Original Article

Different Gameplay Styles, Different Psychological Needs – Linking Relatedness to Behavioral Indicators of Relational Social Influence

Ji Ye Kim[1], Dmitri Williams[1], Donggyu Kim[1], Siyi Zhou[1], Zituo Wang[1], and Aimei Yang[2]

[1]School of Communication, Annenberg School for Communication and Journalism, University of Southern California, Los Angeles, CA, USA
[2]School of Journalism, Annenberg School for Communication and Journalism, University of Southern California, Los Angeles, CA, USA

Abstract: As Massively Multiplayer Online Games (MMOGs) grow in popularity and complexity, understanding how gameplay styles relate to players' psychological needs is increasingly important. Grounded in Self-Determination Theory, this study examines the associations between competence, autonomy, and relatedness and two dominant gameplay styles: achievement-oriented gameplay (AOG) and social-oriented gameplay (SOG). Given that relational influence provides an important context in which relatedness is enacted and sustained, we incorporate two interaction-based behavioral indicators – Social Value and Receptivity – as behavior-based measures of relational social influence. Using *Sky: Children of the Light*, we integrated large-scale behavioral data with survey responses. Structural equation modeling revealed that AOG was positively associated with competence and autonomy but negatively associated with relatedness and behavior-based relational influence, whereas SOG showed the opposite pattern, with parallel directional effects observed across relatedness and behavioral indicators of relational influence. A significant negative residual correlation was also observed between AOG and SOG. The results show that psychological need satisfaction differs across players' gameplay orientations and highlight relatedness as a dynamic process shaped through ongoing interaction.

Keywords: self-determination theory, MMOG, game behavior, media psychology

With the rapid advancement of online gaming technologies, Massively Multiplayer Online Games (MMOGs) provide players with diverse activities and goals while enabling rich social interaction and a strong sense of freedom. Beyond entertainment, gameplay is closely tied to players' psychology as it is driven by their intrinsic motivations and is often linked to the satisfaction of their psychological needs (Ryan et al., 2006). Literature has revealed that gameplay experience is also related to players' affective outcomes, such as enjoyment (Tamborini et al., 2010). At the same time, the popularity of MMOGs continues to grow annually, with an estimated 1.1 billion people playing them today (Clement, 2023). Given both their psychological significance and global growth, it is imperative to study people's behavior within online gaming environments.

Achievement-oriented gameplay and social-oriented gameplay are two of the most prominent playstyles commonly supported in MMOGs (Hamari & Tuunanen, 2014; Nacke et al., 2014). These styles map onto two core motivational dimensions – achievement and social interaction (Yee, 2006) – and have repeatedly emerged as central drivers of engagement across gaming contexts. While player motivations in MMOGs are multifaceted, achievement and social play represent two consistently observable behavioral orientations. Examining how these playstyles relate to players' psychological needs provides a meaningful lens for understanding player behavior in complex digital environments.

While a majority of studies have explored psychological needs related to players' enjoyment of gameplay and their intentions to continue playing (Merikivi et al., 2017; Reer & Krämer, 2020), relatively few have focused on how these factors vary across different gameplay styles. Furthermore, most existing research has primarily focused on a single gameplay style, limiting a deeper understanding of dynamic gameplay behaviors, as most players in MMOGs simultaneously engage in multiple playstyles (Tondello et al., 2019). To address this gap, the current study aims to examine the relationships between players' psychological needs in gameplay and two main playstyles through the framework of Self-Determination Theory. Specifically, to better understand how behavioral relationships in MMOGs relate to different playstyles, this study adopts a process-oriented perspective on sense of

belonging and incorporates behavior-based indicators of relational social influence relevant to relatedness in ongoing interaction.

Relatedness generally refers to an individual's sense of connection with others or their community (Ryan & Deci, 2000a), and prior research has largely focused on this subjective experience as a psychological state (Li et al., 2024; Liu et al., 2021). However, such approaches provide limited insight into how relatedness is sustained and reinforced through ongoing social interaction. From a self-determination perspective, relationships are grounded in interaction and maintained through relational influence (Ryan & Deci, 2000a), which plays a critical role in fostering relatedness (Best, 2024; Jeng et al., 2023; Peacock et al., 2020). Importantly, interaction does not require perfect symmetry; asymmetric dynamics such as leader–follower or giver–receiver relations can still support connection and need satisfaction (Blau, 1964; Mayseless, 2010). To address this gap, the present study incorporates two interaction-based behavioral indicators suggested by Williams et al. (2023) – outgoing influence ("Social Value") and incoming influence ("Following Value," later termed "Receptivity") – that align with how relatedness is sustained in ongoing social interaction.

Williams et al. (2023) introduced Social Value and Receptivity to quantify social influence using behavioral and network data. Social Value (SV) captures the extent to which an individual influences others' behavior, whereas Receptivity reflects the degree to which an individual's behavior is shaped by others through interaction.[1] While self-reported relatedness reflects how connected players feel, SV and Receptivity capture how relatedness is enacted and sustained through behaviors, providing the conditions under which subjective experiences of belonging emerge (Ryan & Deci, 2000a). By situating these behavioral processes alongside relatedness, this study contributes to Self-Determination Theory by clarifying how interdependence in multiplayer environments supports psychological need satisfaction.

Literature Review

Gameplay in Massively Multiplayer Online Games (MMOGs)

Gameplay motivation-related research has demonstrated that player motivations in MMOGs are multidimensional and vary by domain (e.g., games for health; Høeg & Van der Kaap-Deeder, 2024) and by genre (e.g., Battle Royale; Fernandez de Henestrosa et al., 2023). Among them, Yee (2006) categorized MMOG player motivations into three major types: achievement, social, and immersion, among which achievement and social motives are the most prominently observed across diverse environments. These two have consistently emerged as central to gameplay experiences, associated with players' advancement of in-game progress or formation of social connections (Reer & Krämer, 2020). Research further shows that both achievement- and social-oriented play are connected to positive affective outcomes (Ryan et al., 2006; Tamborini et al., 2010).

In terms of immersion, Billieux et al. (2013) found that some of these immersion-related motives, such as role-play, customization, and escapism, did not map cleanly onto specific in-game achievements, largely because immersion is less directly observable in actual gameplay. In line with this evidence, our study conceptualizes immersion-oriented play as a cross-cutting attribute that can manifest through progression or social interaction (e.g., improving game skills through exploration). Considering this study does not seek to provide an exhaustive taxonomy but adopts the most prominent gameplay styles, its approach acknowledges the diversity of player motivations while maintaining a streamlined framework that emphasizes the most salient dimensions for its hypotheses.

Building on this evidence, the current study classifies gameplay styles into achievement-oriented gameplay (AOG) and social-oriented gameplay (SOG) as two overarching modes of engagement that capture the most prominent motivational orientations in MMOGs.

