Dual Psychological Bonds in Digital Games: The Influence of Game Identification and Psychological Ownership on Post-Purchase Satisfaction

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ABSTRACT
Player satisfaction with purchased virtual items plays a crucial role in fostering loyalty, generating positive word-of-mouth, and driving repurchase behaviour. However, this topic has received limited attention in existing literature. Drawing on Social Identity Theory and Psychological Ownership Theory, this study investigates how psychological bonds—both between players and games, and between players and virtual items—influence post-purchase satisfaction. Survey data from 502 players were analysed using structural equation modelling. The results indicate that both game identification and psychological ownership significantly enhance player satisfaction, and that virtual item type preference (functional vs. non-functional) significantly moderates these relationships. Moreover, game identification partially mediates the effect of psychological ownership on satisfaction. Overall, this research extends the gamer satisfaction literature by examining the role of psychological bonds in shaping post-purchase evaluations and identifying the boundary conditions under which they operate. It also confirms that social identity and psychological ownership meaningfully influence user satisfaction within digital and interactive media environments.

Keywords: *In-game purchase, Player satisfaction, Game identification, Psychological ownership.*

1. INTRODUCTION

In recent years, the online gaming industry has witnessed remarkable growth, emerging as a dominant form of entertainment media and a vital pillar of the digital media economy (Hamari & Keronen, 2017; L. Wang et al., 2023). As the "free-to-play" business model becomes increasingly prevalent, the sale of virtual goods has gained substantial importance (Hamari et al., 2020). Consequently, an expanding body of research has focused on identifying the key drivers of players' willingness to purchase virtual items. Existing studies suggest that when virtual goods provide functional, hedonic, and social value, by enhancing players' sense of achievement, social interaction, and immersive experience, purchase intentions are significantly strengthened (Mäntymäki & Salo, 2015; Park & Lee, 2011b). Specifically, functional value enhances in-game character performance (Bae et al., 2019), hedonic value fosters a heightened sense of flow (Cai et al., 2021), and social value improves players' perceived social status within the virtual environment (Marder et al., 2019). In addition, other research has highlighted the influence of technological features (Animesh et al., 2011), affordances (L. Wang, Sun, et al., 2022), and the social factors (H.-W. Kim et al., 2012) on players' in-game purchasing behavior. These findings collectively deepen our understanding of the psychological and environmental factors that motivate virtual item purchases.

Meanwhile, a number of studies have begun to highlight the importance of players' post-purchase evaluations of virtual items, such as customer satisfaction (B. Kim, 2012; W.-T. Wang & Chang, 2014). Customer satisfaction is widely recognized as a key determinant of commercial success in the digital media economy. In the context of online gaming, player satisfaction not only significantly

enhances the overall gaming experience (Reinecke et al., 2012), but also promotes player loyalty, willingness to purchase virtual items, and positive word-of-mouth communication—factors that are essential for the long-term sustainability of gaming companies (B. Kim, 2012; M. Kim & Cho, 2018). Although a substantial body of literature has examined player extensive with the overall gaming experience (C. M. K. Cheung et al., 2015; Chow, 2021; Erb et al., 2021; Yang et al., 2009), research specifically focused on the post-purchase satisfaction with in-game virtual items remains limited.

Customer satisfaction is shaped by how a product is used after the point of purchase (Kuo et al., 2009; Westbrook, 1987). The limited body of research on virtual goods primarily adopts the expectation confirmation perspective, suggesting that players' post-purchase satisfaction is largely influenced by perceived value confirmation (W.-T. Wang & Chang, 2014). Specifically, when players experience higher levels of functional, emotional, hedonic, and cultural value during their use of virtual items, their satisfaction tends to increase significantly (Fu & Liang, 2022; Mkedder et al., 2024). While this perspective provides valuable insights into the cognitive mechanisms underlying player satisfaction, it tends to overlook the affective dimensions that develop through prolonged and repeated interaction with focal game and virtual items.

