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Players' continuous willingness to play in MOBA game ranking mode: through the lens of self-determination theory and social comparison theory

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Multiplayer Online Battle Arena (MOBA) games are a popular genre in the current gaming field, and the highly competitive ranking mode is one of the core parts of the gameplay, and the study of the factors affecting players' continuous willingness to play is a necessary issue to ensure the sustainable profitability of these games. This study has developed a conceptual model delineating the continuous willingness of players within the MOBA game ranking mode, employing the frameworks of self-determination theory (SDT) and social comparison theory (SCT). In this study, 396 valid data samples were collected using questionnaire method. The results show that, social comparison enhances players' continuous willingness and avatar identification, and indirectly enhances their continuous willingness through mediation by avatar identification, while game frustration has a significant positive moderating effect in both paths. This study contributes to both theoretical explorations and practical approaches to MOBA game ranking mode.

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Introduction

Multiplayer online battle arena (MOBA) games, a subset of real-time strategy games, feature two opposing teams, each comprised of five players controlling distinct characters. Their popularity has soared in recent years, positioning MOBA as one of the most prevalent genres in video gaming (Park and Kim, 2015). Given the short product life cycle in the online game market compared to other industries (Bae et al., 2016), the success of game companies heavily relies on players' continuous engagement and willingness to invest in game items (Nguyen, 2015). This continuous willingness, a concept defined as an individual's intention to persist in a particular activity (Bhattacherjee, 2001a), is paramount in free-to-play (F2P) games, serving as a key performance indicator for revenue generation. Therefore, unraveling the factors that drive players' continuous willingness to engage in MOBA games is imperative for game developers to successfully compete and thrive in the highly competitive gaming industry, ensuring their long-term success.

The main strength of the MOBA genre is largely the challenge provided by its gameplay (Johnson et al., 2015). The most popular MOBA game among the Chinese adolescent population is "Honor of Kings" (Chen et al., 2022), which is played mainly in competitive player-versus-player (PVP) battles, with a more competitive ranking mode as its core element of gameplay, corresponding to a richer challenge. Ranking is a visual representation of a player's strength in the game, and a higher rank indicates a stronger player. In addition, the social properties of the ranking system are greatly enhanced, so that players can learn about the dynamics of others' winning rates and rankings in the game, and can easily access their own and others' ranking information through social media platforms such as WeChat and QQ. Sailer et al. (2017) showed through experimental research that ranking, a game design element, has an impact on satisfaction with one's ability and is one of the competitive indicators by which players relate their performance to others'. MOBA games foster a highly competitive culture among players, who compete to improve their ranking (Kou et al., 2016). In addition, MOBA games are more frustrating for players than other genres, and the greater degree of frustration may be a result of the intensive competition and steep learning curve that the games entail. In semi-structured interviews with MOBA gamers, their responses repeatedly included several key words—competition, ranking, and frustration (Johnson et al., 2015)—indicating that a strong competitive motivation and high levels of frustration drive players to compete with others to achieve dominance in the game (T'ng et al., 2022). Players who are keen to compare rankings and compete for titles will have a stronger motivation to play, and this will likely have a greater impact on avatar identification and continuous willingness to play.

Although MOBA games have remained under-attended academically in comparison to MMORPGs (Mora-Cantallops and Sicilia, 2018; T'ng and Pau, 2021). In MOBA games, which have different game backgrounds and mechanisms from MMORPGs, exploring how social comparison and avatar identification affect players' continuous gaming behaviors has certain research value and can fill the research gaps of academic research on MOBA games to a certain extent. Griffiths and Pontes (2020) argued that the test between psychological motivation and gaming behavior should be ongoing, which is one of the key focuses to improve the quality of gaming research, especially in the current popularity of MOBA games, the study of how different factors affect players' continuous willingness can provide both theoretical and practical guidance to the gaming industry, which is crucial to maintain the continuous operation and revenue generation of MOBA games for profitability.

Theoretical background. People's motivations to play games shape their player experience and in-game behavior (Schaekermann et al., 2017; Melhart et al., 2019). Self-determination theory (SDT) is a well-established macro-motivation theory consisting of six micro-theories (Ryan and Deci, 2017). One of these theories is Basic Psychological Needs Theory, which posits that three basic psychological needs are considered universal and innate to human beings and are defined as autonomy, competence, and relatedness. Autonomy refers to the perception that one's behavior and cognition in an activity is under one's control, competence refers to one's own feelings of self-efficacy and ownership, and relatedness refers to the experience of making meaningful connections with others. Satisfying these needs is critical to achieving a sense of well-being and positive outcomes in different contexts (Ryan and Deci, 2017). Ryan et al. (2006) points out that SDT has enabled the study of game motivation to focus on the relationship between game characteristics (e.g., sense of control), game experiences (e.g., continuous willingness), and motivation. Research suggests that video games are appealing because they fulfill lower-order needs such as hedonism, and higher-order needs such as self-perception of autonomy, competence, and relatedness (Ryan et al., 2006; Tamborini et al., 2011).

Motivation can be defined as either intrinsic or extrinsic, depending on the intention and attitude towards action (Ryan and Deci, 2000). Intrinsic motivation refers to engaging in an activity because it is inherently interesting and enjoyable (Guay et al., 2000). In contrast, extrinsic motivation involves participating in an activity to achieve outcomes that are both external to the self and separate from the activity itself (Hayenga and Corpus, 2010). Player motivation is a critical research area in the field of gaming, as the motives that drive people to play games determine their gameplay experience and in-game behaviors (Schaekermann et al., 2017; Melhart et al., 2019). Dindar (2018) argues that while numerous previous studies have generated valuable insights into the intrinsic and extrinsic motivations for online gaming, the combined influence of these two types of motivation on gaming remains underdeveloped. Additionally, Bruhlmann et al. (2020) suggests that early research primarily linked motivation to typologies of player preferences rather than being grounded in any established psychological framework or human motivation theory.

