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The art of being together: How group play can increase reciprocity, social capital, and social status in a multiplayer online game

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ABSTRACT

In-game affordances that can encourage a positive community may be a means to avoid toxicity in massively multiplayer online games (MMOGs). Therefore, it is essential to investigate the affordances of a game design that can encourage prosocial behavior and positive outcomes among players. Drawing on play theories, affordance theory, and bounded generalized reciprocity theory, this study examined group play and its impact on in-game reciprocal behavior and subsequent social benefits (i.e., in-game social status, social capital) in a mobile MMOG, *Sky: Children of the Light*. A combination of cross-sectional survey data and six months of matched and anonymized preceding behavioral data ($N = 1{,}056$) were used for path analysis. The results suggest that players who engaged in more group play than solo play during the previous six months exhibited more reciprocity, had higher social status, and reported higher social capital. In addition, players who were more reciprocal had higher bridging social capital and a higher social status. Moreover, reciprocity was a significant partial mediator of the relationship between group play and social status. Theoretical and practical implications of the findings are discussed.

In the past few decades, the global video game industry has grown phenomenally, generating a worldwide market value of 159.3 billion U.S. dollars in 2020 (Clement, 2021). With the majority of U.S. adults (67%) regularly engaging in games (Entertainment Software Association, 2021), their impact on human communication and behavior has become a central research topic for communication scholars. Just as other media vary by genre and use, games offer a wide range of affordances and limitations. Among these, massively multiplayer online games (MMOGs) feature vibrant social activities, provide copresence (Frostling-Henningsson, 2009), and often generate in-game friendships that motivate gameplay (Badrinarayanan et al., 2015; Lu & Wang, 2008; Yee, 2006). MMOGs can function as social worlds that provide belonging, networking, and integration (Kaye & Bryce, 2012), which shows that the social functions in games are more than a mere means to an end (Whang & Chang, 2004). However, while games can foster human communication, social settings can sometimes engender contagious toxic behavior, such as cyberbullying, harassment, and griefing (e.g., Fox & Tang, 2017; Shen et al., 2020). Such unhealthy behavior is problematic, as it potentially harms the in-game community and the gaming industry (Blackburn & Kwak, 2014) in addition to the direct effects on victims. Thus, it is worth investigating affordances that encourage players to engage in actions that can potentially help foster a sustainable in-game community. One possibility is to increase reciprocal behavior among players. Reciprocal behavior has been deemed as a central feature in developing interpersonal relationships and maintaining group life across various fields, including developmental psychology and sociology (Axelrod, 1984; Brown, 1991; Hartup & Stevens, 1997). In investigating how to encourage reciprocal behavior in-game, this study relied on play theories, affordance theory, and bounded generalized reciprocity theory, as combining the three enables a better understanding of the complexity of our research model—the theories can complement each other to coherently examine the five variables of interest in the model (i.e., group play, reciprocity, bridging social capital, bonding social capital, and social status). The theories and relevant variables are delineated in detail below.

1. Learn while you play: play theories and affordance theory

First, play theories and affordance theory can provide theoretical insight into how group play as an affordance can affect players'

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reciprocal behavior. While there are numerous definitions of what "play" is, theorists in developmental psychology (Csikszentmihalyi, 1981; Fromberg, 1990; Frost, 1992) understand play as a vehicle, in which one can develop, practice, and integrate various experiences (e.g., imagination, intelligence, social skills) without fearing subsequent consequences. In this regard, commercial video games are considered effective teaching tools that can enhance learning and induce fundamental changes in players' world views (Eichenbaum et al., 2014; Li, 2018). Similarly, in the play theory of mass communication, Stephenson (1964) maintains that people use media to create and intensify self-identity by relating to the events and characters in the media while engaging in media consumption for entertainment rather than for information. As such, various play theories suggest that video games may encourage players to engage in a particular behavior (e.g., reciprocal behavior), through which players generate their self-identity without dreading the results of their performance. Then, among various aspects of video games, one might question which aspect is essential in encouraging reciprocal play.

Affordance theory (Gibson, 1979) suggests a relevant concept in answering the above question: Affordances denote possibilities for actions in a given environment, which have been applied to research to describe how individuals learn behavior. For instance, Heft (1988) asserts that children perceive the environment and adapt their actions according to its affordances. Therefore, it can be assumed that certain affordances can allow or block, and incentivize or disincentivize people to act in certain ways, an idea that has been explored in game studies (Williams, 2018). Similarly, the mechanics, dynamics, and aesthetics (MDA) framework (Hunicke et al., 2004; Sellers, 2006) suggests that game mechanics create a set of options, or affordances, for players in terms of actions, behavior, and control. As such, the positive and negative outcomes of games are driven by the *design* of games that provide certain rules players are expected to follow. For instance, participants in a competitive game behaved more aggressively than those in a cooperative game (Velez et al., 2016). In fact, cooperative goal structures are precursors to developing peaceful societies (Bonta, 1997; Deutsch, 1993; Johnson & Johnson, 1983). Therefore, just as games can incent players to engage in poor behavior, they can also incent players to become reciprocal with appropriate affordances of gameplay.

1.1. Group play as an affordance

Playing with others can be considered an in-game affordance that can incentivize players to exhibit and learn reciprocal behavior while enjoying the game without worrying about the consequences, as suggested by play theories. Contrary to the displacement hypothesis that online communication is associated with declines in social involvement (e.g., Kraut et al., 1998; Nie et al., 2002), many online game environments (e.g., MMOGs) have become inherently social (Kaye & Bryce, 2012), enabling in-game social interactions (Schultheiss et al., 2008). However, not everyone is fond of social interactions—Nardi and Harris (2006) note that many players spend substantial time "soloing" to avoid the problems that may arise from collaborating with others (e.g., taking additional time to assemble, clashes of personalities). According to play theories and affordance theory, preferring solo play results from certain affordances during the gameplay. For example, a game design that favors individual achievements at the expense of collaboration leads to players shifting away from social activities, ultimately threatening the in-game community and collective imagination (Braithwaite, 2018). In fact, teamwork is one of the contextual variables in games that can guide players' cooperative behavior (Gentile, 2011; Gentile et al., 2009; Gentile & Stone, 2005). Thus, encouraging group play among players may be a solution to promote reciprocal behavior and a positive in-game community.

