are bound together only by their interest in a certain video game (Williams, 2006).

Theoretical framework

Since the 1950s sociologists have examined various aspects of social exchange, or provision of resources to at least one other individual and expecting some reward in return. Early scholars found multiple perspectives from which to examine social exchange which led to a diversity of social exchange literature (Turk, 1976). Emerson (1976) summarized these differences and proposed that although scholars may disagree, or diverge, on specific aspects of the influence of social exchange, the similarities, or convergence, of central viewpoints allowed for a frame of reference that could aid in the understanding of other theories. Social exchange theory may explain why video games that rely on the interdependence of other players have led to the development of clans and networks (Cropanzano and Mitchell, 2005). Three elements of social exchange theory (interdependence, equity, and relationships) are reviewed from current literature. After this review, we will show how social exchange theory can illuminate tenets of social network analysis (SNA) and explain relevant network concepts to the social exchange process of the gaming community.

Interdependence

One of the basic tenets of social exchange theory is interdependence (Stafford, 2008), or that each person&esquo;s accomplishment of future goals and achievements rest in part on the shoulders of another. Jin, *et al.* (2010) state that not only is it imperative that there be

continuous rewards in the relationship but also a commitment to each other to continue the relationship. In their research, Jin, *et al.* (2010) found that members of online communities contributed back to their communities what they had received. This advances the idea that even in a virtual environment, interdependence among individuals can be present. Interdependence may be more salient in team-based video games where members pursue a team-goal rather than strictly a personal goal. For example, *Madden* is a game that has been, traditionally, a single player game or a co-present multiplayer game; however, new features of the game encourage the player to interact with other players in auctions, games, challenges, and trades to create a better team. Other games are clearly interdependent, as they need at least two players to play, and *Battlefield 4* is one such game. Unlike many first-person-shooter games prior to the *Battlefield* franchise, failure or success in this game depends on the performance of your team. The focus on teamwork rather than individual gameplay could be the major contributing factor to *Battlefield 4* clans, or groups of individual players that come together to play as a team and be more successful.

Equity

Social exchange theory suggests that individuals are constantly evaluating relationships to decide if they are getting out of the relationship at least what they are putting into it (Stafford, 2008). A new layer of complexity is added to this aspect of equity when it is focused on a small group that all share interpersonal relationships and individuals evaluate the amount of effort they are placing towards the relationship in comparison to the amount of effort the other individual is showing towards the third party (Stafford, 2008). Equity can be achieved via multiple items such as time, cognitive engagement, and resource allocation. An interesting caveat of video games is that they generally need one or more of these items to play the game. Time generally shows a commitment in video games; however, with turn-based video games such as *Hanging with Friends*, or competitive games not played simultaneously, such as *QuizUp*, time is not the most significant item for equity consideration. But, cognitive engagement is important as these games need only brief periods of time for turn-taking, but in those periods, the player must be fully engaged to give a proper challenge to the other. Some games, such as *Assassin's Creed Unity*, need an inordinate amount of time, but less cognitive processes.

Resource allocation is also present in many video games. *Clash of Clans*, for example, necessities donations from clan members to protect your castle during war and for the betterment of the clan. Other games, such as *Farmville*, ask you to invest your virtual resources in another player's game and are based solely on your relationship with that person, as donating these resources does nothing for you in the game except to begin or strengthen a relationship with the other player. *Battlefield 4* is unique in that it combines both types of exchange. Individuals must be online together to effectively work as a team, and the game itself involve great cognitive engagement as well as resource exchanges that have a direct impact on the game.

Relationships

Scholars suggest that video games can significantly affect interpersonal relationships (Bogost, 2007; Jin, *et al.*, 2010). These relationships could occur at the dyad-level or in a group context, such as a gaming clan that plays together online and share resources off-line. Two strategies have been shown to mold interpersonal relationships and they are the change of emotional connection and the change of attitude towards the other player(s) (Ledbetter and Kuznekoff, 2012), which result in the developing a sense of a fair return (McGonigal, 2011).