Achievement-Oriented Gameplay

AOG is defined as a style of gameplay in which players strive to accomplish in-game objectives in pursuit of mastery, progression, or recognition (Sherry et al., 2012; Yee, 2006). The achievement-driven players engage in goal-oriented tasks such as leveling up or acquiring rare items. This form of gameplay often requires players to develop specific skills and demonstrate expertise in-game mechanics (McClanahan, 2009). Evans et al. (2011) further classify achievement-related gameplay into categories such as skill-based and repetition-based achievements. While skill-based achievements require players to demonstrate game mechanical expertise, repetition-based achievements – commonly manifested in daily quests – demand sustained effort and consistent behavior over time. These quests

[1] In Williams et al. (2023), the incoming influence property was originally termed "Following Value." In the present study, we refer to this property as "Receptivity," following later terminology (e.g., Yang & Williams, 2026). This term is used to avoid implying that incoming influence necessarily involves a power imbalance, as peers and equals can both exert and receive influence.

reward players with items essential for progression and are associated with sustained motivation to engage in AOG (Machado et al., 2017).

Social-Oriented Gameplay

Social-oriented gameplay (SOG) refers to a gameplay style centered on social interaction and relationship-building within the game environment (Yee, 2006). Players engaging in SOG find satisfaction in facilitating social interactions and making meaningful relationships with others (Sherry et al., 2012). For instance, they take prosocial action with other players or participate in cooperative gameplay. This aligns closely with the concept of SOG, where gameplay is sustained through diverse interactive activities that foster relationships between players.

It is important to note that players do not exclusively engage in a single form of gameplay as the nature of MMOGs lets players engage in both achievement- and social-related activities (Tondello et al., 2019). While researching only AOG may clarify the mechanisms behind players' goal achievement motivations, it may not adequately capture the motivations linked to in-game relationship building. Analyzing gameplay by these categories (AOG and SOG) allows us to see how psychological needs are related to gameplay depending on gameplay styles. Therefore, it is essential to consider both gameplay styles to comprehensively understand how gameplay relates to players' innate psychological needs.

Self-Determination Theory

Self-determination theory (SDT) has been widely applied to understand gaming behavior. According to SDT, individuals have universal, innate psychological needs for competence, autonomy, and relatedness (Ryan & Deci, 2000a). When these needs are satisfied, activities become more enjoyable, fostering greater engagement and persistence (Przybylski et al., 2010; Reer & Krämer, 2020; Ryan & Deci, 2000a,b). This needs satisfaction is necessary for promoting psychological health and well-being, as it encourages individuals to voluntarily engage in behaviors with a positive attitude and to feel socially integrated (Hulaj et al., 2020; Reer & Krämer, 2020; Ryan et al., 2006).

In the context of gaming, gameplay driven by intrinsic motivation – rooted in the satisfaction of these three basic needs – allows players to perceive gaming as inherently rewarding (Ryan et al., 2006). As such, the satisfaction of these psychological needs explains why players are willing to continue playing online games (Ryan et al., 2006); online games enhance their enjoyment by fulfilling these basic needs, providing players with a sense of satisfaction (Przybylski et al., 2010; Ryan et al., 2006).

Given that these needs fulfillments are associated with the success or failure of player behavior (Ryan & Deci, 2000a) and core motivations vary with gameplay styles (Elliot et al., 2017; Ryan et al., 2006), some needs could play a dominant role in particular gameplay styles (Gagné & Deci, 2005). Hence, analyzing the relationship between the two main gameplay styles and the SDT components can provide deeper insights into how SDT applies in different gaming contexts.

Competence

Competence is defined as an individual's perception of their ability to successfully complete a particular task (Ryan & Deci, 2000b). In the gaming context, competence refers to a player's self-perceived ability to effectively handle and master in-game challenges (Hulaj et al., 2020; Reer & Krämer, 2020). Specifically, task-oriented challenges are essential for satisfying players' competence needs, serving as a critical factor in motivating their gameplay (Ryan & Deci, 2000b). Such competence-oriented game mechanics allow players to fulfill their game-related competence needs through AOG. Therefore, higher levels of perceived competence may be associated with increased engagement in AOG. The following research hypothesis is proposed:

Hypothesis 1a (H1a): Players with higher levels of competence engage in more AOG.

Although the association between SOG and competence is less prominent compared to AOG, several studies have revealed SOG is also positively linked to a player's sense of competence (Reer & Krämer, 2020; Ryan et al., 2006; Vella et al., 2016). Social-oriented players discuss gameplay-related topics with other players through social interactions, which are linked with higher reported competence (Reer & Krämer, 2020). Based on the literature, this study assumes higher competence may also relate to greater SOG. The related research hypothesis is as follows:

Hypothesis 1b (H1b): Players with higher levels of competence engage in more SOG.

Autonomy

Autonomy is the sense of freedom to act by following one's own desires and values, without external control or pressure (Ryan & Deci, 2000a). Research has shown that satisfying autonomy needs is associated with greater engagement in AOG, as autonomy allows players to take responsibility for their own game progression by having them perceive gameplay as self-determined and meaningful (Deen, 2015; Ferriss, 2010). This heightened responsibility is associated with greater reported effort in

progressing and achieving objectives. Therefore, the proposed research hypothesis is as follows:

Hypothesis 2a (H2a): Players with higher levels of autonomy engage in more AOG.

However, existing literature suggests a negative association between autonomy and SOG (Deterding, 2016; Krassen, 2021). Because SOG often requires players to conform to community norms and cooperative practices, it is accompanied by lower reported autonomy. Deterding (2016) argued that SOG can heighten social pressure, as maintaining in-game relationships entails aligning with shared cultural expectations rather than pursuing individual preferences. Accordingly, greater SOG is expected to accompany lower autonomy. The corresponding research hypothesis is proposed:

Hypothesis 2b (H2b): Players with higher levels of autonomy engage in less SOG.

Relatedness and Relational Influence

Relatedness is defined as the feeling of belonging and connection to others (Ryan & Deci, 2000a). Prior research has largely conceptualized relatedness as a subjective perception of how connected an individual feels to others (Li et al., 2024; Liu et al., 2021). While this approach effectively captures a sense of belonging, it provides limited insight into how concrete interactions contribute to and sustain these perceptions, given that relationships are grounded in interaction and maintained through relational influence (Ryan & Deci, 2000a).

Indeed, relational influence through repeated interactions provides the behavioral substrate through which subjective relatedness is formed and reinforced (Best, 2024). The experience of influencing others' behavior is positively associated with the recognition of significance within the community, belongingness, and fulfillment of relatedness needs (Jeng et al., 2023; Peacock et al., 2020). Conversely, being influenced by others is associated with greater acceptance and stronger relatedness (Allen et al., 2021; Jeng et al., 2023). Thus, relatedness does not arise in isolation but is reinforced through ongoing behavioral exchanges. Taken together, these findings suggest that relatedness is not only a subjective psychological state but also a relational phenomenon that is enacted and sustained through relational influence embedded in ongoing interaction.