Few studies have explored how competitive social situations affect self-perceptions of autonomy, competence, and relatedness, whereas game leaderboard provides a summary of player performance information for players to compare themselves with others and evaluate themselves (Velez et al., 2018). In previous studies, a number of scholars have examined games, including MOBAs, based on SDT, showing that frustration of the three basic psychological needs-autonomy, competence, and relatedness is strongly associated with negative game behavior, while their need satisfaction is associated with positive game behavior (T'ng et al., 2022; Kosa and Uysal, 2022). In MOBA games, players compete to win through avatars (called heroes or characters in most MOBA games). The player's level of identification and understanding of the avatar contributes to a higher level of mastery, which increases the likelihood of victory. The avatar is one of the key factors that greatly affects the psychological experience of game players (Klimmt et al., 2009), and can reflect the extent to which a player's personal identity is extended into the virtual game world, which is referred to as avatar identification (Soutter and Hitchens, 2016). Avatar identification is a fusion of the player's self-concept and the perceived properties of the avatar, which can be measured in terms of cognitive dimensions (T'ng and Pau, 2021). In recent

years, MOBA games have gradually enhanced the personalized features of character avatars, such as allowing players to match appearances, actions, and special effects in different colors and shapes to create a unique personal image, which may help players identify with their avatars.

Kosa and Uysal (2022) argued that the basic psychological needs of autonomy, competence, and relatedness show a certain degree of overlap. Many scholars have then argued that avatars can better satisfy the three main psychological needs that promote self-motivation to explain positive outcomes: self-competition for autonomy through avatars viewing their own efforts as independent of others; experiencing a sense of competence by seeing themselves performing well through avatars; and relevance through increased identification (Barathi et al., 2018; Koulouris et al., 2020). Furthermore, research by other scholars also points out that an individual's avatar is closely related to their intrinsic motivations, namely the needs for autonomy, competence, and relatedness (Kao et al., 2021; Berberović et al., 2023). In the context of MOBA games, many player behaviors are mediated through the avatar, such as freely customizing the avatar and controlling it in battle, achieving victories and accomplishments through the avatar in the game, and forming social connections with the game world and other players. Therefore, the avatar in MOBA games can be seen as a vehicle for the player's basic psychological needs, and the identification with the avatar is largely related to the satisfaction of the player's needs for autonomy, competence, and relatedness.

On the other hand, Mustafa et al. (2023) saw the need to combine SDT with similar theories and their associated features to fully synthesize intrinsic and extrinsic motivation for in-depth study. In social comparison theory (SCT), it is believed that people assess their own opinions and abilities by comparing them with those of others respectively, and the theory applies social comparison and self-enhancement to increase motivation (Festinger, 1954). Comparisons can take two forms: assessing one's own performance relative to those who perform better (upward comparison) or those who perform worse (downward comparison) (Velez et al., 2018). The phenomenon of social comparison is particularly evident in social environments that promote competition and emphasize success (Buunk and Mussweiler, 2001; Stapel and Koomen, 2005), and in the gaming domain, MOBA games with leaderboard systems are a highly competitive genre. Leaderboards provide an external motivation to enhance one's performance expectations relative to other players, reshaping the gaming experience into a competition driven by external factors through player comparisons of strength (Velez et al., 2018). In order to enhance competition, the MOBA game "Honor of Kings" designs the flow of players' gaming experience, such as by visualization of players' gaming performance, as well as by providing the geographic range and friend list leaderboards of each incarnated character, through which it promotes social comparisons among players. However, while this extrinsic motivation can be effective in encouraging individuals to initiate a behavior, it may fail to sustain motivation as time passes (Mustafa et al., 2023). Therefore, it is of interest to combine SCT with other theories that support intrinsic motivation for the study of continuous willingness to play.

Johnson et al. (2015) study of interviews with MOBA gamers found that two of the prominent themes in MOBA games were "satisfaction comes from a sense of control" and "competition is highly valued", both of which can represent intrinsic and extrinsic motivation to some extent. SDT is a practical framework for collecting and examining data on motivation and behavioral change, and combining it with SCT can help to compensate for the limitations of SDT as a single framework (Mustafa et al., 2023). Therefore, this study aims to advance the research on players' sustained motivation and behavior in the highly competitive MOBA game ranking mode. The following sections will sort out the research variables and propose research hypotheses.

Social comparison. SCT is based on the idea that people can reliably assess their ideas and abilities (Festinger, 1954), and the phenomenon of social comparison is particularly evident in social environments that promote competition and emphasize success. Leaderboards provide an external motivation to enhance one's performance expectations relative to other players, reshaping the gaming experience into a competition driven by external factors through player comparisons of strength (Velez et al., 2018). A study by Esteves et al. (2021) suggested that downward comparison is one of the most influential factors in changing the continuous willingness to play one of these games. Wolf et al. (2018) study of gamified digital services noted that social comparison drives continuous usage behavior when users act on perceived pressure, which stems from not wanting to feel shame for quitting or wanting to be appreciated for performing well. Esteves et al. (2021) study showed that most social comparisons influence online social game enjoyment and enhance players' willingness to continue playing. A previous study showed that downward comparison behavior of MOBA game players can generate positive emotional valence and positively promote their continuous gaming behavior. In the ranking mode of the MOBA game "Honor of Kings", the system highlights players ranked at a high level (compared with the worst performers), such as by indicating that "the strength of the Council exceeds 95% of players with the same role", which makes players unconsciously engage in downward comparisons more frequently. In summary, it is hypothesized that social comparison by players in MOBA game ranking mode will enhance their willingness to continue playing, thus we propose the following hypothesis:

H1: *In MOBA game ranking mode, social comparison positively influences players' continuous willingness.*

The mediating role of avatar identification. Social information about others can influence people's self-perception and enjoyment of an activity by triggering social comparison processes (Wolf et al., 2018). In the game context, avatar identification refers to the extent to which the player perceives the avatar as an extension of themselves (Moon et al., 2013), and is a combination of the player's self-concept and perceived properties of the avatar (T'ng and Pau, 2021), which can largely reflect the intrinsic motivation of gamers' behaviors. Some academic studies have subdivided it into dimensional factors, while others have treated it as a unidimensional structure (Seo et al., 2017; Sioni et al., 2017). Since this study focuses on the overall impact of avatar identification on players' behavioral intentions, it is similarly treated as a unidimensional structure.

Normally, under cognitive motivation, individuals compare themselves to others and obtain information that they use to assess themselves and as motivation for improvement (Esteves et al., 2021). Since avatar identification represents the degree to which players extend their identity and usually encompasses their efficacy expectations, it is also likely to be influenced by social comparison. Kim et al. (2007) concluded that players' satisfaction with their avatars was significantly related to the social comparison factor. On the other hand, many studies have confirmed a correlation between gamers' avatar identification and continuous willingness. Teng (2019) showed a significant positive correlation between online game players' avatar identification and continuous willingness. T'ng and Pau (2021), through a survey of MOBA game players, confirmed that the players' avatar

identification significantly and positively influenced excessive gaming behavior. Mustafa et al. (2023) indicated that individuals can progress from involuntary or controlled forms of motivation to more autonomous forms of motivation, that SCT and SDT can provide insights into extrinsic versus intrinsic motivation, respectively, and that avatars can explain positive outcomes by better meeting the three basic psychological needs that promote self-motivation (Barathi et al., 2018; Koulouris et al., 2020). In MOBA game ranking mode, the game system usually reinforces players' identification with their characters through different means in order to enhance player stickiness. In summary, it can be assumed that player's avatar identification in MOBA game ranking mode has a mediating effect between social comparison and continuous willingness, thus we propose the following hypotheses:

H2: *Social comparison positively influences players' avatar identification in MOBA game ranking mode.*

H3: *In MOBA game ranking mode, players' avatar identification positively influences their continuous willingness, and avatar identification mediates the role between social comparison and continuous willingness.*

The moderating effect of game frustration. Kosa and Uysal (2022) argue that investigating how frustration plays a role in gaming is a valuable future research agenda. In the gaming context, frustration can refer to making little or no progress in achieving one's goals due to limited skills and daunting challenges in the task (Csikszentmihalyi and Csikszentmihalyi, 1988). Although previous studies have addressed the frustrating and demanding aspects of gaming, these studies typically investigated the effects of frustration in life on willingness to play, while research on game-induced frustration is scarce, sometimes games intentionally create player frustration with the goal of eliciting greater engagement and satisfaction (Kosa and Uysal, 2022).

The relationship between social comparison and continuous willingness is likely to be affected by game frustration. Because social comparison can enhance competitive motivation (Suls et al., 2002), thereby positively influencing players' sustained gaming intentions. In situations where game frustration is high, competitive motivation has a greater impact on sustained gaming intentions. For example, Larche et al. (2017) found that when the near-success of the frustration caused a stronger physiological arousal, and the strongest urge to continue the game. Rawsthorne and Elliot (1999) argued that if players are determined to succeed in online games, then a single game frustration may not be sufficient to deter them or change their motivation to continue playing, and game frustration will not likely directly reduce their continuous willingness to play. A study of internet gaming disorder in MOBA games suggests that strong competitive motivation and high levels of frustration drive players to compete with others to achieve dominance (T'ng et al., 2022), i.e., players' continuous willingness to play will likely be enhanced by the combined effects of social comparison and game frustration.

Similarly, game frustration is likely to affecte the relationship between social comparison and avatar identification. Chen et al. (2022) suggested that players with strong competitive motivations have a stronger desire to win and embrace the difficulties and competitions in games. They invest more resources into gaming, leading to a stronger sense of avatar identification. This subtle frustration during gameplay is closely related to the three fundamental psychological motivational needs of autonomy, competence, and relatedness, which contribute to a positive gaming experience (Boulton et al., 2017; Kosa and Uysal, 2022). An increasing number of scholars support the idea that blending negative emotions with positive ones can provide an overall positive experience (Fokkinga and Desmet, 2012). Scholars have found that MOBA gamers' comparison behavior with lower-skilled players generates positive emotional valence, which, when combined with frustration, is likely to enhance their level of avatar identification and continuous willingness to play. From the perspective of SDT, in the MOBA game ranking mode where comparison behaviors frequently occur, players' frustration is likely to stimulate their pursuit of reestablishing a sense of self-worth and control, manifested in avatar identification and sustained gaming intentions. In summary, hypothesizing that gaming frustration positively moderates the relationship between social comparison and both avatar identification and continuous willingness, we propose the following hypotheses:

H4: *Game frustration positively moderates the strength of the effect of social comparison on continuous willingness to play in MOBA game ranking mode.*

H5: *Game frustration positively moderates the strength of the effect of player social comparison on avatar identification in MOBA game ranking mode.*

Based on the above, we have constructed a conceptual model (a moderated mediation model) with social comparison as the independent variable, avatar identification, and game frustration as the mediating variable and moderating variable, respectively, and continuous intention as the dependent variable, as shown in Fig. 1.