Emotional connection of players. There is emotional connection among players of multiplayer games. Ledbetter and Kuznekoff (2012) argued that using Xbox Live allows for relational maintenance and therefore meets the definition of interpersonal communication. Some studies have shown members are often not just in each other's virtual presence but physical presence (*e.g.*, Bowman, *et al.*, 2013; Jansz and Martens, 2005; Jansz and Tanis, 2007; McGonial, 2011)

as well. Bowman, *et al.* (2013) reported that 65 percent of multiplayer games occur in the physical presence of the other. McGonigal (2011) echoed these findings, although from a different perspective. While she did not use communication terms, she did use communicative ideas to show how games are making relationships better. She reported that *Lexulous* has over five million players and then described how many players are not only playing with their friends, but also with family members. Additionally, users are posting and talking about their gameplay on social media. McGonigal (2011) summed up her observations of *Lexulous* with the statement, "Social network games make it both easier and more fun to maintain strong, active connections with people we care about, but who we don't see or speak to enough in our daily lives" [1] .

Change of attitude towards other players. Building on the belief that games do offer a means for emotional connection of players through relational maintenance, consideration must be given to how this affects the actual relationship. Bogost (2007) argues that the interaction in the video game space influences how players view each other outside of the game. For instance, in squad-based games (*e.g.*, *Destiny, Battlefield 4, Chromehounds*), individuals traditionally play with the same group of people. Another example is the extremely mobile video game, *Clash of Clans*. Once a player joins a clan, the leadership of the clan is continuously evaluating performance and how much the player helps the clan. If the player becomes perceived as a burden to the clan and not a productive member, the leadership can kick the player out of the clan. Social exchange research would predict this pattern of membership negotiation behavior (*e.g.*, Hsu and Lu, 2004; Stafford, 2008).

Hypotheses and research questions

As previously mentioned, *Battlefield 4* needs the aid of others to be successful in the game. The best way to examine how players exchange this aid is by examining their gaming network in conjunction with social exchange. Using social network analysis allows not only consideration of the individual player's performance in-game, but also an examination of the network to better understand how the players acquire resources from others and use them.
Furthermore, *Battlefield 4* was released in October 2013 and although it has become less popular since the release of *Battlefield 1* in October 2016 many players are still playing the game. According to *Battlefield's* official message boards, www.battlelog.battlefield.com/bf4, there are 1,631 pages of posts where members are expressing either interest in joining a clan or clans are trying to recruit members. Now there are 10,215 PC, 6,977 PlayStation 3, 1,276 Xbox 360, 4,385 Xbox One, and 17,947 PlayStation 4 players playing *Battlefield 4*. Because the game is both old and popular, publicly available data about the game is rich and can offer an ideal dataset to examine player motivation, performance, and communication through an objective measure, in-game statistics. Analyzing these statistics in combination with clan data can further the understanding of online gaming networks and how communication and resource exchange processes occur.

A key concept in social network analysis is actor centrality, or the importance of a member within a network. Several types of actor centrality can be used to evaluate the importance of a member to the clan. For instance, the number of direct connections (*i.e.*, degree centrality) or the distance between members (*i.e.*, closeness centrality). Bonacich centrality accounts for both the number of connections as well as the quality of those connections considering indirect connections of individuals. Thus, Bonacich centrality captures an individual's centrality from multiple perspectives considering both direct and indirect influence flow through the network. Put simply, this measure creates a weighted analysis of centrality or power (Hanneman and Riddle, 2005; Kadushin, 2012; Wasserman and Faust, 1994).

This analysis best characterizes the combination of quantity and quality of connections and was therefore used to find central actors of the gaming clan in this study. Coupling this understanding of centrality with the knowledge of social exchange theory and the goals of the clan hypotheses could be proffered. The first individual or group to set up dominance in an area is most likely to keep that dominance as future individuals or organizations connect with that individual or group. This network principle of preferential attachment (Barabási and Albert, 1999) proposes that early settlers in the network benefit from their status and that those who join the network later are more likely to form connections with more popular and powerful members. Therefore, it is likely that members with longer clan tenure will be more central to the network because they have had more opportunities and time to make connections and thus we propose:

> *H1*: Player's Bonacich centrality will be positively associated with tenure in the clan..

Three types of resources are shown by social exchange theory as the most common: time, monetary resources, and information. According to social exchange theory, members that contribute time, monetary, or informational resources are likely to have more connections in the network, and therefore be more central to the clan. For this reason, we propose:

> *H2*: A player's Bonacich centrality will be positively associated with the frequency of the most common three resources (*i.e.*, time, money, and information) exchanged in the network. a) time; b) monetary resources; and, c) informational resources..

Given *H1* and *H2* influencing a member's centrality, it would be worthwhile to examine what variables, related to the game, influence a player's centrality the most; therefore we ask:

> *RQ1*: What is the strongest predictor of Bonacich centrality?