2. What reciprocal individuals gain: bounded generalized reciprocity theory

The theory of bounded generalized reciprocity (BGR; Yamagishi et al., 1999; Yamagishi & Kiyonari, 2000) helps understand how reciprocity predicted by group play can yield positive outcomes in the community, including benefits that individuals can achieve (i.e., social capital, social status). Reciprocity can be motivated by self-interest, as reciprocal behavior can increase the chances of receiving benefits from others in the future (Gouldner, 1960; Yamagishi et al., 1999; Yamagishi & Kiyonari, 2000). In this sense, BGR posits that people will perform positive behavior toward others if they expect in-group members to behave the same. That is, if both parties know that they belong to the same group, they will perform more reciprocal behavior compared to when they interact with out-group members. BGR finds the reason for in-group favoritism in people trying to avoid having a bad reputation in their community, as it could potentially result in a loss of receiving favors from others in the long term (Yamagishi & Kiyonari, 2000). Therefore, it is expected that players in MMOGs will perform reciprocal behavior to show good intentions to others in the same community, which will potentially lead to their own benefits, such as favors from others and a good reputation. Thus, BGR provides a theoretical tool to examine how group play (i.e., in-group activity) and reciprocity can result in social benefits, connecting play theories, affordance theory, and BGR.

Although BGR was initially proposed to delineate intergroup behavior, the tenets of BGR apply well in video game environments. For instance, Velez's (2015) study shows that a helpful teammate in a video game was associated with a higher expectation of in-group reciprocity, which led to increases in helping behavior among teammates. Furthermore, BGR suggests that reciprocal behavior can happen not only simultaneously and synchronously (i.e., two individuals perform it at the same time), but also sequentially and asynchronously (i.e., one individual's behavior follows another's) (Yamagishi & Kiyonari, 2000). Considering that game items can be exchanged synchronously and asynchronously, BGR can be applied to investigate both simultaneous and sequential reciprocal behavior in game environments.

Another aspect of reciprocity that should be considered here is how reciprocal behavior influences communities. Reciprocity is a universal norm of fundamental human civilization which influences the stability of social systems (Gouldner, 1960), and is understood as a strategic behavior to accomplish social cooperation (Fehr & Rockenbach, 2004). While the intention of reciprocal behavior can be traced back to egoistic motivation, reciprocity has evolved in human societies such that it has become a "moral norm" that transcends one's self-interest (Gouldner, 1960; Selznick, 1994)—those who are not reciprocal may benefit individually, but such conduct is considered a cause of conflict and threat to the community. Therefore, reciprocity is deemed a "norm" that can facilitate a stable social system by inhibiting potential exploitations among group members. Based on these concepts, this study investigated whether being reciprocal in a community will lead to one's social benefits and whether those benefits increase if people are involved in more group behavior than individual behavior. As for social benefits, this study specifically focused on social capital and in-game social status.

2.1. Social capital as a social benefit

BGR and theories about reciprocity suggest that performing reciprocal behavior increases one's benefits as well as the overall benefits of the community. One of the benefits of exhibiting reciprocity can be social capital (Parks-Yancy et al., 2008). Social capital has different definitions according to various schools of thought, but it generally refers to benefits produced in a social network structure (Putnam, 2000; Resnick, 2001; Williams, 2006). Putnam (2000) introduced two types of social capital: bridging and bonding. Bridging social capital refers to weak ties and loose social connections between individuals that result in

opportunities for innovative ideas and new information—it helps broaden social horizons and worldviews (Williams, 2006). On the other hand, bonding social capital corresponds to close relationships (e.g., family, close friends) that provide emotional support and access to limited resources (Williams, 2006). According to Putnam (1995), shared norms of reciprocity are a vital factor in fostering social capital among members of a community. And, reciprocal actions are a critical part of not only face-to-face communities but also virtual communities (Blanchard & Horan, 1998; Wellman & Gulia, 1999). Therefore, it is worth investigating whether reciprocal behavior in MMOGs can lead to an increase in social capital for individuals and communities.

2.2. Social status as a social benefit

According to BGR, one motivation that drives people to exhibit reciprocal behavior is the desire to avoid having a bad reputation in one's community (Yamagishi & Kiyonari, 2000). In other words, reciprocity is a way to manage one's social status, which broadly refers to an individual's influence and potential over valuable resources (Cheng et al., 2010). Differences in social status inevitably emerge in social groups (Leavitt, 2005; Magee & Galinsky, 2008; Van Vugt et al., 2008), and it is not uncommon for members in the community to desire to achieve a high social status (Anderson et al., 2015; Magee & Galinsky, 2008). In fact, a high social status comes with benefits for individuals, such as power, self-esteem, and physical well-being (Hardy & Van Vugt, 2006; Keltner et al., 2003; Marmot, 2004). Among various factors that lead to the emergence of hierarchy, reciprocity plays an important role—a lack of reciprocity can lead individuals to lose their status (Gould, 2002). While reciprocity and social status have been studied in offline settings, little effort has been devoted to understanding how reciprocal behavior in-game can affect one's social status in virtual communities. Therefore, this lack of research warrants the need to investigate how people achieve a high social status in game environments to foster a positive online game community.

3. Contextualizing theories in games—*Sky: Children of the Light*

Based on the above theories and review, *Sky: Children of the Light* (*Sky*), a free-to-play mobile MMOG developed by *thatgamecompany*, was used to investigate group play as an affordance and its impact on social benefits for the players. *Sky* takes place in a fantasy kingdom, where players can fly around together to find fallen ancestor spirits and restore them to the constellations in the sky. In collecting the spirits, players do not compete against each other. Instead, they are *encouraged to collaborate* by flying together or guiding spirits as a team. In fact, the central theme of the game is "compassion" (Martens, 2019)—progressing in the game results in having a better ability to socialize with other players. For instance, advanced players can unlock additional abilities to interact with friends (e.g., hug, chat) or shoot fireworks to celebrate. Therefore, *Sky* is particularly focused on helping each other and being kind to others, which makes it a suitable environment to observe reciprocal behavior among players.