From this perspective, relatedness and behavioral interaction are mutually reinforcing: perceptions of belonging are sustained by enacted social exchange, while such exchanges are more likely to occur and persist when individuals perceive themselves as connected to others. This view aligns with social exchange theory, which conceptualizes social bonds as emerging from ongoing interaction and relational responsiveness (Blau, 1964). Additionally, reciprocity need not be perfectly symmetric; leader–follower or giver–receiver relationships can still satisfy the need for relatedness (Mayseless, 2010). Building on this process-oriented view, the present study is guided by prior work suggesting that social interaction provides an important context in which relatedness is enacted and sustained (Allen et al., 2021; Best, 2024; Blau, 1964; Jeng et al., 2023; Peacock et al., 2020; Ryan & Deci, 2000a).

Relatedness

In the gaming context, studies have shown that players who feel a strong sense of belonging to their game community have greater satisfaction with their relatedness needs (Hsiao & Chiou, 2017). Online games provide opportunities for cooperative play where they play together to complete game quests that contribute to their achievements in gameplay (Tamborini et al., 2010). This cooperative gameplay fulfills players' relatedness needs by facilitating meaningful social contact (Johnson et al., 2015). Given that goal-driven cooperative gameplay is often linked to AOG, relatedness satisfaction through goal-oriented cooperative gameplay may be connected to sustained AOG (Barr & Copeland-Stewart, 2022). Therefore, the following hypothesis is proposed:

Hypothesis 3a (H3a): Players with higher levels of relatedness engage in more AOG.

As noted earlier, SOG emphasizes interaction with other players, making it inherently tied to relatedness. With the growing popularity of MMOGs that promote social interaction, research has increasingly focused on the role of relatedness satisfaction in gameplay (Reer & Krämer, 2020; Tamborini et al., 2010). Ryan et al. (2006) identified relatedness as most strongly correlated with SOG among the SDT components. Building on these findings, this study hypothesizes:

Hypothesis 3b (H3b): Players with higher levels of relatedness engage in more SOG.

To reflect how relatedness is enacted through interdependent interaction, this study employs two interaction-based behavioral indicators – Social Value and Receptivity (Williams et al., 2023). As discussed above, these measures capture relational influence processes that may provide interactional conditions relevant to the development and maintenance of relatedness. Specifically, they indicate whether interaction between individuals is sufficiently consequential to produce measurable changes in behavior, thereby reflecting interactional conditions that are theorized to be relevant to subjective experiences of relatedness

(Best, 2024). Full details about the construction of the SV and Receptivity measures are available at OSF (https://osf.io/8wgcx/overview?view_only=48953b5fb3b24b8bbaac2c8139f69d1e).

Social Value

Social Value (SV) captures how an individual's presence alters others' behavior under co-presence (Williams et al., 2023). Rather than measuring social behavior broadly, SV assesses whether a specific relationship produces behaviorally meaningful change by comparing an individual's behavior in the absence versus presence of a particular other. For example, in gaming contexts, if one player's co-presence systematically leads another to play games three more hours, the first player's SV equals three hours. SV thus captures the *outgoing* dimension of influence, clarifying how relatedness is enacted and sustained through interaction. Building on prior work linking influence to relatedness and gameplay (Allen et al., 2021; Jeng et al., 2023; Peacock et al., 2020), this study examines how players' behavioral influence within the game community relates to AOG and SOG:

Research Question 1 (RQ1): How does a player's outgoing influence on their game community (SV) relate to AOG?

Research Question 2 (RQ2): How does a player's outgoing influence on their game community (SV) relate to SOG?

Receptivity

In contrast, Receptivity captures the extent to which an individual's behavior changes in response to others' presence (Williams et al., 2023). For example, if a player systematically plays five additional hours when a peer is present compared to when playing alone, those actions contribute to the player's Receptivity. Receptivity thus captures the *incoming* side of influence. Building on evidence that being influenced by others is associated with stronger relatedness (Jeng et al., 2023), this study investigates how players' Receptivity relates to the two gameplay styles:

Research Question 3 (RQ3): How does a player's incoming influence from their game community (Receptivity) relate to AOG?

Research Question 4 (RQ4): How does a player's incoming influence from their game community (Receptivity) relate to SOG?

Together, SV and Receptivity capture complementary but distinct forms of behavioral influence through which relatedness is enacted in interaction. Figure 1 presents the theoretical model linking SDT's core psychological needs with behavior-based measures of social influence (SV and Receptivity) to gameplay styles, which are linked to processes through which relatedness is enacted in interaction.

Method

Game Context: *Sky: Children of the Light*

The current study focuses on AOG and SOG among players of the online game *Sky: Children of the Light* (*Sky*). *Sky* is a cross-platform MMOG with millions of players building relationships with other players and accomplishing various game quests (Takahashi, 2025). The core gameplay involves completing tasks and social interaction, making it an ideal site to operationalize achievement and social motivations.

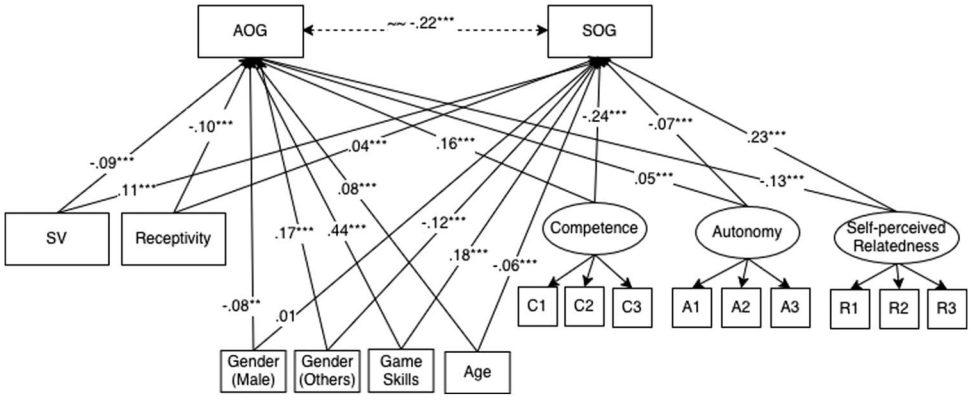

Figure 1. SEM analysis of the research model. All continuous variables are standardized ($M = 0$, $SD = 1$). Gender is dummy coded (Female = Reference group). AOG (achievement-oriented gameplay) and SOG (social-oriented gameplay) are the two dependent variables. *$p < .05$. **$p < .01$. ***$p < .001$.

Data

Survey Data

The current study utilized survey data collected from *Sky* players by *Thatgamecompany* to measure players' SDT components. *Thatgamecompany* conducted the survey between October 15 and October 26, 2024, including 15 questions divided into four sections: demographics, players' competence, autonomy, and relatedness. The response rate of the survey was 93% (N = 44,397) out of 47,738 participants. Among them, 20,940 respondents provided informed consent, completed the entire survey, and were successfully matched with their in-game behavioral data, allowing us to connect survey responses with both AOG and SOG measures. After further excluding patterned responses, repeated entries, and irrelevant answers (e.g., "cat" for gender), the final analytic sample included 9,711 players. Among 9,711, 64.1% identified as female, 23.6% as male, and 12.3% as other. Participants ranged in age from 18 to 77 years (M = 23.92).