Both the game type and the clan studied put an emphasis on interdependence among players. Social exchange theory proposes that interdependence needed to keep a desire for even exchange. It is likely players who play the game according to the values of the clan will be more central and more powerful in the clan and therefore it can be hypothesized:

> *H3*: Bonacich centrality will be positively associated with a player's adherence to clan values..

Method

Collection

The data for this study was collected entirely from publicly available sources on the Internet and therefore the IRB verified that their approval was not needed. Three Web sites were used to gather demographic, gameplay, and friendship data, and they were www.enjin.com, www.xbox.com, and www.bf4stats.com. The first Web site visited was enjin.com where the first clan had made its membership roster publicly available, and it was listed on the recruitment forum. This roster listed 62 players as members of the clan. The names

on the membership roster were entered to the username search on www.enjin.com to obtain any available demographic information.

Through the previously mentioned *Battlefield* forums, the lead researcher found an active clan with publicly available clan membership data. From this list of members some demographic variables could be gathered. Furthermore, the researchers examined the clan's homepage to garner a better understanding of the goals of the clan. The selected clan states on its welcome page that it is an "Xbox One First Person Shooter Clan" and that "Our goal at [name of clan removed] is to be not just any clan, but a growing and diverse group of friends dedicated to the clan and not ourselves". Such a statement may appear at odds with a stereotypical image of gamers playing video games alone in their parent's basement, but if the clan does in fact run in the manner that they propose, it is in line with the propositions of social exchange theory as well as a comparable group to traditional off-line volunteer groups.

Participants

Members can conceal some or all their demographic information on their clan site and therefore not all the members' demographic data was available. Of the 62 members, all reported their sex as male and 36 reported their age which ranged from 18 to 49 (M = 28.89, SD = 6.60). Nationalities reported by 39 members were United States (n = 28), United Kingdom (n = 3), Canada (n = 3), Ireland (n = 1), Germany (n = 1), New Zealand (n = 1), and Norway (n = 1).

A gamertag search was conducted on www.Xbox.com for all clan members, and any publicly available friend lists were downloaded for analysis. Four members of this clan did not make their friends list public; however, some information can be gathered about them because Xbox live friendships are non-directional (either present or absent). This first nodelist (*i.e.*, who is a friend with whom) dataset consisted of 3,916 unique usernames. A preliminary examination of this friendship network via Netdraw visualization resulted in the decisions to remove both isolates, players who do not have any listed friends, and pendants, players with only one friend listed, as is suggested as a method to offer a clearer picture of the network (Hanneman and Riddle, 2005). This data reduction resulted in a list of 247 unique nodes (*i.e.*, players). These nodes were imported into UCINET in nodelist format for network analysis (Hanneman and Riddle, 2005).

Although this data was collected through a modified form of egocentric data collection, friends were pulled from objective sources rather than participant responses; with the availability of the clan roster, it could be found who was in the clan and who was in the overall community. This differentiation is critical because members of the clan are formally committed to the clan and more likely to take part in social exchange than members of the community, or individuals with two or more connections to the clan but not a member of the clan. The number of Xbox friends clan members had, after data reduction, ranged from 1 to 58 (M = 19.79, SD = 11.32).

Measures

Wasserman and Faust (1994) articulate that in symmetric socio-matrices, or mutual relationships, actor centrality should be used to measure power; Bonacich centrality scores ranged from 31.03 to 14,977.44 (M = 2,680.17, SD = 3,477.14). The overall network was moderately centralized that there were some players who are more influential and have easier access to others compared to the rest of players. Figure 1 illustrates the network in terms of Bonacich centrality and clan-membership. Clan members represented by orange color nodes were more central than non-clan members represented by blue color nodes.