3.1. Helping and gifting in Sky

In keeping with play theories and BGR, Sky's affordances and mechanics likely have a direct bearing on how players interact and reciprocate with others. Central to level advancement in *Sky* is its in-game currency, which are candles that players can collect from different realms or through daily quests. Players primarily collect candles to unlock/buy cosmetics (e.g., capes, masks), spells (e.g., fast recharge spell), and advanced expressions (e.g., laugh). However, candles can also be spent on other players to help them. In *Sky*, to play in the same group requires in-game friendship, and friendship requires candles; to send a friend request to another player in the first place, a player has to spend one candle. This friendship is necessary to be involved in group play because avatars need to be (virtually) physically attached (e.g., holding hands) in *Sky* to move together as a group. Notably, it is *Sky*'s culture for experienced players to help out those in need; it is not uncommon in *Sky* to see veteran players helping beginners by holding hands, as beginners often rely on veteran players to find spirits, collect candles, or complete quests. Whilehelping other players with quests requires a certain form of reward (i.e., in-game items) in some games, helping without extrinsic rewards is one of the granted norms in the *Sky* community. As mentioned above, holding hands for assisting others requires friendship through one candle.[1] Therefore, offering candles to other players can be understood as "helping by spending" in *Sky*.

Another use of candles for *Sky* players is to exchange hearts. Players can exchange three candles for one heart, which can then be sent to friends. Hearts are considered rare items because a player can only get a limited amount of them from the ancestor spirits. Any additional hearts obtained are gifts from friends, limited to one per day from each friend. As certain items can only be purchased using hearts, in-game friendship is essential in obtaining more hearts to gain those items. As players acknowledge that hearts are precious in *Sky*, hearts are used as gifts for other players to help them achieve their goals. Even the user interface in *Sky* shows a gift box icon to denote the heart-gifting function. Accordingly, heart-gifting can be understood as "helping by gifting" in *Sky*.

The two forms of helping others (i.e., candles and hearts) require in-game labor (e.g., collecting candles every day). Therefore, these currencies are relevant to the norm of reciprocity, as not returning others' favors is considered rude. In fact, various online *Sky* communities make it clear to the members that the behavior of not reciprocating should be reported to the moderators. And, oftentimes, those who are reported are banned from participating in the community. Thus, candles and hearts are suitable instruments to observe reciprocal behavior in the *Sky* community.

3.2. Theories in action in Sky

Based on the context of *Sky* and aforementioned theories, this section will discuss research questions and hypotheses.[2] First, play theories suggest that players in *Sky* may obtain certain behaviors through certain affordances. In *Sky*, group play as an affordance may encourage reciprocal behavior among players. As alluded to above, players must have a good understanding of not only the game mechanics (e.g., locations of candles, flying skills) but also the importance of collaboration with friends to be successful in *Sky*. In that vein, playing together in *Sky* has advantages over playing solo, as more friends mean more in-game currencies (i.e., candles, hearts) to unlock cosmetics and friendship abilities, which, in turn, leads to in-game advancement (i.e., better ability to socialize with others). However, solo play can be preferable for some players, as group play can be more time-consuming and require more cognitive effort. For instance, flying as a group can cause players to be split up when entering a new area due to the limit on the number of players for each area, which requires patience and coordination among team members to reconvene. For this reason, some players might play solo more often, which may lead to a decrease in reciprocal behavior toward other players. Based on this context, this study investigated how group play (vs. solo play) as a game affordance can affect in-game reciprocal behavior and subsequent social benefits in *Sky*.

[1] A new update to *Sky* allows players to hold hands with strangers without spending candles. However, this study was conducted before the update.

[2] Research questions were generated when there is a lack of previous evidence that suggests specific relationships between the variables of interest (Connelly, 2015), thereby requiring further knowledge in the research gap (Farrugia et al., 2010). On the contrary, hypotheses were formulated when it was possible to expect certain directions (positive or negative) between the variables of interest based on theories or previous research studies (Polit & Beck, 2014).

In addition to play theories and affordance theory, theories on reciprocity and BGR can be applied to the context of *Sky*. As BGR purports, people tend to reciprocate more when they are in the same group (Yamagishi et al., 1999). In fact, expected in-group reciprocity was related with helping behavior among teammates (Velez, 2015). Thus, it can be expected that those who engage in more group play will exhibit more reciprocity, giving back to the members of the groups they belong to:

H1. Group play is positively associated with reciprocity.

BGR and theories on reciprocity also suggest that reciprocity can increase one's benefits, one of them being social capital (Parks-Yancy et al., 2008). To test this theory, this study investigated the social benefits (e.g., social capital, social status) of reciprocal behavior in *Sky*. First, when it comes to social capital in *Sky*, bridging social capital can be conceptualized as weak ties created by gaming in groups to socialize casually or merely complete quests, while bonding social capital can be understood as strongly-tied friends/groups (i.e., favorited friends) based on continuous in-game social interactions. Although the effect size was small, one study found that people who experienced reciprocity, compared to those who did not experience reciprocity, reported higher social capital in general (Wohn, 2011). However, more investigation is required on how reciprocal behavior might affect different types of social capital.

RQ1. Is reciprocity positively associated with bridging social capital?

RQ2. Is reciprocity positively associated with bonding social capital?