Behavioral Data

The current study leveraged the in-game activity logs to measure players' AOG, SOG, game skills, SV, and Receptivity. Only actions occurring between June 30, 2023, and October 14, 2024 (prior to the survey) were included to avoid post-survey influence. Of the 9,711 survey respondents, 9,267 players had sufficient behavioral data to be included in the final dataset. Players were excluded if they had no record of engaging in AOG and SOG during the time frame. Meanwhile, the total number of players included in the SV and Receptivity calculations was about 3 million, as the broader player network is essential for calculating community-level influence analyses (See details below).

Measurement

Achievement-Oriented Gameplay (AOG)

Players' AOG was measured as the number of daily quests completed per minute of gameplay during the time frame. We divided the number of daily quests completed by total gameplay minutes to account for the possibility that players with higher accumulated gameplay time might naturally have a higher number of completed daily quests. Daily quests are game tasks provided to players to complete every day. These quests play a key role in AOG, as players complete them to receive game items that are crucial in gameplay progression. Completed daily quests per unit of playtime are distinct from game skills (see details below) in that they rely more on persistence and effort to achieve in-game goals rather than exceptional gameplay fluency. Table 1 provides details on the study variables, operationalization, and measurement scales.

Table 1. Study variables and operationalization

	Variable	Data source	Operationalization
Independent variable	Competence	Survey	Modeled as a latent construct indicated by three self-report items assessing perceived competence during gameplay.
	Autonomy	Survey	Modeled as a latent variable indicated by three self-report items capturing perceived autonomy during gameplay.
	Relatedness	Survey	Modeled as a latent construct indicated by three self-report items assessing perceived belonging within the game community.
	SV	Behavioral log	Measures the extent to which a player's presence produces systematic changes in others' Winged Light collecting activities.
	Receptivity	Behavioral log	Measures the extent to which a player's Winged Light collecting activities change in response to others' presence.
Control variable	Gender	Survey	Self-reported gender. Coded as 0 = female, 1 = male, 2 = other
	Age	Survey	Self-reported age in years.
	Game skills	Behavioral log	Number of waxes collected per minute of total playtime.
Dependent variable	AOG (achievement-oriented gameplay)	Behavioral log	Number of daily quests completed per minute of total playtime.
	SOG (social-oriented gameplay)	Behavioral log	Number of hand-holding actions per minute of total playtime.

Social-Oriented Gameplay (SOG)

The current study used a hand-holding activity to explore the relationships between the SDT components and SOG in *Sky*. Hand-holding refers to an in-game activity in which a player uses the hand-holding function to assist other players in progressing their gameplay. Although they assist in other players' game progression, this behavior is distinct from AOG, as their primary goal is to help others rather than to achieve their own game objectives. Players' SOG was measured as the number of hand-holding actions performed per minute of gameplay during the time frame to account for the tendency that players with higher accumulated gameplay time were likely to have a higher number of hand-holding actions.

Competence/Autonomy/Relatedness

Competence, autonomy, and relatedness were assessed using La Guardia et al.'s (2000) nine-item Need Satisfaction Scale, adapted for the gaming context and measured on a 5-point Likert scale. Each construct was measured with three items. For competence, an example item was "When I am playing Sky, I feel like a competent person" (Cronbach's $\alpha = .70$). For autonomy, an example item was "When I am playing Sky, I have a say in what happens" (Cronbach's $\alpha = .88$). For relatedness, an example item was "When I am playing Sky, I feel a lot of closeness in the gaming community" (Cronbach's $\alpha = .73$). All scales demonstrated acceptable internal consistency.

SV

To measure SV, we employed a random forest regression model that estimates the degree of behavioral influence between players (Williams et al., 2023). The target variable in the model was the amount of "Winged Light" units collected, an in-game item that players gather to strengthen or maintain their capacity to move through the game world. Collecting Winged Light requires exploration of the game world and sustained play over time, and thus serves as an indicator of a player's level of gameplay engagement. For a given behavior (Winged Light collecting activity), the model estimates how a peer's Winged Light collection (e.g., Player B) changes when a focal player (e.g., Player A) is present versus absent. The difference in Player B's behavior across these conditions is attributed to Player A's influence. A player's overall SV is then calculated by aggregating this estimated influence across all interaction partners. This measure captures the extent to which a player's presence systematically alters other players' behavior, thereby quantifying cross-player behavioral influence.

Receptivity

Receptivity is calculated using the same modeling framework as SV but applied in the opposite direction, focusing on incoming influence. It estimates changes in the focal player's own Winged Light collection when others are present versus absent. The difference between these two conditions is attributed to the player's Receptivity. As with SV, Receptivity was calculated using the amount of Winged Light units collected as the target behavior, but they differ in whose behavior is treated as the outcome (SV: peer's behavior; Receptivity: focal player's behavior). In the current study, Receptivity thus represents the degree to which a player is behaviorally responsive to others regarding Winged Light collecting activities, capturing an estimated effect of social presence rather than the absolute observed frequency of that action. A more detailed explanation of how SV and Receptivity were constructed and calculated is provided on OSF (ESM 1–4).

Game Skill

Game skill was used as a control variable in the model, measured as the total "wax" collected per minute of gameplay during the time frame. Candles figure prominently in *Sky* and wax is the foundational currency. Collecting wax requires an understanding of the game's mechanics. Given that wax is a prerequisite for crafting items directly related to game progression, the rate of wax collection is a reliable measure of a player's game skill.

Results

Statistical analyses were performed using Python 3.10.12, implementing the *semopy* package for structural equation modeling (SEM). SEM was used to simultaneously estimate the relationships among SDT components, behavior-based influence measures (SV and Receptivity), and two gameplay styles. All continuous variables were standardized (z-scored) prior to estimation to enhance interpretability. Residual covariances between AOG and SOG were freely estimated, and significance was assessed using two-tailed tests with a threshold of $p < .05$ (see ESM 7 for the SEM analysis code in a Jupyter Notebook). SV and Receptivity were analyzed using a random forest regression implemented in Python.

Descriptive Statistics

Descriptive statistics were conducted for all study variables (see ESM 5). Observations with absolute z-scores above three were treated as outliers and removed to enhance statistical accuracy (Howell, 1997). Competence ($M = 3.88$, $SD = 0.73$), Autonomy ($M = 3.96$, $SD = 0.73$), and relatedness ($M = 3.77$, $SD = 0.77$) were measured as composite scores from three survey items. Zero-order correlations across all study variables

were generally small (see ESM 10). In particular, associations between relatedness, SV, and Receptivity were small in magnitude. Relatedness was weakly but significantly correlated with SV (r = .036, p = .001), whereas its association with Receptivity was not statistically significant (r = −.007, p > .05). Differences in measurement between subjective self-reports and behavior-based indicators may contribute to this pattern.

Competence, Autonomy, Relatedness, SV, Receptivity, and Gameplay Patterns

The SEM results showed good fit, $\chi^2(90)$ = 1,730.17, p < .001, CFI = .93, TLI = .90, SRMR = .03, RMSEA [90% CI] = 0.048 [0.046; 0.050] (Hu & Bentler, 1999). Gender and age were included as control variables, given prior findings on their relationship with gameplay investment and engagement patterns (Dindar, 2018; González-González et al., 2022; Procci et al., 2013). Game skill was also treated as a control variable, since research suggests it relates to gameplay engagement (Stafford et al., 2017) but is not always indicative of actual competence (e.g., the Dunning–Kruger effect).