To address this limitation, the present study shifts focus to the broader set of psychological bond mechanisms. These mechanisms emerge through players' ongoing interactions with game-related elements and influence their post-purchase satisfaction. Given that the use of virtual items is highly dependent on interaction within the game environment (Lehdonvirta, 2009), this study distinguishes between two types of psychological bonds that players may form: player–game bond and player–virtual item bond. On one hand, players who consistently engage with a game on cognitive, emotional, and behavioral levels are more likely to develop a strong psychological bond with the game itself. According to social identity theory (Ashforth & Mael, 1989; Tajfel, 1982), as these bonds deepen, players begin to integrate the game into their self-concept, forming a sense of game identification (Badrinarayanan et al., 2015; L. Wang, Sun, et al., 2022). On the other hand, through prolonged use and interaction with virtual items, players invest substantial time and emotional energy, forming deep psychological connections with these digital assets. Drawing on psychological ownership theory (H. Kim et al., 2024; Pierce et al., 2003), such connections can evolve into a perceived sense of ownership, even though these items exist solely in the virtual world (Tan & Yang, 2022).

Based on this theoretical framework, we propose the following research questions: 1) How do game identification and psychological ownership independently influence players' satisfaction with purchased virtual items? 2) Does game identification mediate the relationship between psychological ownership and satisfaction with virtual items? 3) To what extent do individuals' virtual item type preferences moderate the effects of game identification and psychological ownership on satisfaction?

Answering these research questions contributes to a more nuanced understanding of the mechanisms that shape players' satisfaction with in-game virtual items. This study offers four key theoretical contributions. First, it shifts the focus from overall game satisfaction and purchase intention to post-purchase satisfaction with virtual items, providing a more specific lens for examining user experience in digital consumption. Second, it introduces game identification and psychological ownership as dual psychological bond mechanisms that influence satisfaction, thereby extending current research beyond cognitive value assessments to include affective and identity-driven processes. Third, by demonstrating that these mechanisms operate even in the context of intangible, digitally mediated goods, the study expands the applicability of social identity and psychological ownership theories to digital media environments. Fourth, by incorporating virtual item type preference (functional vs. non-functional) as a moderating variable, the study identifies boundary conditions under which identification and ownership exert their effects, offering new insights into user heterogeneity in interactive media consumption. Collectively, these contributions enrich theoretical understanding of post-purchase behavior in digital contexts and provide actionable implications for game developers and marketers.

2. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

2.1 Player Satisfaction with Virtual Items

Customer satisfaction is a critical factor driving the commercial success of the digital media

economy. In online gaming, player satisfaction not only enhances the overall gaming experience (Reinecke et al., 2012), but also significantly promotes player loyalty, the intention to repurchase virtual items, and positive word-of-mouth (B. Kim, 2012; M. Kim & Cho, 2018), all of which are essential for the continued success of gaming companies. While extensive research has examined player satisfaction with overall game experiences (C. M. K. Cheung et al., 2015; Chow, 2021; Erb et al., 2021; Yang et al., 2009), there is limited focus on post-purchase satisfaction specifically related to in-game virtual items. For instance, players who experience higher levels of functional, emotional, hedonic, and cultural value during their use of virtual items report greater satisfaction (Fu & Liang, 2022; Mkedder et al., 2024). While these findings emphasize the positive role of usage experiences and perceived value, the underlying mechanisms shaping post-purchase satisfaction remain underexplored.

The psychological bond between customers and brands or products has been identified as a key predictor of post-purchase satisfaction. For example, brand trust, brand attachment, and product involvement have all been shown to significantly influence satisfaction (Richins & Bloch, 1991; Zboja & Voorhees, 2006). Drawing from this perspective, the present study explores how psychological bonds formed during the use of virtual items contribute to post-purchase satisfaction.

As a distinct category of digital media, virtual goods differ fundamentally from other digital content (e.g., music, e-newspapers, or streaming videos) in how they are used. The use of virtual items is highly dependent on the game environment—that is, their value is closely tied to gameplay and cannot be realized outside of it (Lehdonvirta, 2009). Given this, we differentiate between two types of psychological bonds influencing satisfaction: player–game bond and player–virtual item bond. This study conceptualizes player–game bond as game identification and player–virtual item bond as psychological ownership.