Another factor to consider with regard to social capital is group play. BGR suggests that being in the same community affects individuals' exhibition of reciprocal behavior (Yamagishi et al., 1999; Yamagishi & Kiyonari, 2000). Then, is being involved in a group (i.e., group play) more likely to result in reciprocal behavior compared to soloing, and, in turn, result in more social capital? To the best of our knowledge, reciprocal behavior has not been tested as a mediator of the relationship between group play and social capital, either in online or offline settings. However, a strand of research hints at the direct effects of group play on social capital. Traditionally, online game communities have been understood as a place to build bridging social capital more often than bonding social capital (Kobayashi, 2010; Williams, 2006), as they afford interactions between heterogeneous communities in terms of gender, ethnicity, and geographic location (Katz & Rice, 2002). In fact, the frequency of group play increases network diversity (Shen & Chen, 2015). Moreover, players can develop bonding social capital in MMOGs. For instance, guild members can develop strong ties as they interact frequently and share the guild identity (Hiltz & Turoff, 1993). And, in Zhong's (2011) study, the frequency of group actions in massively multiplayer online role-playing games was positively associated with gamers' bonding social capital.

H2a. Group play is positively associated with bridging social capital.

H2b. Group play is positively associated with bonding social capital.

Furthermore, this study also explored whether reciprocal behavior plays a mediating role between group play and social capital based on the above literature on the direct effects of group play on social capital:

RQ3. Does reciprocity mediate the relationship between group play and social capital?

Secondly, this study explored in-game social status as another social benefit of reciprocity among *Sky* players. In fact, reciprocity can signal the actor's resources and ability to confer benefits upon others, which drives others to choose the individual as allies instead of enemies (Barclay, 2013; Smith & Bird, 2000). And, not surprisingly, reciprocal individuals achieve a positive reputation in society (Fehr & Fischbacher, 2003; Nowak & Sigmund, 1998). Therefore, the following hypothesis was tested:

H3. Reciprocity is positively associated with social status.

BGR asserts that members in a community manage their reputation through reciprocity such that they do not lose the possibility of receiving benefits offered by others (Yamagishi & Kiyonari, 2000). Therefore, being in the same group (e.g., group play) will lead to individuals exhibiting more reciprocal behavior, which will contribute to achieving a higher reputation in *Sky*. In fact, individuals who contribute more to the group attain higher social status because they are viewed as valuing the group (Hardy & Van Vugt, 2006; Willer, 2009). Therefore, solo players may have lower social status due to not contributing to their social group, while group players may have higher social status due to efforts they put in their social group within the *Sky* community. Lastly, the hypotheses (*H1*, *H3*, and *H4*) suggest that there may be a mediation effect of reciprocity on the relationship between group play and social status (See Fig. 1 for the theorized research model).

H4. Group play is positively associated with social status.

RQ4. Does reciprocity mediate the relationship between group play and social status?

4. Methods

4.1. Procedure

In collaboration with the game publisher, *thatgamecompany,* a survey questionnaire was distributed in-game between November 20, 2020, and November 30, 2020, randomly to the players who reached the end of the last realm in *Sky*. Having finished the last realm indicates that the players have gone through the basic storyline of *Sky* at least once. *Sky* is designed such that players can see the ending by going through all seven realms, all of which constitute a storyline, a narrative journey. While players can opt to quit the game after seeing the ending, it is possible to collect more items and spirits by repeatedly visiting the realms that one had already gone through. In that sense, veteran players regularly visit the last realm to get special items even after finishing the storyline. Therefore, the last realm was chosen for survey distribution because we wanted to reach the players who have at least some degree of understanding of the game (i.e., what candles and hearts can do) to exhibit reciprocal behavior in *Sky*. In other words, the last realm enabled us to capture both beginners with some level of *Sky* knowledge and veteran players with profound *Sky* knowledge at random. Moreover, doing so enabled us to connect theories to our proposed model, as players who visit the last realm can provide information about exhibiting and experiencing group play, reciprocity, and subsequent benefits (i.e., social capital, social status) embedded in the three core theories of this study (i.e., play theories, affordance theory, and BGR).

4.2. Participants

Eligible participants were players who self-reported to be 18 years of age and older. After retrieving the survey data, it was linked to six months of in-game behavioral data (from April 12, 2020, to October 12, 2020) prior to the survey, including only the players who were active on *Sky* for at least 30 days during the six months. After combining the two datasets, 1,056 unique players were involved in the final analysis. All user information was anonymized by using randomized identifiers. Participants were aged 18–62 years old ($M = 23.02$, $SD = 5.12$). The average active days and playtime on *Sky* for the participants were 133.54 days ($SD = 77.11$) and 490.37 hours ($SD = 366.3$), respectively. On average, the participants had 50.55 friends ($SD = 65.18$) in-game. See Table 1 for further participant details regarding sociodemographic characteristics.

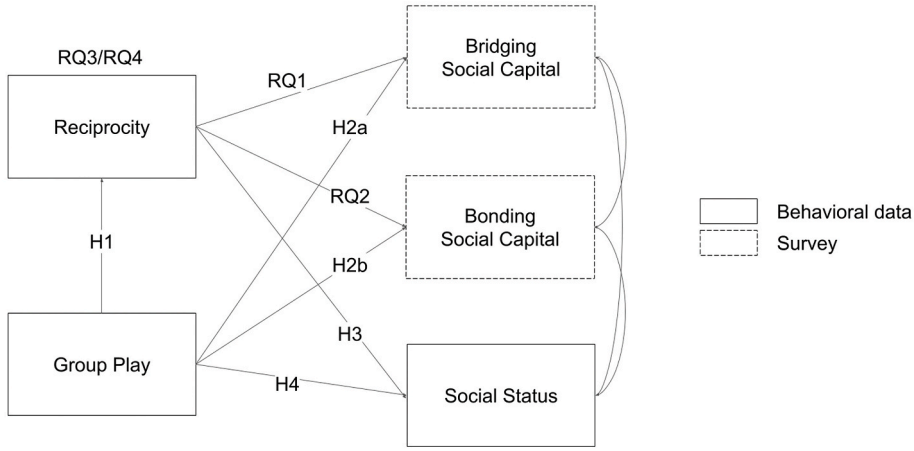

Fig. 1. Theorized research model.