For AOG, competence (β = .159, p < .001) and autonomy (β = .048, p < .001) were positively associated, while relatedness (β = −.126, p < .001), SV (β = −.090, p < .001), and Receptivity (β = −.099, p < .001) were negatively associated. Age (β = .081, p < .001) and game skill (β = .443, p < .001) also showed positive associations, while gender showed mixed patterns: male players reported lower AOG (β = −.078, p = .001), whereas players identifying as other reported higher AOG (β = .166, p < .001) compared to female players (see Figure 1).

Regarding the SOG results, competence (β = −.241, p < .001) and autonomy (β = −.067, p = .001) were negatively associated, whereas relatedness (β = .233, p < .001), SV (β = .111, p < .001), and Receptivity (β = .038, p < .001) were positively associated. Younger players engaged more in SOG (Age: β = −.060, p < .001), and players identifying as other genders reported lower SOG compared to female players (β = −.124, p = .001). Game skills were positively associated with SOG (β = .175, p < .001) (see Figure 1).

The model explained 22.5% of the variance in AOG (R^2 = .225) and 7.9% in SOG (R^2 = .079). Effect size analyses (f^2) suggested that game skills, SV, and Receptivity accounted for the largest unique variance in AOG, while SV and game skills were the largest in SOG (full results in ESM 6). This stronger contribution does not suggest that behavioral indicators are better predictors in this model, but instead reflects their closer alignment with behavioral outcome variables, whereas self-reported measures exhibit weaker connections. Bootstrap confidence intervals for all path estimates are reported in ESM 6.

Finally, a significant negative residual correlation was observed between AOG and SOG (r = −.217, p < .001), indicating that AOG and SOG were inversely related after accounting for all independent variables.

Estimation of SV and Receptivity via Random Forest Models

To generate the SV and Receptivity variables, random forest regression models were applied prior to the SEM. The resulting variables were then incorporated as predictors in the subsequent SEM analysis. We evaluated out-of-sample performance using an 80/20 train–test split (all records from a given player appear in only one partition). The random forest model demonstrated strong performance, with a test-set R-squared of .87 and a 77.8% test-weighted relative accuracy (in sample: R^2 = .98, accuracy = 91.7%; see ESM 8 for SHAP value interpretations and ESM 9 for the random forest model results).

Discussion

The current study examined how core SDT components relate to players' gameplay in *Sky: Children of the Light*. Adopting a process-oriented perspective on how relatedness is shaped and sustained over time, we incorporated SV and Receptivity as behavior-based indicators of relational influence, alongside traditional measures of relatedness. By modeling both AOG and SOG within a structural equation model, this study reveals how SDT components and behavior-based influence measures (SV and Receptivity) map onto two distinct gameplay styles.

First, competence was positively associated with AOG but negatively with SOG. Players who perceived themselves as highly competent were more engaged in goal-driven activities, consistent with prior research (e.g., Przybylski et al., 2010; Reer & Krämer, 2020; Ryan et al., 2006), hence supporting H1a. At the same time, competence was negatively related to SOG, which rejects H1b and diverges from previous studies (Reer & Krämer, 2020). One plausible explanation for this opposite pattern is that highly competent players may prioritize efficiency and mastery over social activities. In other words, the same sense of competence linked to greater AOG engagement may be connected to a reduction in social interactions, as these can slow down progress toward individual goals. It also aligns with the negative relationship between AOG and SOG, which implies players tend not to pursue both achievement and social goals; engagement in one style is associated with lower involvement in the other.

Autonomy also showed inverse relationships. It was positively related to AOG, supporting H2a and reflecting prior findings that autonomy is connected to engagement in

goal-related tasks (Ryan et al., 2006). Conversely, autonomy was negatively associated with SOG, supporting H2b and echoing previous studies (Deterding, 2016; Krassen, 2021). This association is often discussed in connection with the social demands of SOG (i.e., social pressure), where aligning with group norms or collective goals is accompanied by lower reported autonomy. Reer and Krämer (2020) similarly noted that social gameplay may not necessarily be related to autonomy needs fulfillment. In *Sky*, players engaging in SOG may experience subtle pressure to conform or coordinate, which is often reported alongside reduced autonomy. These results indicate a tension between autonomy and engagement in gameplay, varying by style of play.

Similarly, relatedness revealed an opposite result between AOG and SOG. It was negatively associated with AOG, diverging from prior studies that linked a strong sense of belonging to persistent AOG (Hsiao & Chiou, 2017; Johnson et al., 2015). This indicates that players who feel less connected to others tend to report more focus on achievement-oriented tasks, which means achievement-oriented players may prefer to pursue game goals independently rather than through social interaction, aligning with prior research (Vella et al., 2016). Bartle (1996) similarly observed that achievement-driven players typically minimize social engagement unless it directly contributes to success. In *Sky*, the game design allows players to achieve objectives without the need for cooperation, which is observed alongside lower levels of relatedness among AOG-focused players. In contrast, relatedness was positively associated with SOG, supporting H3b. It indicates that players who feel a strong connection to others are more involved in socially driven gameplay. Players with a strong sense of belonging may prioritize relationship-building, choosing to interact and play together rather than focus on completing game objectives. These players use gameplay as a medium for connection, which supports H3b. Furthermore, this finding aligns with the earlier explanation regarding cooperative gameplay in *Sky*. In the context of *Sky*, cooperative gameplay is more closely connected to SOG than to AOG, considering that achievement-oriented players in *Sky* tend to prefer solo AOG.

SV and Receptivity exhibited directional patterns that aligned with relatedness across gameplay styles: negative with AOG (RQ1&3) and positive with SOG (RQ2&4). Players with low SV and Receptivity tended to pursue AOG more, reflecting a pattern of play that is more self-directed and less contingent on social interaction. Since AOG requires little interaction or coordination with others, it is unsurprising that players who exhibit lower levels of relational influence are more oriented toward this gameplay style. In contrast, players high in SV and Receptivity were more engaged in SOG, displaying openness to influencing others and being influenced in return, which coincided with higher engagement in socially oriented play. Effective social play requires individuals to be flexible in accepting different opinions and to possess an active willingness to engage in others' gameplay experiences.

The consistent directionality observed across relatedness, SV, and Receptivity strengthens the theoretical coherence of our framework. Although conceptually distinct, these constructs exhibited parallel patterns across gameplay styles: negative with AOG and positive with SOG. This convergence suggests that subjective feelings of relatedness and behavior-based influence processes (SV and Receptivity) are shaped by similar interactional conditions embedded in gameplay. Prior research supports this perspective by showing that experiences of relatedness are sustained through the interplay between subjective perceptions and ongoing social interaction (Best, 2024). Within this process, influencing others is associated with feeling like a valued member of the community (Peacock et al., 2020), while being influenced by others is linked to heightened feelings of acceptance within the community (Allen et al., 2021). Together, SV and Receptivity capture complementary interactional pathways through which social connection is expressed in gameplay.