2.2 Game Identification

Identity is closely tied to how individuals define and express their sense of self (Vignoles et al., 2011). When individuals establish cognitive and affective bond with a particular referent (e.g., community, organization, or role), a corresponding form of identity is developed, such as community identity, organizational identity, or social role identity (Ashforth et al., 2008; Stryker & Burke, 2000; Tajfel, 1982). Online games offer a rich array of referents—such as the game itself, avatars, and gaming communities—through which players can construct and express their self-concept. When players integrate a specific game into their self-concept, they form and express a sense of game identification. Drawing on social identity theory, game identification has been defined as "the extent to which a player sees the game as an extension of the self" (Badrinarayanan et al., 2015; L. Wang, Sun, et al., 2022).

Identity literature suggests that individuals tend to evaluate more positively those objects or entities that are consistent with their self-concept (Reed et al., 2012). This positive evaluation not only applies to the referent object as a whole but also extends to its constituent elements. For example, organizational identity fosters employees' satisfaction with both their organization and their work (Loi et al., 2014), while community identity enhances favourable evaluations of both the group and its members (Greenwald et al., 2002; Tajfel, 1982). Building on this logic, when players form a strong game identity, their positive evaluations of the game are likely to extend to the virtual items embedded within it, thereby enhancing their post-purchase satisfaction with those items.

- Hypothesis 1: Game identification is positively associated with players' post-purchase satisfaction with virtual items.

2.3 Psychological ownership

Psychological ownership theory describes a psychological state in which individuals feel as though a particular target belongs to them, even in the absence of formal legal ownership (Pierce et al., 2001, 2003). Psychological ownership arises from several antecedents: investment of the self, perceived control, intimate knowledge, and self-object congruity (Peck & Luangrath, 2023). These targets may include not only physical objects but also intangible entities such as ideas, designs, data, digital content, and digital platforms (Peck & Luangrath, 2023).

Psychological ownership can trigger the endowment effect, where individuals become emotionally attached to a target and consequently assign it higher subjective value, accompanied by loss aversion and stronger supportive behaviours (Dommer & Swaminathan, 2013; Franciosi et al.,

1996). This effect has been widely validated in digital media environments. For example, customers' psychological ownership of AI voice assistants enhances satisfaction (M. Kim & Kim, 2024); while ownership over music streaming content promotes loyalty, satisfaction, and willingness to pay (Danckwerts & Kenning, 2019; Sinclair & Tinson, 2017). In gaming context, psychological ownership has been shown to enhance hedonic experiences (Tan & Yang, 2022). These findings suggest that heightened value assessment and positive behavioural responses driven by psychological ownership reflect individuals' elevated levels of satisfaction with digital objects.

- Hypothesis 2: Psychological ownership is positively associated with players' post-purchase satisfaction with virtual items.

In online games, players' psychological ownership of virtual items stems from their self-investment—time, effort, money, attention, and emotional energy—into those items (Peck & Luangrath, 2023). Through sustained use and engagement, virtual items often acquire symbolic meaning related to identity expression (Dittmar, 2011; Pierce et al., 2001). For example, owning and displaying certain virtual items may confer a sense of visual authority and elevated social status within the game's social environment, linking the item to the player's self-concept (Huang et al., 2025; Park & Lee, 2011b). Because virtual items are embedded in the game ecosystem, psychological ownership over these items encourages players to incorporate both the virtual items and the game environment into their sense of identity, fostering game identification.

Prior literature on game identification also suggests that players' perceptions and experiences of game components are key predictors of identity formation. Specifically, game-related attributes such as challenge, balance, novelty, and aesthetics are positively associated with identification (Badrinarayanan et al., 2015; L. Wang, Sun, et al., 2022). Moreover, immersive experiences, emotional engagement, and social embeddedness have all been shown to strengthen players' sense of identity with the game (Badrinarayanan et al., 2015). As such, psychological ownership over virtual items reflects players' psychological connection with those items. When players feel that virtual goods belong to them, they are more likely to perceive the game and its elements as part of their extended self. According to social identity theory, this sense of psychological possession and belongingness contributes to the formation of game identification (Ashforth et al., 2008; L. Wang, Sun, et al., 2022).

- Hypothesis 3: Psychological ownership is positively associated with game identification.