Table 1
Sociodemographic characteristics of participants.

	n	%
Gender		
Female	773	73.2
Male	270	25.6
Other	13	1.2
Ethnicity		
Asian	778	73.7
White	132	12.5
Multiracial	115	10.9
Black	16	1.5
Other	15	1.4
Level of education		
Some college but no degree	334	31.6
High school or equivalent	277	26.2
Bachelor's degree	228	21.6
Associate degree	91	8.6
Master's degree	54	5.1
Professional degree (e.g., MD, JD)	39	3.7
Less than high school	27	2.6
Doctoral degree	6	0.6
Income		
Under $15,000	608	57.6
$15,000–29,999	200	18.9
$30,000–49,999	118	11.2
$50,000–74,999	68	6.4
$75,000–99,999	32	3.0
$100,000–249,999	22	2.1
$250,000 or more	8	0.8

Note. $N = 1056$.

4.3. Measures

4.3.1. Group play

When a player was active in *Sky*, the time spent was divided into sessions. A new session was created when a player moved to a new area in the game defined by *thatgamecompany*. Based on whether players engaged in group play or not, each player's session was categorized as either "solo play" or "group play." The game system recorded a group play session when a player had at least one friend present within four virtual meters of the player[3] in a session, whereas solo play was logged when no other players were present or only strangers were present.[4] The occurrence of each session between April 12, 2020, and October 12, 2020, was counted for each player, based on which the group play rate was obtained by dividing the seconds spent in group play sessions by the total seconds of gameplay sessions. Each player's group play rate can range from 0 to 1, where a value closer to 1 indicates that the player has been involved in more group play than solo play.

4.3.2. Reciprocity

In-game reciprocity was measured by computing the proportion of the total number of in-game currencies (i.e., candles and hearts) a player offered to other players compared to the total amount of currencies one held by October 12, 2020. Therefore, a more generous player will spend more candles and hearts for other players in order to help and gift them during the same amount of time. The score was normalized such that the variable ranges from 0 to 1, where a bigger value indicates that a player has engaged in more reciprocal behavior.

4.3.3. Social status

To assess a player's social status in-game, a PageRank (PR) score has been adapted. PR scores have been frequently used in search engine optimization to evaluate the importance of a web page (e.g., Xing & Ghorbani, 2004), but have also been applied to evaluate and identify influential users and their social power ranking as a proxy for importance in the network (Gleich, 2015; Heidemann et al., 2010). An outbound link was created pointing from a player u to a friend v a) when they had active relationships (i.e., interacted within the last two weeks), and b) when the player has given more than four in-game currency items (i.e., candles) to the other player or received more than two in-game currency from that friend; and the same player will also have an inbound link from the friend if, from the friend's perspective, the two

[3] One meter in *Sky* is equivalent to the default height of a player's avatar.

[4] Playing with strangers was coded as solo play because it takes up less than 10% of the total gameplay time for each realm. Completing one realm in *Sky* takes 40 min on average (HowLongToBeat, 2022), but gameplay that requires strangers only takes a few seconds to a few minutes (e.g., about 2.5 min as shown in Press Peach, 2021). Moreover, tasks involving strangers are functional rather than social, where players are not expected to connect with others. Thus, counting gameplay with strangers as group play undermines our intention to measure how the core values of *Sky* (e.g., friendship, socializing) manifested by group play can predict reciprocity and social capital.

criteria were satisfied. For each player u, the ratio $r(u)$ between the number of inbound links to a player $I(u)$ and the number of outbound links from the player $O(u)$ was computed $\left(r(u) = \frac{I(u)}{O(u)}\right)$, and the PR score of a player is the sum of the ratio of all the player's friends $v \in B(u)$, denoted as $PR(u) = \sum_{v \in B(u)} r(v) = \sum_{v \in B(u)} \frac{I(v)}{O(v)}$. This score was calculated every 15 minutes when a player was active on *Sky* to dynamically indicate the social status at the time frame. For the players without any outbound links, the ratio was calculated as the number of inbound links over the number of all active players at the time frame. For the analysis, the final score for each player was retrieved from the last date a player logged on *Sky* between April 12, 2020, and October 12, 2020. The score was normalized to have a value between 0 and 1 to indicate the quantile of players based on the PR score, where a value closer to one denotes a higher social status of a player in-game.

4.3.4. Social capital

Williams' (2006a) Social Capital Scales (SCS) were adapted for use to assess the players' social capital, which involved a bridging social capital subscale (10 items) and a bonding social capital subscale (8 items).[5] Participants were asked to rate each item based on how much they agree with the statements about when they are playing *Sky* based on a 5-point Likert scale ranging from 1 (*I disagree completely*) to 5 (*I agree completely*). Example items for the bridging social capital subscale include: "Interacting with people in Sky makes me feel like part of a larger community" and "Interacting with people in Sky reminds me that everyone in the world is connected." Example items for the bonding social capital subscale include: "When I feel lonely, there are several people in Sky I can talk to" and "The people I interact with in Sky would help me fight injustice." Cronbach's alpha for bridging social capital was .90, and for bonding social capital, .87.

4.3.5. Controls

Age, gender, the number of active days on *Sky*, playtime on *Sky* in hours, and the number of friends each player has were used as control variables.

4.4. Analysis

Path analysis was conducted in *R* version 4.0.3 (R Core Team, 2020) using the *lavaan* package (Rosseel, 2012). The path modeling approach (Bollen & Long, 1993; Loehlin, 1987) was chosen to investigate the complex relationships between the variables of interest and test potential mediation effects. Next, in order to control for the variance accounted for by the control variables mentioned above (i.e., age, gender, race, income, education, number of active days, playtime in minutes, number of friends), a residualized covariance matrix was created before testing the theorized model by regressing all variables in the model on the control variables, following Shah et al.'s (2007) method.[6] Then, the residualized covariance matrix was used to compute the path estimates. Therefore, the results can be interpreted without the variance explained by the control variables. Mediation analysis using percentile bootstrap confidence intervals was conducted to test the role of reciprocity in the model.