Methods

Data collection and sample characteristics. This study utilized quantitative data collection methods and was conducted in the form of a web-based questionnaire using the online questionnaire platform "Questionnaire Star". The questionnaire included demographic data (gender, age, and occupation), MOBA game experience (historical length and frequency of playing qualifying mode), and scales measuring four variables (avatar identification, social comparison, game frustration, and continuous willingness).

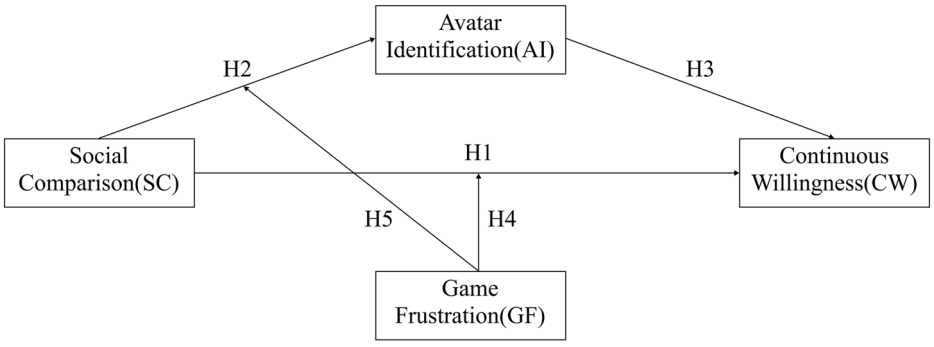

Fig. 1 Conceptual model. This figure shows the theoretical basis model of this study.

The research population of this study was Chinese adult MOBA gamers between the ages of 18 and 50 years old, a sample group that ensured that gamers could rely on a more mature level of mindfulness and social networks to play MOBA games in order to fulfill the objectives of this study. Sampling techniques allow researchers to make judgments about a group without considering each individual, so convenience sampling was included in this study to select a representative sample from the entire population.

The questionnaire was validated through a pilot study with 30 participants to assess its validity before being formally distributed. The pilot study demonstrated the suitability of the questionnaire for a large-scale study, and after fine-tuning the wording based on the comments collected, we made it available to MOBA gamers within China. We distributed the questionnaire to several MOBA game communities (e.g., Sina Weibo, Baidu Post Bar) and MOBA game players' communication groups, and the public was able to fill out the questionnaire after agreeing to confirm the informed consent form on the login screen of the questionnaire. We used 4 days to collect the questionnaires and collected a total of 476 responses with MOBA game experience. After eliminating invalid questionnaires such as those with a too short completion time or too many consecutive choices of the same response, 396 valid questionnaires were finally obtained, with a valid recovery rate of 83.2%. Among the respondents, 72.2% were male, and 27.8% were female, with the largest number of participants in the 18–25 age range at 65.2%, and 38.9% of participants were students. The samples were drawn from 27 of the country's 34 provincial-level administrative regions, and are therefore representative of the wide range of MOBA gamers in China. 65.4% of the participants had experience with MOBA game ranking mode for 3 years or more, and 80.3% had experience with ranking mode for more than 5 days per month.

Instrument development. The measurement options in the questionnaire were appropriately modified based on the relevant mature scales and the actual context of MOBA games. In addition, three psychologists were asked to evaluate the validity of the questionnaire to ensure that the questions were easy to understand. The respondents were asked to evaluate items (including avatar identification, social comparison, game frustration, and continuous willingness) on a 5-point Likert scale, with "strongly disagree" at 1 and "strongly agree" at 5. The assessment of the questionnaire involved 4–6 measures for each variable, which were adjusted accordingly with reference to previous studies in the same field. The specific design of questionnaire items and detailed information on their sources are shown in Table 1.

Results

Reliability and validity analyses. We first used SPSS 26.0 (IBM, Armonk, NY, USA) to analyze the data for reliability and validity. Cronbach's alpha and combined reliability (CR) were used to measure reliability. As shown in Table 2, the Cronbach's alpha values of the model variables ranged from 0.74 to 0.88, and the CR values ranged from 0.81 to 0.89; all of these are above the standard value of 0.7 (Hair et al., 2010; Abbasi et al., 2021), indicating that the scale data are real and reliable, and the measured items have high internal consistency as well as good overall reliability.

We then measured the validity of the questionnaire, including content validity and construct validity. The items of the questionnaire were referred from relevant references or adapted from mature scales, and the validity was assessed and modified by three psychologists, so the content validity was good. Structural validity includes convergent validity and discriminant validity; convergent validity requires that the average variance extracted (AVE) value of the variables is higher than 0.5, CR value is higher than 0.7, and factor loading value is higher than 0.5 (Hair et al., 2020; Abbasi et al., 2021). As shown in Table 2, the AVE and CR values of this model meet the criteria, and the factor loading value of each variable is between 0.62 and 0.84, which is above the standard value of 0.5; thus, the convergent validity is good. Discriminant validity requires that the square root of the AVE value of each variable is higher than the correlation coefficient between the variables (Fornell and Larcker 1981; Cheah et al., 2020). As shown in Table 3, the square root of the AVE value of all variables is higher than their correlation coefficient, which indicates that the discriminant validity is good. In addition, the KMO value is 0.897, which is greater than the standard value of 0.5 (López et al., 2023), which ensures the adequacy of the sample size. The approximate chi-square of the Bartlett's test is 3166.831, with the free degree of 153, and the significance p-value is less than 0.001, which indicates that the link between the variables is significant. Since significant results were obtained for the KMO and Bartlett's test of series, factor loadings, and structural validity, it can be seen that the sample size is appropriate, the correlation between variables is significant, and the structure is valid and reliable. Overall, the reliability and validity of the questionnaire are good and meet expectations, so it can be analyzed subsequently.