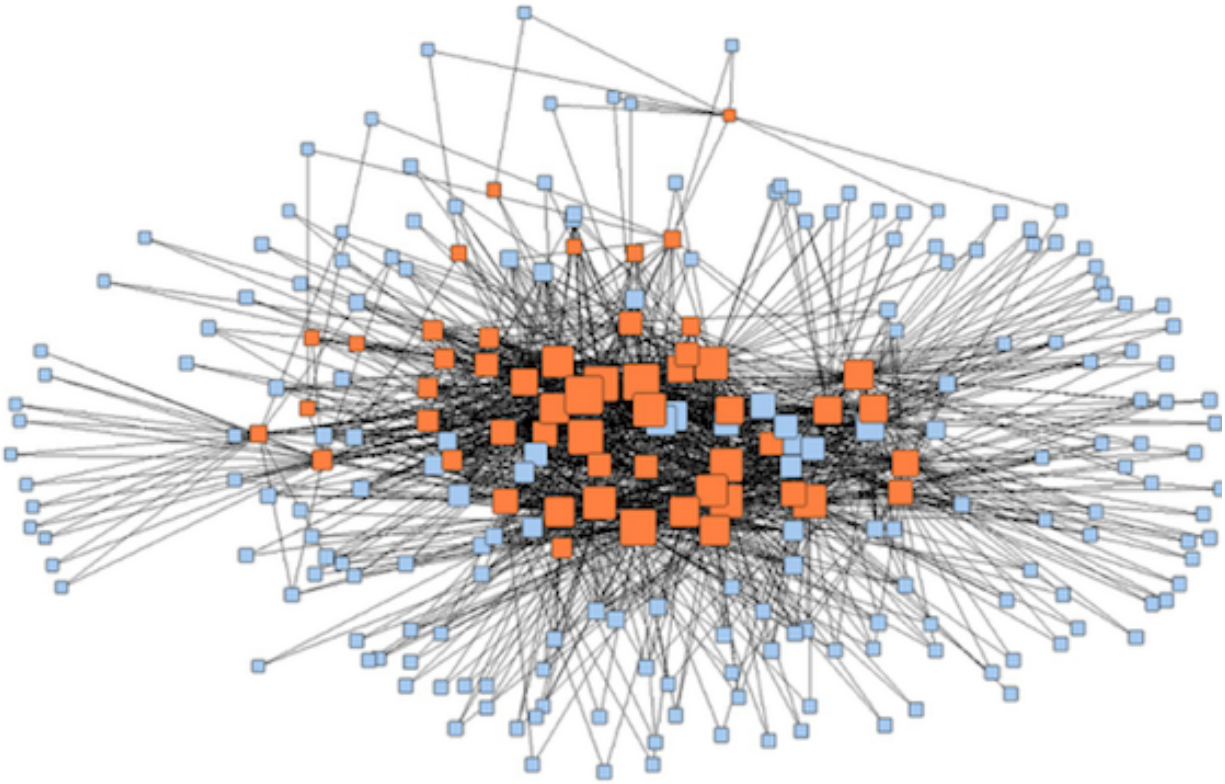

Figure 1: View of entire network by membership and Bonacich centrality. Color is based on clan membership (Orange = Clan Member, Blue = Non-Member). Size is based on Bonacich Centrality; the larger the node the higher the centrality score.

Note: Larger version of figure available here.

Overall network statistics were examined. Density was .050 and there were 3,090 network ties with an average number of ties being 12.36 (*SD* = 0.22). Network transitivity was 15.01 percent with 7,203 triples with all three legs and 47,995 triples having two legs (total triples were 15,438,000). The standardized score of centrality ranged from 0.022 to 3.394. The overall network centralization score was 35.55 (percent). Network statistics were calculated via UCINET as described by Hanneman and Riddle (2005). In addition to these overall stats individual member attributes were obtained when available. For clan members, the following attribute information were available: sex, age, country, Xbox friends, clan friends, time in the clan, posts on clan Web site (informational exchange), other members' views of posts on the clan Web site, clan rank, monetary donation to the clan (monetary exchange), participant in clan activity 1 (time exchange), participant in clan activity 2 (time exchange), and membership of a competitive clan squad (time exchange). Clan activities appeared to be special member only events.

Game play stats were available for all members of the community and consisted of 47 independent variables that fell in four main dimensions decided by *Battlefield 4*developers: general stats, combat stats, squad stats, and team stats. The main variables that were used for analysis of in-game performance were (a) score per minute (SPM), general score divided by

minutes of gameplay; (b) skill, a mathematical representation of all players' stats in a standardized format ranging from 0 to 1000; (c) combat score, an individual's score in the game that includes items such as kills, headshots, etc.; (d) squad score, actions in the game that benefit the squad such as repairs, revives, assists, etc.; (e) team score, actions that contribute to the team winning the game such as objective defense, flag capture, etc. Other variables considered were kill to death ratio as well as win to loss ratio as these are stats that are often examined by players.

Outliers

A conversion of the four variables of age, times in the clan, time in the game, and posts into standardized z-scores allowed an examination of outliers. One player was an outlier, at a threshold of +/- 4 *SD*, in the variable of posts; there were no other outliers at this threshold in the other variables examined. Furthermore, a Mahalanobis D2 test supported that this player was the only multivariate outliers at $p < .001$. This member was the founder of the clan and therefore it is natural that he had significantly more posts than other members did.