Despite these consistent directional patterns, the associations between relatedness and the behavioral influence measures were small in magnitude. One plausible explanation is the difference in measurement modality. Relatedness was assessed through self-reports capturing subjective perceptions of social connection, whereas SV and Receptivity were derived from behavioral log data capturing patterns of influence during gameplay. These measures, therefore, reflect different levels of social experience and may not converge strongly. The weak correlation also suggests that relational influence and relatedness should not be interpreted as interchangeable constructs. SV and Receptivity, as operationalized in this study, may be weak behavioral indicators of relatedness in this context. They may index relational influence during gameplay more directly than relatedness itself. Although SV and Receptivity capture behavioral influence during social interaction, players may experience relatedness through channels that are not expressed as measurable changes in gameplay behavior, such as communication or emotional support. From this perspective, relational influence may represent one dimension of the social engagement processes through which relatedness is enacted and sustained.

Another possible explanation concerns the behavioral indicator used to estimate SV and Receptivity. The present study used Winged Light collection because it provides a consistent and quantifiable indicator central to gameplay engagement in *Sky*. However, it may not capture all socially meaningful forms of relational influence among players. Thus, the relationship between relational influence and perceived relatedness may depend in part on the behavioral domain selected.

Beyond the relationship between relatedness and behavioral influence, another key insight from the results is that the

two gameplay styles were inversely structured across SDT components, especially autonomy and relatedness. AOG was positively associated with autonomy but negatively associated with relatedness. In contrast, SOG showed the opposite patterns. This consistent reversal across two gameplay styles shows a fundamental tension between autonomy and relatedness, echoing Galston's (2001) argument that participation in collective activities may reduce perceived personal agency. In *Sky*, cooperative play that characterizes SOG often requires alignment with others, thereby reinforcing relatedness while diminishing autonomy. Conversely, AOG emphasizes independent goal pursuit, which coincides with enhanced autonomy but decreased relatedness.

Importantly, this framework revealed a significant negative association between AOG and SOG at the aggregate level, suggesting a relative trade-off in how players allocate engagement across gameplay styles after accounting for all predictors. This trade-off provides a psychological explanation for how players are oriented toward different forms of gameplay: people with higher competence and autonomy showed greater involvement in AOG and less communal engagement, whereas players with higher relatedness were more invested in social interaction. These findings suggest that interpretations of SDT components in gameplay should emphasize relational dynamics and trade-offs, rather than assuming uniformly positive pathways across different play styles. However, it is important to note that the observed relationship between motivational orientation and gameplay style should not be assumed to remain constant across the entire course of gameplay. Instead, this relationship may change as players reach different stages of experience or progression.

This study contributes to SDT-based game research by showing that the associations between SDT components and gameplay differ across playstyles and contexts. In particular, considering social dynamics alongside relatedness enhances conceptual clarity in how relatedness operates within gameplay contexts. The unique effect sizes explained by SV and Receptivity, along with their low intercorrelation and consistent associations with both AOG and SOG, support their theoretical distinctiveness and their utility for capturing behavior-based relational influence processes in gameplay. However, it is important to note that their relatively strong unique effect sizes do not mean that they are better indicators than self-reported measures. Rather, this pattern likely reflects the fact that they are behavioral indicators derived from the same in-game environment as the outcomes compared to self-reported measures.

Methodologically, this study incorporates self-report data and large-scale behavioral metrics, offering a more objective perspective on in-game psychological dynamics. The use of pairwise influence data also provides an innovative approach to capturing the embedded, relational nature of relatedness in multiplayer settings. Together, these findings both theoretically and empirically advance understanding of the interplay between psychological needs and gameplay behavior, and offer valuable insights for future game design and the study of digital social interactions.

Nonetheless, this study has several limitations. First, it focused exclusively on two gameplay styles (AOG and SOG) without considering immersion-oriented gameplay, which has been identified as another key motivation in prior literature (Yee, 2006). This focus may limit the generalizability of the findings across the broader range of player motivations identified in prior literature. Future research should integrate immersion to offer a more comprehensive understanding of gameplay dynamics.

Second, the cross-sectional design limits causal inference and prevents direct examination of how psychological needs and gameplay orientations change over time. Although we normalized behavioral measures by total playtime to reduce confounding from differential gameplay exposure, this adjustment cannot capture developmental shifts in needs satisfaction or gameplay orientation across experience levels. Accordingly, the findings reflect aggregate associations rather than dynamic within-player processes. Future longitudinal or experimental studies are needed to establish directionality and examine the co-evolution of gameplay orientations over time.

Third, the study was limited to a single game, which may limit generalizability. Given Sky's unique gameplay mechanics and social infrastructure, replicating this framework in other MMOGs will be crucial for validating the robustness of these findings.

Another limitation is that while our SEM focused on additive effects between SDT components and gameplay patterns, it did not explicitly test interaction terms among the components. Follow-up research could explore these dynamics and clarify whether the trade-offs we observe between autonomy and relatedness reflect additive associations or conditional effects.

Finally, how relatedness as defined by SDT is best examined in gameplay contexts remains an open question. Although the present study modeled relatedness alongside behavioral indicators of relational social influence, it did not directly capture the affective and experiential dimensions emphasized by SDT, such as emotional closeness (Ryan & Deci, 2000a). Future research could address this limitation by triangulating behavioral log data with affective indicators and perceptual measures of belonging. Such an approach would help clarify how interactional processes captured in gameplay relate to players' subjective and emotional experiences of connection, thereby offering a more comprehensive account of relatedness in gaming environments.

Conclusion

Using gameplay log data from *Sky*, this study examined how SDT-driven psychological needs and behavior-based relational influence processes relate to two distinct gameplay styles. Findings suggest that AOG was positively associated with competence and autonomy, but negatively associated with relatedness and relational social influence measures, which reflect interactional processes linked to experiences of relatedness, whereas SOG exhibited the opposite pattern. In addition, there was an inverse relationship between AOG and SOG.