5. Results

5.1. Model specification

Various indices were tested to evaluate the fit between the theorized model and the data based on the cut-off criteria suggested by Hu and Bentler (1999); they recommend a) a non-significant χ^2 statistic, b) the Comparative Fit Index (CFI) larger than .90, c) the Tucker-Lewis Index (TLI) larger than .95, and d) the Root Mean Square Error of Approximation (RMSEA) less than .05. The goodness-of-fit value (χ^2 statistic) failed to support an acceptable fit ($p < .001$). However, researchers are recommended to test other fit indices as well because the χ^2 test is sensitive toward complex models and large samples (Kline, 2005). While the χ^2 statistic did not show a good model fit, other fit indices indicated an acceptable model fit (CFI = 1.00, TLI = 1.00, RMSEA < .001).

5.2. Direct effects

Direct effects on the endogenous variables were estimated by standardized path estimates (see Fig. 2). As hypothesized, group play positively influenced reciprocity ($\beta = .11$, $p < .001$). Therefore, H1 was supported. H2a and H2b were also supported as group play significantly predicted bridging social capital ($\beta = .39$, $p < .01$) and bonding social capital ($\beta = .88$, $p < .001$), respectively. Moreover, group play was a significant predictor of social status ($\beta = .18$, $p < .001$), which indicates that H4 was supported as well. Next, reciprocity positively affected bridging social capital ($\beta = .45$, $p < .05$), answering RQ1. As suggested by H3, reciprocity was positively associated with social status ($\beta = .43$, $p < .001$). RQ2 asked about the relationship between reciprocity and bonding social capital. The results showed that reciprocity did not significantly predict bonding social capital ($\beta = .41$, $p > .05$).

5.3. Indirect effects

RQ3 asked whether reciprocity mediates the relationship between group play and both types of social capital. The results of the mediational analysis revealed that there is a significant total effect of group play on bridging social capital ($\beta = .44$, $p < .01$, 95% CI [.17, .71]). In addition, a direct effect of group play on bridging social capital was found to be significant ($\beta = .39$, $p < .01$, 95% CI [.12, .67]). However, no significant indirect effect of group play on bridging social capital was found ($\beta = .05$, $p > .05$, 95% CI [.00, .11]). Therefore, no supporting evidence was found for the mediating effect of reciprocity on the relationship between group play and bridging social capital. Also, reciprocity significantly did not mediate the relationship between group play and bonding social capital, as the indirect effect of group play on bonding social capital was insignificant ($\beta = .04$, $p > .05$, 95% CI [-.01, .10]), although the total effect ($\beta = .92$, $p < .001$, 95% CI [.62, 1.23]) and the direct effect ($\beta = .88$, $p < .001$, 95% CI [.58, 1.19]) were significant.

Next, RQ4 questioned if reciprocity mediates the relationship between group play and social status. Results show that there is a significant total effect of group play on social status ($\beta = .23$, $p < .001$, 95% CI [.17, .29]). The indirect effect of group play on social status was also significant, with reciprocity mediating the relationship ($\beta = .05$, $p < .001$, 95% CI [.02, .08]). In addition, a significant direct effect of group play on social status was found ($\beta = .18$, $p < .001$, 95% CI [.13, .24]), indicating that reciprocity partially mediates the relationship between group play and social status. Table 2 summarizes the results of mediation analyses for the theorized model.

[5] A confirmatory factor analysis was conducted with Social Capital Scales (20 items) to confirm that the two social capital components (bonding and bridging) are distinct. Oblimin rotation was used as the two subscales are intended to be related, not wholly separate (Williams, 2006). All reverse items were recoded beforehand. The items load onto each factor as intended. The analysis yielded two factors, which is consistent with previous literature (Oztok et al., 2015; Stefanone et al., 2012; Yu & Wang, 2019). Two items from the bonding social capital subscale (the third and the ninth items) were removed from the analysis as they loaded less than |0.4| on the bonding social capital component. Therefore, eight items in the bonding social capital subscale were utilized in the analysis. See Appendix B for factor loadings and communalities.

[6] The control variables accounted for a substantial amount of the variance (12.79%–94.25%). See Appendix A for the results of regression analyses for residualization.

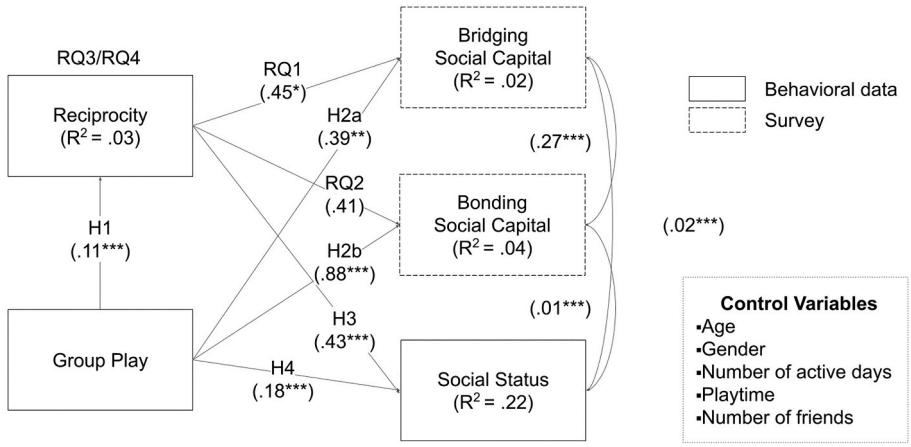

Fig. 2. Results of path analysis for the theorized research model. *Note.* $*p < .05$. $**p < .01$. $***p < .001$. For RQ3 and RQ4, refer to Table 2 for further details.

Table 2
Results of mediation analysis for the theorized research model.