Analysis

Examination of the continuous variables used in this study revealed that three items were significantly skewed ($p < .001$): time played, time in the clan, and Xbox friends. Corrective actions, as proposed by Tabachnick and Fidell (2007), were attempted and all numerical transformations resulted in worse scores. Thus, claims related to time played, time in clan, and Xbox friends should be approached with caution. The following variables were tested for bivariate correlations: Bonacich score, Xbox friends, clan friends, days in the clan, posts to clan Web site, views of clan posts, donation to clan, clan activity 1, clan activity 2, and competition squad participation. As the current study is focused on the network properties of this clan, only correlations between Bonacich score and other variables are reported in the result section, but Table 1illustrates these correlations in their entirety. Multiple regressions analyses were then performed to test the three hypotheses examining the relationships between game players' Bonacich centrality scores and other variables, and to answer the research question about the relationships between game-activities (both online and off-line) and Bonacich centrality or power.

Table 1: Correlations between network based variables and Bonacich centrality score

		Bonacich	Xbox Friend	Clan Friend	Days in Clan	Views	Posts	Donate	Clan Act 1	Clan Act 2	Comp Squad
Bonacich	*r*	1									
	p										
	n	242									
Xbox Friend	*r*	.124	1								
	p	.395									
	n	49	49								
Clan Friend	*r*	.728**	.004	1							
	p	.000	.978								
	n	65	49	65							
Days in Clan	*r*	.524**	.090	.506**	1						
	p	.000	.537	.000							
	n	61	49	61	61						
Views	*r*	.146	-.048	.223	.566**	1					
	p	.260	.745	.084	.000						
	n	61	49	61	61	61					
Posts	*r*	.364**	-.019	.435**	.704**	.641**	1				
	p	.004	.899	.000	.000	.000					
	n	61	49	61	61	61	61				
Donated	*r*	.575**	-.024	.473**	.576**	.258*	.460**	1			
	p	.000	.870	.000	.000	.045	.000				
	n	65	49	65	61	61	61	65			
Clan Activity 1	*r*	.237	-.097	.206	.791**	.434**	.596**	.584**	1		
	p	.057	.506	.100	.000	.000	.000	.000			
	n	65	49	65	61	61	61	65	65		
Clan Activity 2	*r*	.597**	0.193	.473**	.746**	.468**	.480**	.618**	.541**	1	
	p	.000	0.184	.000	.000	.000	.000	.000	.000		
	n	65	49	65	61	61	61	65	65	65	
Comp Squad	*r*	.553**	0	.549**	.350*	.034	.280*	.385**	.108	.432**	1
	p	.000	.998	.000	.006	.795	.029	.002	.392	.000	
	n	65	49	65	61	61	61	65	65	65	65

Notes: * = $p < .05$, ** $p < .01$

Results

H1 of this study posited that the more tenure a member had in the clan the more central to the clan they would be. The variable of days in the clan was significantly and positively correlated with the Bonacich centrality score, $r(61) = .52$, $p < .001$; therefore *H1* based on the preferential

attachment was supported. The result indicated that the longer members were in the clan, the more central they were within the clan having both many direct and important indirect connections.

H2 proposed that a player's Bonacich centrality would be positively associated with the amount of time, monetary resources, and informational resources provided to the clan. Participation in clan activity two was significantly and positively correlated with the Bonacich score, $r(65) = .60$, $p < .001$. Participation in a competitive squad of the clan, which was a proxy measure of the time spent was significantly and positively correlated with the Bonacich score, $r(65) = .55$, $p < .001$. Donation to the clan (*i.e.*, monetary resource) was also significantly positively correlated with the player's Bonacich score, $r(65) = .58$, $p < .001$. Posts to the clan Web site, which measured the amount of information provided, was significantly and positively correlated with the Bonacich score, $r(61) = .364$, $p < .01$. As members spent more time with the clan, spent more money for the clan, and provided more information to the clan, their centrality scores increased, which supported *H2* that these exchanges would be associated with centrality.

H3 hypothesized that a player's centrality would increase as squad score and team score that measured the player's performance increased. All correlations from this analysis are reported in Table 2. The correlations that follow are related to *H3*. Squad score was significantly and positively associated with Bonacich centrality score, $r(178) = .20$, $p < .01$. Team score was not significantly associated, $r(178) = .02$, $p > .05$. Combat score was not significantly associated, $r(178) = .11$, $p > .05$. *H3* was partially supported in these findings, as only squad score was significantly associated with centrality. These findings indicate that the most central members did focus on the squad, but not on the team. Thus, squad score factors were later analyzed.