References

Allen, K. A., Kern, M. L., Rozek, C. S., McInerney, D. M., & Slavich, G. M. (2021). Belonging: A review of conceptual issues, an integrative framework, and directions for future research. *Australian Journal of Psychology*, *73*(1), 87–102. https://doi.org/10.1080/00049530.2021.1883409

Barr, M., & Copeland-Stewart, A. (2022). Playing video games during the COVID-19 pandemic and effects on players' well-being. *Games and Culture*, *17*(1), 122–139. https://doi.org/10.1177/15554120211017036

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of MUD Research*, *1*(1), 1–27. https://mud.co.uk/richard/hcds.htm

Best, A. (2024). Alienation through psychological neglect: When deprivation of individual psychological needs leads to societal harm. *The Humanistic Psychologist*, *52*(3), 267–273. https://doi.org/10.1037/hum0000334

Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., & Thorens, G. (2013). Why do you play World of Warcraft? An in-depth exploration of self-reported motivations to play online and in-game behaviours in the virtual world of Azeroth. *Computers in Human Behavior*, *29*(1), 103–109. https://doi.org/10.1016/j.chb.2012.07.021

Blau, P. M. (1964). Justice in social exchange. *Sociological Inquiry*, *34*(2), 193–206. https://doi.org/10.1111/j.1475-682X.1964.tb00583.x

Clement, J. (2023, August 23). *Online gaming – statistics & facts*. Statista. https://www.statista.com/topics/1551/online-gaming/#topicOverview

Deen, M. (2015). G.A.M.E., Games autonomy motivation & education: how autonomy-supportive game design may improve motivation to learn. [Phd Thesis 1 (Research TU/e / Graduation TU/e), Industrial Design]. Technische Universiteit Eindhoven. https://doi.org/10.13140/2.1.3945.0402

Deterding, S. (2016, May). Contextual autonomy support in video game play: A grounded theory. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 3931–3943). https://doi.org/10.1145/2858036.2858395

Dindar, M. (2018). An empirical study on gender, video game play, academic success and complex problem solving skills. *Computers & Education*, *125*, 39–52. https://doi.org/10.1016/j.compedu.2018.05.018

Elliot, A. J., Dweck, C. S., & Yeager, D. S. (Eds.) (2017). *Handbook of Competence and Motivation: Theory and Application*. The Guilford Press.

Evans, M., Jennings, E., & Andreen, M. (2011). Assessment through achievement systems: A framework for educational game design. *International Journal of Game-Based Learning (IJGBL)*, *1*(3), 16–29. https://doi.org/10.4018/ijgbl.2011070102

Fernandez de Henestrosa, M., Billieux, J., & Melzer, A. (2023). Last man standing: Battle royale games through the lens of self-determination theory. *Games and Culture*, *18*(4), 427–448. https://doi.org/10.1177/15554120221101312

Ferriss, A. L. (2010). Intellectual autonomy. In A.L. Ferriss (Ed.), *Approaches to improving the quality of life: How to enhance the quality of life* (pp. 43–50). Springer. https://doi.org/10.1007/978-90-481-9148-2_5

Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, *26*(4), 331–362. https://doi.org/10.1002/job.322

Galston, W. A. (2001). Review of the book *Bowling alone: The collapse and revival of American community*, by R. D. Putnam. *Journal of Policy Analysis and Management*, *20*(4), 788–790. https://doi.org/10.1002/pam.1026

González-González, C. S., Toledo-Delgado, P. A., Muñoz-Cruz, V., & Arnedo-Moreno, J. (2022). Gender and age differences in preferences on game elements and platforms. *Sensors*, *22*(9), Article 3567. https://doi.org/10.3390/s22093567

Hamari, J., & Tuunanen, J. (2014). Player types: A meta-synthesis. *Transactions of The Digital Games Research Association*, *1*(2), 29–53. https://doi.org/10.26503/todigra.v1i2.13

Howell, D. C. (1997). *Statistical methods for psychology* (4th ed.). Duxbury Press.

Høeg, E. R., & Van der Kaap-Deeder, J. (2024). Beyond intrinsic motivation: Why researchers should consider the full motivation continuum in games for health research. *Games for Health Journal*, *13*(1), 1–4. https://doi.org/10.1089/g4h.2023.0100

Hsiao, C. C., & Chiou, J. S. (2017). The social influence of online collaborative community: The moderating effect of achievement. *Behaviour & Information Technology*, *36*(3), 269–280. https://doi.org/10.1080/0144929x.2016.1221463

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hulaj, R., Nyström, M. B., Sörman, D. E., Backlund, C., Röhlcke, S., & Jonsson, B. (2020). A motivational model explaining performance in video games. *Frontiers in Psychology*, *11*, Article 1510. https://doi.org/10.3389/fpsyg.2020.01510

Jeng, A., Bosch, N., & Perry, M. (2023). Sense of belonging predicts perceived helpfulness in online peer help-giving interactions. *The Internet and Higher Education*, *57*, Article 100901. https://doi.org/10.1016/j.iheduc.2022.100901

Johnson, D., Wyeth, P., Clark, M., & Watling, C. (2015). Cooperative game play with avatars and agents: Differences in brain activity and the experience of play, In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 3721–3730). https://doi.org/10.1145/2702123.2702468

Kim, J. Y. (2026, August 13). *Gameplay and Self-Determination Study* [Supplementary Materials]. https://osf.io/8wgcx

Krassen, C. S. (2021). *Games of social control: Understanding social & technical pressure in online multiplayer games* (Doctoral dissertation). KU Leuven, Faculteit Sociale Wetenschappen, Instituut voor Mediastudies.

La Guardia, J. G., Ryan, R. M., Couchman, C. E., & Deci, E. L. (2000). Within-person variation in security of attachment: A self-determination theory perspective on attachment, need fulfillment, and well-being. *Journal of Personality and Social Psychology*, *79*(3), 367–384. https://doi.org/10.1037/0022-3514.79.3.367

Li, L., Hew, K. F., & Du, J. (2024). Gamification enhances student intrinsic motivation, perceptions of autonomy and relatedness, but minimal impact on competency: A meta-analysis and systematic review. *Educational Technology Research and Development*, *72*(2), 765–796. https://doi.org/10.1007/s11423-023-10337-7

Liu, Y., Chen, C., Zhang, J., Guo, Y., & van Dierendonck, D. (2021). The compensatory association of autonomy and relatedness

satisfaction on affect and aggressive feelings. *Journal of Happiness Studies*, *22*(6), 2739–2760. https://doi.org/10.1007/s10902-020-00338-1

Machado, A., Santos, P., & Dias, J. (2017). On the structure of role playing game quests. *Revista de Ciências da Computação*, *12*(Special Issue), 81–98. https://doi.org/10.34627/rcc.v12iEspecial.15

Mayseless, O. (2010). Attachment and the leader – follower relationship. *Journal of Social and Personal Relationships*, *27*(2), 271–280. https://doi.org/10.1177/0265407509360904

McClanahan, G. (2009). *Achievement design 101*. Game Developer. https://www.gamedeveloper.com/design/achievement-design-101

Merikivi, J., Tuunainen, V., & Nguyen, D. (2017). What makes continued mobile gaming enjoyable? *Computers in Human Behavior*, *68*, 411–421. https://doi.org/10.1016/j.chb.2016.11.070

Nacke, L. E., Bateman, C., & Mandryk, R. L. (2014). BrainHex: A neurobiological gamer typology survey. *Entertainment Computing*, *5*(1), 55–62. https://doi.org/10.1016/j.entcom.2013.06.002

Peacock, S., Cowan, J., Irvine, L., & Williams, J. (2020). An exploration into the importance of a sense of belonging for online learners. *The International Review of Research in Open and Distributed Learning*, *21*(2), 18–35. https://doi.org/10.19173/irrodl.v20i5.4539

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, *14*(2), 154–166. https://doi.org/10.1037/a0019440

Procci, K., James, N., & Bowers, C. (2013, September). The effects of gender, age, and experience on game engagement. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 57, No 1, pp. 2132–2136). SAGE Publications. https://doi.org/10.1177/1541931213571475

Reer, F., & Krämer, N. C. (2020). A self-determination theory-based laboratory experiment on social aspects of playing multiplayer first-person shooter games. *Entertainment Computing*, *34*, Article 100353. https://doi.org/10.1016/j.entcom.2020.100353

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037//0003-066x.55.1.68

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, *30*(4), 344–360. https://doi.org/10.1007/s11031-006-9051-8

Sherry, J. L., Greenberg, B. S., Lucas, K., & Lachlan, K. (2012). Video game uses and gratifications as predictors of use and game preference. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 248–262). Routledge. https://doi.org/10.4324/9780203873700-18

Stafford, T., Devlin, S., Sifa, R., & Drachen, A. (2017). Exploration and skill acquisition in a major online game, In *Proceedings of the Annual Meeting of the Cognitive Science Society* (Vol. 39, pp. 3249–3254).