Results analysis. Descriptive data for the four variables of avatar identification, social comparison, game frustration, and continuance willingness are shown in Table 3. The data indicate that the skewness of the variables ranges from −1.31 to −0.37 and the kurtosis ranges from −0.45 to 1.87, suggesting that the data are close to a normal distribution.

Since this study utilized a self-reporting format, which may result in systematic errors due to the homogeneity of the measurement environment and the psychology of evaluating the expectations of the sample as a whole, Harman's single-factor test was used to test for common method bias. The results showed that the number of factors with eigenvalues greater than 1 was five, with the first factor explaining 20.55% of the variance, which was significantly less than the critical criterion of 50% (Podsakoff and Organ, 1986; Anubha and Shome, 2020). Therefore, it can be concluded that the questionnaire approach used in this study does not have a serious problem of common method bias.

Next, we analyzed the correlation of the data. As shown in Table 3, MOBA game players' social comparison in ranking mode is positively correlated with avatar identification ($r = 0.53$, $p < 0.01$), game frustration ($r = 0.43$, $p < 0.01$), and continuous willingness ($r = 0.49$, $p < 0.01$). Avatar identification is positively correlated with game frustration ($r = 0.16$, $p < 0.01$) and continuous willingness ($r = 0.51$, $p < 0.01$). Game frustration is positively correlated with continuous willingness ($r = 0.16$, $p < 0.01$).

We used the Process macro program developed by Hayes (2013) to select Model 4 (simple mediating effect model) and Model 8 (moderated mediating effect model) in two steps, consistent with the hypothesized path of this study, as well as the bias-corrected nonparametric percentile bootstrap method and the Johnson–Neyman (JN) method to test the mediating and moderating effects. In both bootstrap tests, the sampling number was set to 5000 and the data related to the moderating variables were centralized. While the traditional approach to reporting moderating effects is to use simple slope analysis, the JN method is appropriate for path-specific moderating effects in models when the study variables are all continuous, with this method used to capture exactly how the moderating effects of each path change as the values of the moderating variables change (Preacher

Table 1 Questionnaire constructs and items.

Construct	Scale Items	Source
Avatar Identification (AI)	AI1: I have a strong sense of ownership of the characters I often choose in MOBA game ranking mode. AI2: I feel that the role I often choose in MOBA game ranking mode is an extension of myself. AI3: The character I often choose in MOBA game ranking mode provides me with a form of self-expression. AI4: The character I often choose in MOBA game ranking mode is important to me.	(Moon et al., 2013; Liao et al., 2019)
Social Comparison (SC)	SC1: When playing a MOBA game, I will compare my ranking with my friends list. SC2: When playing a MOBA game, I would watch other people's ranking performance in order to expect to feel good about my own performance. SC3: When playing a MOBA game, when I see my friend's high ranking, I hope to reach the same goal myself. SC4: When playing a MOBA game, I feel envious of other people's high rankings. SC5: When playing a MOBA game, I feel like I am competing with others for ranking. SC6: When playing a MOBA game, one of my goals is to get the winning side MVP [the gamer who contributes the most to the victory] by performing better than others.	(Gibbons and Buunk, 1999; Hanus and Fox, 2015)
Game Frustration (GF)	GF1: Sometimes it frustrates me when playing in MOBA game ranking mode. GF2: I think the failure of MOBA game ranking mode frustrates me. GF3: I think the mechanics of MOBA game ranking mode are more complicated. GF4: I think it is more difficult to improve ranking in MOBA game ranking mode.	(Huang et al., 2017; Kammann and Flett, 1983)
Continuous willingness (CW)	CW1: I plan to continue playing in MOBA game ranking mode rather than give up the game. CW2: I want to continue to play in MOBA game ranking mode instead of other modes. CW3: I plan to continue playing in MOBA game ranking mode in the future. CW4: I think I'll continue to play in MOBA game ranking mode in the future.	(Bhattacherjee, 2001b; Teng, 2017; Venkatesh and Davis, 2000)

Table 2 Scales for reliability and convergent validity.

Construct	Item	Loading	α	CR	AVE
SC	SC1	0.75	0.88	0.87	0.53
	SC2	0.70			
	SC3	0.74			
	SC4	0.77			
	SC5	0.77			
	SC6	0.64			
AI	AI1	0.71	0.86	0.86	0.61
	AI2	0.83			
	AI3	0.81			
	AI4	0.78			
GF	GF1	0.83	0.74	0.89	0.66
	GF2	0.78			
	GF3	0.81			
	GF4	0.84			
CW	CW1	0.67	0.76	0.81	0.52
	CW2	0.62			
	CW3	0.79			
	CW4	0.80			

et al., 2007). In the JN figure, the straight line represents the effect of the independent variable on the dependent variable under the moderating variable (slope), while the two curved dashed lines above and below the straight line represent the 95% confidence interval for the regression analysis.

In the first step, Model 4 in the Process program was selected for mediating effects analysis. The results show that MOBA game players' social comparison in ranking mode is positively related to avatar identification ($B = 0.58$, SE = 0.05, $p < 0.001$) and continuous willingness (B = 0.26, SE = 0.04, $p < 0.001$), and avatar identification is positively related to continuous willingness ($B = 0.27$, SE = 0.04, $p < 0.001$). The indirect effect of social comparison through avatar identification on continuous willingness is significant ($B = 0.16$, SE = 0.03, 95% CI [0.09, 0.22]).