Consequent		Antecedent		
		X	M	
		Group play	Reciprocity	Constant
Reciprocity	Coeff.	.11***	–	.01***
	SE	.03	–	.00
	95% CI	[.06, .16]	–	[.01, .02]
Social status	Coeff.	.18***	.43***	.02***
	SE	.03	.05	.00
	95% CI	[.13, .24]	[.33, .53]	[.01, .02]
Bridging social capital	Coeff.	.39**	.45#	.50***
	SE	.14	.23	.02
	95% CI	[.12, .67]	[.01, .91]	[.45, .55]
Bonding social capital	Coeff.	.88***	.41	.70***
	SE	.15	.25	.03
	95% CI	[.58, 1.19]	[-.09, .88]	[.64, .76]

Note. $^{\#}p = .05$. $*p < .05$. $**p < .01$. $***p < .001$.

6. Summary

For social status, reciprocity ($\beta = .43$, $p < .001$) was more influential than group play ($\beta = .18$, $p < .001$), where reciprocity was a significant mediator between reciprocity and group play, although the effect size was smaller than the direct effects ($\beta = .05$, $p < .001$). Similarly, reciprocity ($\beta = .45$, $p < .05$) was more influential than group play ($\beta = .39$, $p < .01$) for bridging social capital. Finally, for bonding social capital, only group play ($\beta = .88$, $p < .001$) was a significant predictor. Reciprocity was not a significant mediator between group play and both types of social capital.

7. Discussion

Considering that social features in games can generate a toxic in-game culture (e.g., cyberbullying), this study was conducted to investigate whether group play as an affordance in an MMOG can facilitate reciprocal behavior among players and bring benefits to individuals in the community. This study suggests that spending more time group-playing than soloing leads to individuals exhibiting more reciprocity in *Sky*. This finding adds to the previous literature on group play and reciprocity in video games (e.g., Greitemeyer & Cox, 2013; Greitemeyer et al., 2012; Jin & Li, 2017), as this study is one of the first to find evidence for the effects of group play on reciprocal behavior in an MMOG environment. In addition, the results suggest that group play not only leads to more reciprocity among players but also to an individual player's higher measures of bridging social capital, bonding social capital, and social status. These findings indicate that group play is generally beneficial for both the community (i.e., increased amount of reciprocity) and the individuals (i.e., higher social capital and social status).

Moreover, reciprocity was a significant partial mediator of the relationship between group play and social status, which implies the existence of a virtuous circle where players who engaged in more group play than solo play over the previous six months were more likely to gain higher social status through exhibiting more reciprocity. Therefore, this study is the first in the field, so far as we know, to provide longitudinal validation regarding whether group players exhibit more reciprocal behavior in an MMOG and if being reciprocal in that context is beneficial to those players. Moreover, this analysis accounted for longitudinal effects based on the players' behavioral patterns that took place before the survey was executed. Survey methods are traditionally considered limited due to potential bias in self-reported measures. However, behavioral data in this study can provide unobtrusive data, which overcomes the shortcomings of a survey method employed alone. Therefore, the results of this study provide rigor that overcomes the typical cross-sectional nature and self-reported bias of survey-only research.

In addition, this study is the first to test the mediating role of reciprocity between group play and subsequent social benefits (i.e., social capital and social status) in an MMOG. While no significant mediating effects of reciprocity were found for the relationship between group play and two types of social capital, reciprocity was a significant partial mediator of the relationship between group play and social status. Therefore, when considering the relationship between group play and social status, reciprocity may be an essential mediating variable. While reciprocity was an insignificant mediator between group play and both types of social capital, it should be noted that the relationship between reciprocity and bridging social capital in the mediational model was close to significant ($p = .05$). In other words, reciprocity could potentially be a partial mediator between group play and bridging social capital with better prediction models including additional factors, such as the frequency of encounters or the content of verbal exchanges between players.

The current results provide several theoretical and practical implications. First, they provide evidence that play theories are applicable to game environments and that gameplay can serve as a vehicle for players to develop certain behavior (e.g., reciprocal behavior). In other words, commercial games like *Sky* have the potential to be used as a teaching tool (Eichenbaum et al., 2014; Li, 2018) to make players embody reciprocity. This is in line with research that investigates the possibility of video games to foster positive outcomes (e.g., increase prosocial thoughts; Greitemeyer & Osswald, 2011) and potentially change health behavior (Lister et al., 2014). In other words, play theories and affordance theory suggest that game developers and designers can promote

positive behavior by implementing a game structure (e.g., affordances) that encourages prosocial behavior, which can eventually reduce in-game toxicity. Second, the findings indicate that group play is an in-game affordance that can positively affect individuals' reciprocity as well as their social capital and social status. Therefore, game designers should encourage social affordances for the individual players as well as the in-game community. Having more reciprocal individuals can potentially contribute to a sustainable gaming community, as reciprocity is essential for community-building and player engagement (Kou et al., 2017). Based on BGR's theorem that people tend to reciprocate in-group members' positive behavior, reinforcing reciprocity (and ultimately reducing toxicity) in a game structure can make the community a place where players want to stay. Moreover, each player can enjoy the benefits of higher social status and social capital and will be less likely to quit—this can be advantageous for game developers as they can expect less player churn.

Moreover, the results extended the application of BGR to a mobile MMOG for the first time. Our findings provide an empirical insight for BGR regarding whether performing reciprocity can result in social benefits. BGR notes that not being reciprocal in the group can result in losing the opportunity to receive favors from others in the long term (Yamagishi & Kiyonari, 2000). The results of this study demonstrate that less reciprocal players perceived themselves to have less bridging social capital and lower social status than those who were more reciprocal after six months. Therefore, the findings support BGR by demonstrating that performing reciprocal behavior helps individuals avoid a bad reputation and achieve increased social benefits, as demonstrated by higher bridging social capital and social status. Based on these findings, reciprocity as a social norm to establish a stable social system (Gouldner, 1960) is present in an online game world as well as the "real" one. Thus, game designers and online community moderators should focus on facilitating reciprocal behavior among group members in order to sustain positive online communities. However, it has to be taken into consideration that *Sky* is a unique game, as it is specifically designed to encourage positivity towards other players. In other words, group play in a naturally cooperative game may be different from group play in a violent game, and not all games will see increased reciprocity via group play. Hence, forthcoming researchers are encouraged to conduct additional research using other types of games to see the effects of group play on reciprocity and social benefits. Nevertheless, this study provides theoretical connections between play theories, affordance theory and BGR by examining the relationships among group play, reciprocity, social capital, and social status in a single model as evidenced by empirical data.