Table 2: Correlations between squad based variables and Bonacich centrality score

		Bonacich	SPM	Skill	W/L ratio	K/D ratio	Squad score	Team score	Combat score
Bonacich	*r*	1							
	p								
	n	242							
SPM	*r*	-0.01	1						
	p	0.899							
	n	178	378						
Skill	*r*	-0.077	.622**	1					
	p	0.304	.000						
	n	178	378	378					
W/L ratio	*r*	0.103	.353**	.365**	1				
	p	0.173	.000	.000					
	n	178	378	378	378				
K/D ratio	*r*	-0.005	0.009	-0.007	0.007	1			
	p	0.948	0.859	0.887	0.886				
	n	178	378	378	378	378			
Squad score	*r*	.198*	.252**	.283**	.220**	0.01	1		
	p	0.008	.000	.000	.000	0.852			
	n	177	377	377	377	377	377		
Team score	*r*	0.023	.277**	.284**	.172**	0.042	.688**	1	
	p	0.761	.000	.000	0.001	0.42	.000		
	n	178	378	378	378	378	377	378	
Combat score	*r*	0.112	.296**	.348**	.224**	0.043	.900**	.741**	1
	p	0.136	.000	.000	.000	0.401	.000	.000	
	n	178	378	378	378	378	377	378	378

Notes: * = $p < .01$, ** $p < .001$

To assess what clan-specific variables were most significant in explaining Bonacich centrality, and therefore answer *RQ1*, the researcher ran a linear regression analysis. Included in this analysis were all items significantly associated with a player's centrality: days in clan, posts, donations, clan activity 2, and participation in a competition squad as predictor variables and Bonacich centrality score as the dependent variable. Due to missing data demographic controls were not used in regression.

As a result, the model explained 45 percent of the variance (Adjusted R^2) of the Bonacich centrality score (see Table 3). The two variables that predicted Bonacich score significantly were donation to the clan ($\beta = 0.26$, $t = 2.04$, $p < .05$) and taking part in a competitive squad ($\beta = 0.33$, $t = 3.08$, $p < .01$). Days in clan, posts, and participation in clan activity 2 did not predict Bonacich score significantly, but are reported in Table 3. These results indicate that, in regards to out of game exchanges, being a member of a competitive squad was the most significant predictor of centrality and that donating to the clan was a significant predictor, but not as strong as participating in a competitive squad. Thus, the most significant exchange resource is time followed by monetary resource. Tolerance values, values of inverse frequency (VIF), and

condition indexes were all examined to see if collinearity was indicated, but it was not. One response had a residual value greater than 2.5; therefore, this response was analyzed to decide if it should still be in the analysis. This case was also present as an outlier in an assessment using Cook's D. A close analysis of this case revealed no responses that had any theoretical reason for exclusion; therefore, it was kept in the further analysis.

Table 3: Regression analysis on Bonacich centrality score of network variables

	B	SE	β	*t*	*p*
(Constant)	5246.787	486.752		10.779	.000
Days in clan	2.022	2.797	0.129	0.723	0.473
Posts	-0.975	3.349	-0.04	-0.291	0.772
Clan activity two	1741.971	1260.35	0.215	1.382	0.173
Comp squad	3191.416	1036.329	0.328	3.08	0.003**
Donated	2132.193	1048.013	0.255	2.035	0.047*

Notes: $n = 62$. $R^2 = .503$, $F(5, 56) = 11.147$, $p < .001$. * = $p < .05$ ** = $p < .01$

To assess what in-game variables were most significant in explaining the Bonacich score a linear regression analysis was performed. Since only one variable, squad score, was significantly correlated, the components of squad score were included as predictor variables to examine the relationships with Bonacich centrality score. The model explained 36% of the variance (adjusted R^2) of the Bonacich centrality (see Table 4). Two variables had significant relationships with Bonacich score. The first was the number of times a player revived other players ($\beta = 0.45$, $t = 4.69$, $p < .001$) and the second was the number of heals a player performed ($\beta = -0.23$, $t = -1.98$, $p < .05$). Suppression assists, resupplies, repairs, flag defends, and flag captures did not predict Bonacich score significantly, but are reported in Table 4. Tolerance values, VIF, and condition indexes were all examined to see if collinearity was indicated, but it was not. One response had a residual value greater than 2.5; therefore, this response was analyzed to decide if it should remain in the analysis. This case was also present as an outlier in an assessment using Cook's D. A close analysis of this case revealed no responses that had any theoretical reason for exclusion; therefore, it was kept in the analysis. Therefore, the most significant in-game predictor of centrality was reviving other members or possibly exchanging the members virtual life for another member's.