In the second step, Model 8 in the Process program was selected for the moderated mediating effect analysis. The results in Table 4 show that MOBA gamers' social comparison in ranking mode is positively related to avatar identification ($B = 0.79$, SE = 0.06, $p < 0.001$), and the interaction of social comparison and game frustration is positively related to avatar identification ($B = 0.26$, SE = 0.05, $p < 0.001$). In this study, the JN method was used for visual analysis of the moderating effect, and the effects of game frustration moderating social comparison and avatar identification are shown in Fig. 2. When the level of game frustration is higher than the critical value of 1.14, the confidence interval does not contain 0, which indicates that the moderating effect is statistically significant, and the positive relationship between social comparison and avatar identification increases as the level of game frustration increases. The results also show that social comparison ($B = 0.38$, SE = 0.05, $p < 0.001$), avatar identification ($B = 0.23$, SE = 0.04, $p < 0.001$), and the interaction of social comparison and game frustration ($B = 0.12$, SE = 0.04, $p < 0.01$) are all positively related to continuous willingness. A diagram of the direct path effect of game frustration moderating the relationship between social comparison and continuous willingness using the JN method to quantify the data is shown in Fig. 3. When the level of social comparison is

Table 3 Descriptive data and correlation matrix of variables.

Construct	*M*	*SD*	Skewness[a]	Kurtosis[b]	SC	AI	GF	CW
SC	3.93	0.83	−1.31	1.59	**0.73**			
AI	3.93	0.92	−1.22	1.02	0.53**	**0.78**		
GF	3.45	0.91	−0.37	−0.45	0.43**	0.16**	**0.81**	
CW	4.01	0.71	−1.11	1.87	0.49**	0.51**	0.16**	**0.72**

Scores in bold represent square root of average variance extracted for a construct.
M mean, *SD* standard deviation, *SC* social comparison, *AI* avatar identification, *GF* game frustration, *CW* continuous willingness.
**$p < 0.01$.
[a]Standard Error 0.123.
[b]Standard Error 0.245.

Table 4 Tests of moderated mediating effect model.

Construct	AI			CW		
	B	SE	95%CI	*B*	SE	95%CI
SC	0.79***	0.06	[3.76, 3.92]	0.38***	0.05	[0.27, 0.49]
GF	−0.14**	0.05	[−0.24, −0.05]	−0.06	0.04	[−0.13, 0.01]
SC×GF	0.26***	0.05	[0.17, 0.36]	0.12**	0.04	[0.04, 0.20]
AI				0.23***	0.04	[0.16, 0.31]

SE standard error, *95%CI* 95% confidence interval, *AI* avatar identification, *GF* game frustration, *SC* social comparison, *CW* continuous willingness.
**$p < 0.01$, ***$p < 0.001$.

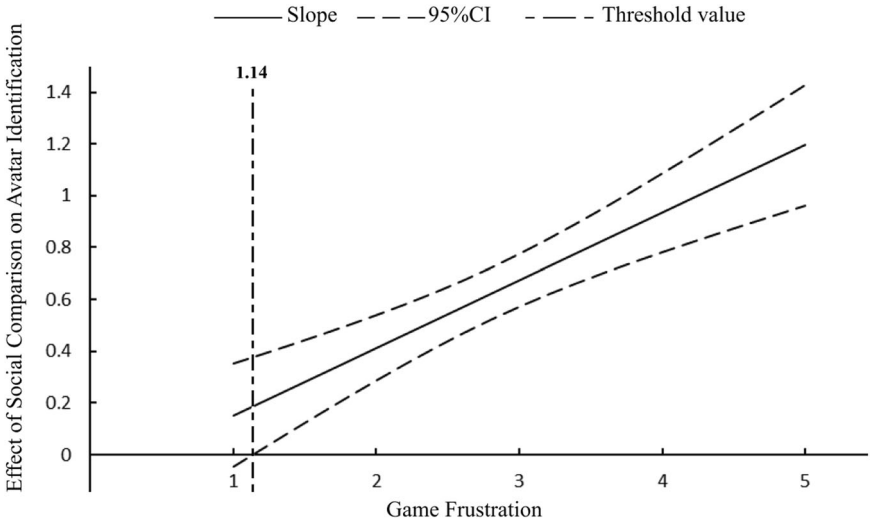

Fig. 2 Moderating effect on avatar identification. This figure shows the moderating effect of game frustration on relation between social comparison and avatar identification.

higher than the critical value of 1.40, the confidence interval does not contain 0. The moderating effect is significant, and the positive relationship between social comparison and continuous willingness increases as the level of game frustration increases.

Discussion of results

Player motivation is a crucial area of research in the gaming field, as the motives that drive people to play games determine their gameplay experience and behaviors within the game. Previous scholars have suggested that the influence of both intrinsic and extrinsic motivation factors on gaming intention and behavior should be explored comprehensively, and such research should be grounded in established psychological frameworks or human motivation theories (Dindar, 2018; Bruhlmann et al., 2020). Based on this, the current study constructs a moderated mediation model through the lens of SDT and SCT related to gamers' intrinsic and extrinsic motivation. We explored how social comparison in MOBA game ranking mode with a strong competitive nature affects players' continuous willingness to play, in which avatar identification and game frustration serve as mediating and moderating variables, respectively. The results of the comprehensive data analysis indicate that all hypotheses (H1, H2, H3, H4, H5) hold, and we will explore the results in detail below.