Tamborini, R., Bowman, N. D., Eden, A., Grizzard, M., & Organ, A. (2010). Defining media enjoyment as the satisfaction of intrinsic needs. *Journal of Communication*, *60*(4), 758–777. https://doi.org/10.1111/j.1460-2466.2010.01513.x

Takahashi, D. (2025, June 17). *How Sky: The Children of the Light broke records for most simultaneous people on the screen | Jenova Chen interview*. GamesBeat. https://gamesbeat.com/how-sky-the-children-of-the-light-broke-records-for-most-simultaneous-people-on-the-screen-jenova-chen-interview/

Tondello, G. F., Arrambide, K., Ribeiro, G., Cen, A. J. L., & Nacke, L. E. (2019). "I don't fit into a single type": A trait model and scale of game playing preferences. In D. Lamas, F. Loizides, L. Nacke, H. Petrie, M. Winckler, & P. Zaphiris (Eds.), *Human-Computer Interaction–INTERACT 2019: 17th IFIP TC 13 International Conference, Paphos, Cyprus, September 2–6, 2019, Proceedings, Part II* (pp.375–395). Springer. https://doi.org/10.1007/978-3-030-29384-0_23

Vella, K., Klarkowski, M., Johnson, D., Hides, L., & Wyeth, P. (2016, June). The social context of video game play: Challenges and strategies, In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (pp. 761–772). https://doi.org/10.1145/2901790.2901823

Williams, D., Khan, E. M., Pathak, N., & Srivastava, J. (2023). Social value: A computational model for measuring influence on purchases and actions for individuals and systems. *Journal of Advertising*, *52*(2), 247–263. https://doi.org/10.1080/00913367.2021.2002743

Yang, A., & Williams, D. (2026). Finding receptive donors: Unpacking the dynamics of social influence in large-scale political donor networks. *Nonprofit Management and Leadership*. Advance online publication. https://doi.org/10.1002/nml.70051

Yee, N. (2006). Motivations for play in online games. *Cyberpsychology & Behavior*, *9*(6), 772–775. https://doi.org/10.1089/cpb.2006.9.772

History
Received April 9, 2025
Revision received July 14, 2026
Accepted July 17, 2026
Published online September 1, 2026

Acknowledgments
We thank Jenova Chen and thatgamecompany for providing access to their anonymized data and Tina Lu for her valuable feedback.

Conflict of Interest
The authors report there are no competing interests to declare.

Publication Ethics
The study data and plan were preapproved by the University of Southern California Institutional Review Board on June 1, 2020.

Authorship
Ji Ye Kim, conceptualization; methodology; software; validation; formal analysis; investigation; supervision; data curation; visualization; writing – original draft. Dmitri Williams, resources; data curation; writing – review & editing. Donggyu Kim, supervision; methodology; writing – review & editing. Siyi Zhou, software; validation. Zituo Wang, conceptualization; writing – review & editing. Aimei Yang, software; validation; writing – review & editing. All authors approved the final version of the article.

Open Science
Open Materials: The supplementary materials include additional details on the measurement and operationalization of Social Value and Receptivity (ESM 1–2), descriptive statistics of the study variables (ESM 5), structural equation modeling results (ESM 6), descriptive statistics and SHAP values from the random forest regressions used to calculate Social Value and Receptivity (ESM 8–9), and zero-order correlations among study variables (ESM 10). In addition, Jupyter notebooks for network construction, Social Value and Receptivity calculation, and statistical analyses are provided (ESM 3–4, ESM 7). All materials are available at: https://osf.io/8wgcx/overview?view_only=48953b5fb3b24b8bbaac2c8139f69d1e (Kim, 2026). Other study materials are available upon request with the permission of the game publisher.

Funding
This work did not receive any funding.

ORCID
Ji Ye Kim
https://orcid.org/0009-0004-7384-9467
Dmitri Williams
https://orcid.org/0000-0001-7995-4429
Donggyu Kim
https://orcid.org/0000-0002-9226-7065
Zituo Wang
https://orcid.org/0000-0002-2944-6546
Aimei Yang
https://orcid.org/0000-0003-3756-7812

Ji Ye Kim
Annenberg School for Communication and Journalism
University of Southern California
3502 Watt Way
Los Angeles, CA 90089-0281
USA
jiyek@usc.edu

Ji Ye Kim (MA, University of North Carolina at Chapel Hill) is a PhD student at the University of Southern California, Annenberg School for Communication. Her research focuses on the behavioral and psychological effects of gameplay and on how player interactions shape gaming experiences. She applies computational methods, such as natural language processing and random forest regression, and also examines gaming communities through social network analysis.

Dmitri Williams (PhD, Michigan 2004) is a professor at USC Annenberg, where he teaches courses on technology and society, games and data analytics. His current work focuses on the study of influence among populations through the concept of "social value." His ongoing work centers on the social and economic impacts of new media, often within online games.

Donggyu Kim (MA, University of Texas at Austin), is a PhD Student at the University of Southern California, Annenberg School for Communication. His research focuses on the psychological underpinnings of human-AI interaction and AI-mediated communication, with particular attention to how AI systems influence persuasive processes. Specifically, his work examines how virtual humans/influencers shape audience perceptions and persuasive outcomes within strategic communication contexts.

Siyi Zhou is a PhD student at the University of Southern California's Annenberg School for Communication. Her research examines how information circulates under conditions of moderation, with a focus on user linguistic adaptation and cross-platform migration. Specifically, she evaluates the effectiveness of information control by analyzing how users' language and posting behaviors change after experiencing moderation.

Zituo Wang researches digital technology, social justice, and disadvantaged communities within both health and political contexts. He is interested in the underlying mechanisms that produce public opinion and the social networks that mobilize collective expression, particularly how these dynamics are shaped by politics and artificial intelligence. By employing computational methods like natural language processing and computer vision, he wants to address existing challenges in multilingual, multimodal, and multiplatform studies.

Aimei Yang (PhD, University of Oklahoma) is an associate professor of public relations at the Annenberg School for Communication and Journalism, University of Southern California. Her research sits at the intersection of strategic advocacy, social-mediated information networks, and computational social science.