Table 4: Regression analysis on Bonacich centrality score of game variables

	B	SE	β	*t*	*p*
(Constant)	2798.821	331.091		8.453	.000
Suppression assists	-0.564	0.749	-0.108	-0.753	0.452
Resupplies	0.17	0.102	0.134	1.67	0.097
Repairs	0.254	0.33	0.082	0.769	0.443
Flag defends	-0.297	0.654	-0.134	-0.454	0.651
Flag captures	-0.046	0.506	-0.024	-0.09	0.928
Heals	-0.113	0.057	-0.232	-1.985	0.049*
Revives	1.234	0.263	0.448	4.688	.000**

Notes: $n = 177$. $R^2 = .140$, $F(7, 169) = 3.925$, $p < .001$. * = $p < .05$ ** = $p < .001$

Discussion and conclusions

Before discussing the specific findings in relation to our hypotheses, it is proper to decide if the current study's sample is a distinct and unique network. Density of the overall network was measured at .05 showing that the overall network was not incredibly dense. However, density of the gaming clan was .44 showing that the clan is moderately dense and connections are closer and more frequent than in the overall network community. Likewise, while overall network transitivity was 15.01, clan transitivity was 34.20 indicating higher tendency for forming cliques (*i.e.*, if A is a friend of B, and B is a friend of C, then A and C also become friends with each other) in the clan than in the overall community. Considering these findings, we can determine that the gaming clan studied has more distinct boundaries and functions as a network more precisely than the individuals that are related to the clan but not part of the clan.

Bonacich centrality was measured to determine the relative power of a member in the clan. The Bonacich score indicated that there were clear differences in power among the actors of this network. Therefore, examination of the possible contributions to the varying Bonacich power scores was warranted. *H1*, time in the clan would be significantly associated with Bonacich centrality, was supported by the result of correlation analysis. Game players with longer tenures within the clan probably had more opportunities to make connections with other players and interact with them by playing games together, helping them, and getting to know each other. Also based on the preferential attachment principle and power law distribution of network formation (Barabási and Albert, 1999), those who join the network later are more likely to form connections with early settlers who have more connections than others, which makes early settlers (longer tenures) become more central over time.

H2 was supported as time, money, and information resources all significantly predicted the Bonacich centrality score. This means the more often clan members played in competitive squad, donated to help other members, and interacted with them by posting on the discussion forum, the more powerful and influential they were in the network. In social exchange theory, the more resources game players invested in the community and relationships they built within the community, the higher returns (*i.e.*, central position) they received from the exchange. The social exchange happened in this gaming community might not be the form of *quid pro quo* reciprocity, as players might not receive the exact same form of resource as the one they invested in return, but more of network-generalized exchange (Malinowski, 1922) based on

interdependence among members and overall equity principle. The fact that gamers spent more time playing as a team (*i.e.*, squad), donated to help others and shared information within the clan may have more ceremonial and symbolic meaning for the community, which earned them more power/influence rather than direct economic benefits.

RQ1 asked which variables would be the most influential to members' centrality score. According to the regression analysis, donating to the clan and participating in a competitive squad of the clan were most influential to the Bonacich score (or member's influence/power in the network). These findings resonate with social exchange theory. Donation is a clear indicator that a member is committed to the clan and is willing to invest financial resources in the clan; therefore, these members are more likely to be embedded in many relationships and be more active in the clan as they are financially invested. Taking part in a competitive squad shows two other aspects of social exchange as it exemplifies both time for practice, scrimmages, and tournaments as well as a high cognitive load that is required to focus on competing in a complex game. Considering these findings, principles of social exchange theory, such as interdependence and equity apply to the online gaming context as well as to the offline daily life. See Figure 2 for a visual representation of these two variables (*i.e.*, donation and competitive squad) on the clan only network.