The results indicate that players' avatar identification mediates between social comparison and continuous willingness and that social comparison directly enhances the continuous willingness to play, which supports hypotheses H1, H2, and H3. MOBA game ranking mode reshapes the gaming experience into a competition driven by external factors, where strong competitive motivation and high frustration drive players to compete with others for dominance, and the phenomenon of social comparison can be particularly pronounced (Stapel and Koomen, 2005; Velez et al., 2018; T'ng et al., 2022). And online games with a large amount of social information provide a convenient platform for social

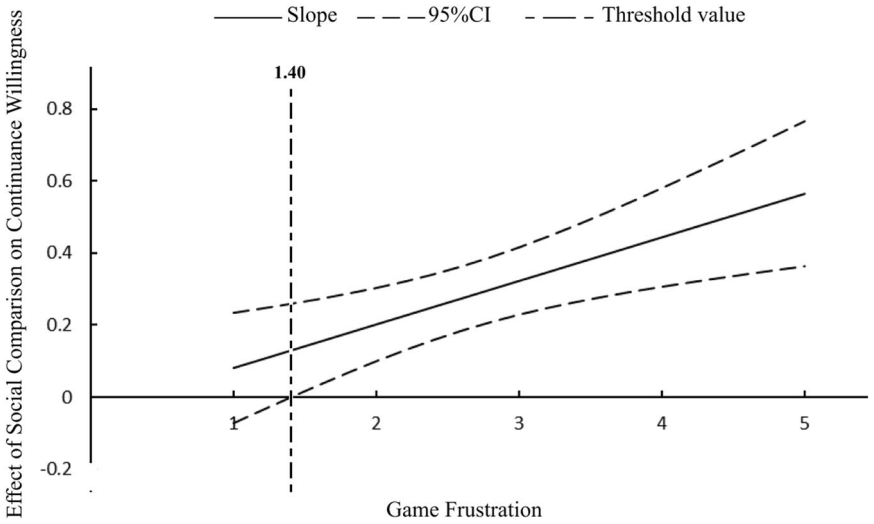

Fig. 3 Moderating effect on continuance willingness. This figure shows the moderating effect of game frustration on relation between social comparison and continuous willingness.

comparison between players, this social comparison enhances the extrinsic motivation of gamers' behavior. However, while social comparison can externally motivate players, it may not consistently ensure continued player behavior. SCT suggests that social comparison tendency factors work through internalization and identification mechanisms (Shen, 2012). Internalization and identification mechanisms in online games include players' social comparison of their game behaviors, achievements, and performances, and downward comparison is a powerful factor in games that influences players' continuous willingness to play (Esteves et al., 2021), a phenomenon that is largely carried on top of the players' game avatars.

Mustafa et al. (2023) argue that intrinsic and extrinsic motivation should be comprehensively synthesized for in-depth research, such as considering and analyzing SCT in conjunction with SDT. Some scholars define avatar identification as the player's perception of the avatar character (or in-game representation) as an extension of themselves. This perception serves as an antecedent to various factors, including enjoyment, flow of mind, and fun, all of which have an impact on game loyalty (Christy and Fox, 2016). Avatars can be a good fulfillment of the three basic psychological needs that promote self-motivation to explain positive outcomes (Barathi et al., 2018; Koulouris et al., 2020), and are the bearers of the player's intrinsic motivation in the midst of the game. Abbasi et al. (2021) argued that MOBA games offer players significant flexibility in character selection, and the projection of players onto their chosen characters is significantly positively correlated with their willingness to engage in MOBA gameplay. In addition, several scholars have verified the positive correlation between avatar identification and continuous willingness (Teng, 2019; T'ng and Pau, 2021), the emotional link that players develop to their avatars contributes to their continued play behavior, and the present study also confirms this. In the MOBA game "Honor of Kings", the players' avatars (game characters) can be ranked based on the strength of their performance in the geographical area and the friends list, and many players will focus on specific characters for long-term competition in ranking mode, thus forming a sense of identification with their avatars. The player's personal information screen and the official game checkout page will display a message reinforcing "players with the same character whose strength exceeds 95%", which will affirmation and emphasis on the player's exceptional ability, promote the player's avatar identification, and allow for implicit downward social comparison with others, thereby directly or indirectly increasing the player's willingness to continue participating in ranked matches.

At the same time, we introduced the variable of game frustration to extend the hypothesized conceptual model. Kosa and Uysal's (2022) study focused on the relationship between three basic psychological needs (autonomy, competence, and relatedness) and frustration. The results of the study suggest that game frustration positively moderates the strength of the effect of social comparison on avatar identification and continuous willingness, which supports hypotheses H4 and H5. Much of the enjoyment of the MOBA genre lies in its challenging nature, and rich challenges are bound to bring about game frustration more easily. A single instance of game frustration may not be sufficient to deter a player or change their motivation to continue playing, whereas the combined effect of strong competitive motivation and frustration will drive players to compete with others to achieve dominance (Rawsthorne and Elliot, 1999; T'ng et al., 2022), so game frustration is likely to moderate the effect of social comparison on subsequent variables. According to the JN figures (Fig. 2 and Fig. 3), the social comparison behavior of players with high levels of game frustration has stronger explanatory power for avatar identification and continuous willingness to play compared to players with low levels of game frustration, i.e., higher levels of game frustration promote stronger avatar identification and continuous willingness to play. Some scholars suggest that when someone's self-image is threatened, it motivates them to act to affirm their self-worth and maintain their self-image (Layous et al., 2017; Teng, 2019). In order to enhance players' sense of superiority, MOBA games repeatedly highlight high-power performance through the design of game elements, which implicitly strengthens players' downward social comparison. Under this premise, a high level of game frustration will threaten players' self-worth, and players will likely have a stronger sense of avatar identity and continuous game willingness in order to maintain self-esteem, according to the often-stated maxim "what doesn't kill you makes you stronger".

Theoretical implications and practical implications

This study has some theoretical contributions to the study of MOBA games. The main contribution of this study is to establish a novel theoretical explanation that focuses the research object on the

more competitive qualifying tournament mode in MOBAs and explores the multiple factors that affect players' willingness to play continuously. MOBA games have been one of the popular game genres in recent years, but compared to MMORPGs, MOBA games have not been able to receive sufficient academic attention and research (Mora-Cantallops and Sicilia, 2018; Esteves et al., 2021), so this study can fill the theoretical gap in this field to some extent. Mustafa et al. (2023) believe that it is necessary to combine SDT with similar theories and their related features to comprehensively synthesize intrinsic and extrinsic motivation for in-depth research. This paper constructs and validates a theoretical model that explores the influence of continuous willingness of MOBA game players by comprehensively combing and analyzing two motivation-related theories, SDT and SCT.