Practically, the findings have implications for offline communities as well. The mapping principle (Williams, 2010) states that understanding in-game behavior can inform the corresponding offline behavior under some circumstances. Therefore, researchers or policymakers who work to improve local communities may utilize these results to foster positive community culture, encouraging group members to engage in more reciprocal interactions. Moreover, online socializing features can be utilized to promote the sense of community in pandemic times or in rural communities where people are physically distant and isolated, as being in a group and being reciprocal can bring positive social benefits for both the community and individuals.

8. Limitations and directions for future research

While there are meaningful implications of this study, the results should be interpreted with limitations in mind. First, a self-selection bias should be taken into consideration when interpreting the results because this study looked at the uncontrolled, natural behavior of the players over time. As there was no control group, it is difficult to tell if the players exhibited reciprocity due to the affordances of the game or because they happen to be reciprocal players who chose to play *Sky* in particular. While the methods of this study prioritized external validity, the results of this study may not hold for everyone who plays *Sky*. Second, this study showed that there is no significant relationship between reciprocity and bonding social capital. The insignificant results may be due to hidden confounding variables (e.g., the frequency of encounters) that should be considered. Therefore, future research can investigate additional factors regarding the relationship for a more accurate analysis, which may reveal new information about the mediating role of reciprocity between group play and social capital that was not discovered in this study. Third, the measure of reciprocity may not be accurate as it reflects the propensity of a player's friends in terms of how generous they are. If a player has a very generous friend who gives more than what one receives, a player's reciprocity score can become lower than their actual level of reciprocity. Therefore, future studies should find more rigorous ways to measure reciprocity by controlling for other people's generous personalities. Fourth, this study is rooted in the theoretical perspective that the systematic structure can shape the behavior of individuals. However, a different theoretical approach is also present where the emphasis is more on the agency of individuals in terms of the creation of culture and content (e.g., participatory culture as in Jenkins, 2006). Thus, future research could employ the latter perspective to investigate how players develop, interact, and learn through their engagement and individual traits (e.g., personality) to enrich the understanding of maximizing in-game reciprocity. Finally, future research can investigate whether group play can encourage not only in-game reciprocity but also reciprocal behavior in offline settings to see any carryover effects.

9. Conclusion

Building on play theories, affordance theory, and BGR, the results of this study demonstrate that group play as an affordance in gameplay can encourage reciprocity among players, which, in turn, results in beneficial social outcomes for individuals (i.e., enhanced social capital and social status) as well as for the whole community. This study was one of the first to examine the effects of group play on reciprocal behavior and subsequent benefits in a mobile MMOG through a combination of behavioral data and survey data. The findings of this study are expected to provide insight into game designs and education/intervention research utilizing games to shape behavior change.

Credit author statement

Steffie Kim: Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Software, Formal analysis, Visualization, Project administration. Ke Huang-Isherwood: Conceptualization, Writing – original draft, Writing – review & editing. Weiwei Zheng: Conceptualization, Writing – review & editing, Methodology, Software. Dmitri Williams: Conceptualization, Writing – review & editing, Investigation, Resources, Supervision.

Declaration of competing interest

There is no conflict of interest with this paper.

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Appendix A. Regression Analyses for Residualization

	Group play	Reciprocity	Bridging social capital	Bonding social capital	Social status
Age	-.006***	.001	-.023***	-.033***	-.002*
Gender (Male)	.006	.012	.125*	.064	.003
Gender (Other)	.043	.026	.388#	.054	.049
Active days	-.001***	.000	-.002***	-.002***	.000
Playtime (hrs)	.000***	.000***	.001***	.001***	.000***
Number of friends	.000**	.000	.001**	.001	.000
R^2 (%)	30.22	6.08	9.05	10.16	32.17

Note: Standardized regression coefficients are reported.
#$p = .05$. *$p < .05$. **$p < .01$. ***$p < .001$.

Appendix B. Factor Loadings and Communalities for Social Capital Scales Items

Component	1	2	Communality
	Bridging	Bonding	
Interacting with people in Sky makes me interested in things that happen outside of my town in real life.	**0.641**	0.114	0.467
Interacting with people in Sky makes me want to try new things.	**0.703**	0.135	0.568
Interacting with people in Sky makes me interested in what people unlike me are thinking.	**0.684**	0.038	0.485
Talking with people in Sky makes me curious about other places in the world.	**0.790**	-0.126	0.580
Interacting with people in Sky makes me feel like part of a larger community.	**0.811**	-0.059	0.632
Interacting with people in Sky makes me feel connected to the bigger picture.	**0.778**	0.028	0.620
Interacting with people in Sky reminds me that everyone in the world is connected.	**0.775**	-0.061	0.576
I am willing to spend time to support Sky community activities.	**0.621**	0.171	0.478
Sky gives me opportunity to talk to new people.	**0.774**	-0.126	0.557
In Sky, I come in contact with new people all the time.	**0.553**	0.177	0.396
There are several people in Sky I trust to help solve my problems.	0.398	**0.470**	0.491
There is someone in Sky I can turn to for advice about making very important decisions.	0.376	**0.546**	0.562
There is no one in Sky that I feel comfortable talking to about intimate personal problems.	0.239	-0.219	0.074
When I feel lonely, there are several people in Sky I can talk to.	0.440	**0.422**	0.482
If I needed an emergency loan of $500, I know someone in Sky I can turn to.	-0.261	**0.797**	0.579
The people I interact with in Sky would stand up for me, even if it was hard.	0.273	**0.678**	0.645
The people I interact with in Sky would be good job references for me.	0.073	**0.743**	0.590
The people I interact with in Sky would share their last dollar with me.	-0.153	**0.844**	0.659
I do not know people in Sky well enough to get them to do anything important.	0.092	-0.048	0.008
The people I interact with in Sky would help me fight an injustice.	0.182	**0.675**	0.563

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