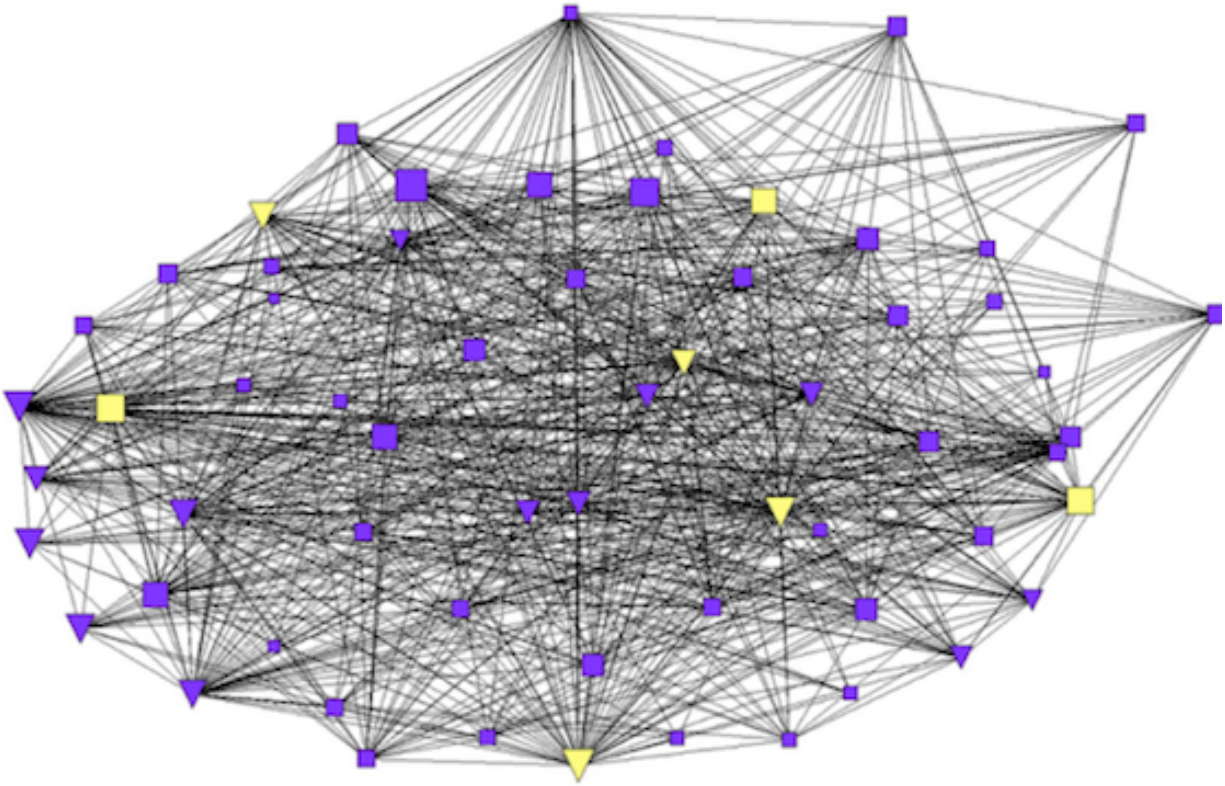

Figure 2: View of clan only based on donations and competitive squad membership.Notes. Node shape based on donations — triangle = donated, square = did not donate; Node color based on squad — yellow = competitive squad, purple = not in squad; Node size based on Bonacich centrality score.

H3 was supported as squad score, as a performance measure, was significantly and positively associated with Bonacich score. A regression analysis was performed to see what factors of squad score were most influential to Bonacich score. The squad score variables that were significantly associated with Bonacich centrality were reviving other players and distributing health. If player A is revived (brought back to life) or healed (provided more health) by player B, it is likely that player A will feel some sense of debt to player B and may be driven to return the favor, as predicted by social exchange theory's reciprocity and equity principles.

When considering the findings of this study, we conclude that social exchange principles can be applied to online relationships. Our findings support social exchange research and extend it from face-to-face interactions to online interactions. Examining social exchange in an existing online social network allowed for a more in-depth understanding of this communicative process and a realization that communication and relational behaviors are in the game.

Limitations and future research

The nature of this publicly available data led to two clear limitations in this study: missing demographic data and inability to view specific posts. First, members could decide to simply not complete their profile on the Web site and therefore only a handful of the clan members reported all their demographic data making analysis of this data inappropriate. Secondly, although we could see how many posts a member has posted in the community we could not see what the content of the posts were. Future researchers of gaming clans should consider an immersive ethnography of the clan to better gather this demographic data.

About the authors

Wiliam T. Howe is a doctoral student in the Department of Communication at the University of Oklahoma.
Direct comments to: w.howe@ou.edu

Sun Kyong (Sunny) Lee is an Assistant Professor in the Department of Communication at the University of Oklahoma.
E-mail: sunklee@ou.edu

Note

1. McGonigal, 2011, p. 80.

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