Compared to other genres, MOBA games require more social awareness services, and it brings a new way of competition (Losup et al., 2014). Few previous studies have examined how high-intensity competitive social situations and negative experiences affect players' self-perception and continuous willingness (Liao et al., 2016; Velez et al., 2018). Additionally, Mora-Cantallops and Sicilia (2018) argued that future research on player experience in MOBA games should further develop research on factors related to competition and sense of mastery. Overall, this study echoes this previous literature.

From the perspective of MOBA game stakeholders, in practical application, the life cycle of products in the online game market is shorter than that of service products in other industries (Bae et al., 2016), and the revenue flow of F2P games such as "Honor of Kings" mainly relies on sales of virtual products such as character skins and game props, and this kind of profitability strongly relies on players' continuous willingness to play. Ranking mode, which is the core gameplay of MOBA games, is particularly important to ensure a high level of daily active users and enhance user retention.

Leaderboards can motivate continuous play behavior, and social comparison behavior triggered by leaderboards thus deserves the attention of game stakeholders. In designing MOBA games, game designers can optimize motivational elements such as leaderboards, point systems, and badges, for instance, redesigning the visual elements of the leaderboard interface (Esteves et al., 2021). This redesign can selectively highlight information about players' more successful performance in the game and present it through multiple repetitions, thus suggestively motivating downward social comparison, promoting players' identification with the characters they control, maintaining their self-worth, and thus increasing their willingness to continue playing. The system should provide a flexible dynamic performance assessment method with the aim of maximizing the player's sense of superiority compared to lower-level players. For example, it can selectively emphasize the player's Kill-Death-Assist indicators. After the game ends, the system may display messages such as "In this match, your number of kills is 200% higher than the average for this character" or "In this match, your number of deaths is 50% lower than the character's average". Our research demonstrates the motivational effect of game frustration on avatar identity and continuous willingness in the highly competitive game environment, and a number of games have been designed with elements of frustration to promote greater player engagement (Kosa and Uysal, 2022), with such subtle frustration contributing to a positive game experience (Boulton et al., 2017). Therefore, MOBA game designers should consider a more reasonable opponent matching mechanism, which can be re-examined and evaluated in the context of the widely used Elo rating system. A fairer matching mechanism would help players find opponents with similar strength, reduce crushing game losses, and intentionally increase players' game outcomes of near-misses, in which game frustration contributes to a positive game experience and game behavior. On the other hand, since players identifying with their avatars significantly increases continuous willingness, it is suggested that game manufacturers offer boot camp models equipped with dynamically difficult balancing techniques, such as promoting continuous improvement of players' understanding and control of characters by using game-based feature metrics to assess player performance and adjusting opponent AI difficulty accordingly (Silva et al., 2017).

In conclusion, our study provides suggestions on how MOBA game stakeholders can enhance user retention in the MOBA game ranking mode, and has implications for the game industry to further understand social comparison, avatar identity and game frustration factors and translate these to the design requirements level.

Limitations and future research

Our study still has some limitations, which can provide a reference direction for future in-depth research. First, this study explored how players' social comparison in MOBA game ranking mode affects their continuous willingness to play through the mediating effect of avatar identification and game frustration, but did not explore the effect of other factors, and future research could be conducted from a more comprehensive perspective. Second, this study conducted convenience sampling within China, and subsequent studies could adopt stratified random sampling to explore the mechanisms of different demographic variables, such as gender and age, on continuous willingness to play in MOBA game ranking mode. Since our experimental data came from a web questionnaire, it is likely that differences in the continuous willingness of users at different age levels to play in MOBA game ranking mode were ignored, which could be a focus in subsequent studies, and we also consider expanding the sample size of the study to improve the reliability of the data. Third, more diversified research approaches could be explored in the future, with a focus on longitudinal studies, and at the same time multiple research approaches could be integrated, such as field interviews, grounded research, experimental study, case study, etc.

Conclusions

This study synthesizes the dual theories of SDT and SCT related to intrinsic and extrinsic motivation, focuses on MOBA game ranking modes (e.g., Honor of Kings), which are strongly competitive in nature, and constructs a conceptual model of players' continuous willingness. The result shows that, in MOBA game ranking mode, players' social comparison enhances their continuous willingness to play and their avatar identification, and indirectly enhances continuous willingness through the mediating effect of avatar identification, in which game frustration has a significant positive moderating effect. This study broadens the exploration of the continuous willingness of players in MOBA games with respect to the qualifying mode, provides guidance on the design and improvement of MOBA game mechanics, and provides practical implications for the continued development of the MOBA game industry.

Data availability

The data obtained and examined in this study are documented in the paper and provided in the supplemental data file.

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Author contributions

TX: Conceptualization, Methodology, Validation, Writing—original draft, review, and editing. XL: Conceptualization, Methodology, Writing—original draft and editing. XM: Validation, Writing—Review and editing. QS: Validation, Writing—Review and editing. SD: Conceptualization, Writing—review and editing. All authors have read and agreed to the manuscript's published version.

Competing interests

The authors declare no competing interests.

Ethical approval

All procedures in this study were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Departmental Ethics Committee and the Institutional Review Board of the Guangdong University of Technology (No. GDUTXS2023001).

Informed consent

All participants were informed regarding this study's aim and scope as well as the ways in which the data would be used. The respondents' participation was completely consensual, anonymous, and voluntary. Informed consent was obtained from all participants included in the study before they participated in the survey.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-024-03934-1.

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