2.4 The Mediating Role of Game Identification

Game identification is proposed to mediate the relationship between psychological ownership and post-purchase satisfaction with virtual items. From the perspective of expectation confirmation theory, whether virtual items meet players' utilitarian and social expectations plays a key role in shaping post-purchase satisfaction and repurchase intention (W.-T. Wang & Chang, 2014). Utilitarian expectations are reflected in the item's usefulness and ease of use during gameplay—such as speeding up progress, saving time, or improving performance (Shukla & Drennan, 2018). Social expectations pertain to the ability of virtual items to fulfil social needs, such as self-presentation, maintaining social relationships, or enhancing communication (Ho & Wu, 2012; Mäntymäki & Salo, 2013).

Virtual items that meet utilitarian expectations enhance self-efficacy, thereby boosting self-esteem, while those that meet social expectations help players express identity and gain a sense of belonging, also improving self-esteem (Marder et al., 2019). When players perceive psychological ownership over such items, their self-esteem increases (Jin et al., 2017; W. Wang & Hang, 2021), which in turn enhances their game identification and further leads to higher satisfaction with virtual items.

- Hypothesis 4: Game identification mediates the relationship between psychological ownership and players' post-purchase satisfaction with virtual items

2.5 The Moderating Role of Virtual Item Type Preference

Game identification—defined as the extent to which players incorporate a targeted online game into their self-concept—is heavily influenced by the game's features and player experience. Prior literature finds that game affordance such as balance, fairness, challenge, aesthetic, and novelty may strengthen game identification (Badrinarayanan et al., 2015; L. Wang, Sun, et al.,

2022). Likewise, aspects of players' in-game experiences, including skill development and telepresence, have been shown to positively impact game identification (Badrinarayanan et al., 2015).

The use of in-game items may affect players' perceptions of game affordances and experiences. Virtual items in online games are generally classified as either functional or non-functional (L. Wang, Sun, et al., 2022). Functional items deliver utilitarian value by enhancing performance—such as weapons or power-ups—while non-functional items provide hedonic or social value (e.g., character skins or emotes) that do not affect gameplay outcomes (Lehdonvirta, 2009). Importantly, functional items are often viewed as a threat to game balance and fairness, while non-functional items are seen as enhancing the game's hedonic experience (Palmeira, 2021).

Consequently, players who prefer functional items tend to place less emphasis on game fairness and balance and are generally less skilled than those who favour non-functional items (Bae et al., 2019). Moreover, non-functional items enable players to visually express their ideal self-image and convey social value in player-to-player comparisons (Lehdonvirta, 2009). When players are motivated by identity signalling, they are more likely to favour non-functional items (Shelton, 2010).

As a result, player satisfaction derived from functional items is less likely to be based on game identification compared with satisfaction associated with non-functional items.

- Hypothesis 5a: Virtual item type preference moderates the positive relationship between game identification and satisfaction, such that the effect is stronger for players who prefer non-functional items.

Customers experience higher satisfaction when they have greater psychological ownership of their purchased items, as this ownership meets basic psychological needs such as autonomy, competence, and relatedness (Li & Atkinson, 2020). Functional items directly and objectively enhance in-game performance (Bae et al., 2019; Lehdonvirta, 2009; Park & Lee, 2011a) and boosting players' sense of control and flow state (Ghazali et al., 2023; Goli & Vemuri, 2021), thereby fulfilling players' needs for autonomy and competence during gameplay. In contrast, non-functional items primarily offer hedonic and social value (Lehdonvirta, 2009; Shelton, 2010), which satisfy the need for relatedness. However, the relatedness derived from non-functional items is more subjective and varies among players. For instance, some players purchase in-game items under peer influence driven by either envy or conformity (L. Wang, Luo, et al., 2022); this indicates that while some players buy virtual items to foster social connections, others do so to present a unique identity in the game's social environment. Consequently, the effect of psychological ownership on satisfaction tends to be more salient and stable among players who prefer functional items compared to those who favour non-functional items.

- Hypothesis 5b: Virtual item type preference moderates the positive relationship between psychological ownership and satisfaction, such that the effect is stronger among players who prefer functional items.

3. METHOD

3.1 Sample and Data Collection

Data for this study were collected through an anonymous online questionnaire administered via Wenjuanxing ("Survey Star"; Changsha Ranxing Science and Technology, Shanghai, China). In the preliminary stage, a pilot test involving 25 university student gamers was conducted to identify and refine ambiguous or unclear items. Based on their feedback, the questionnaire was revised accordingly. The final survey was distributed in August 2023 using a convenience sampling approach, with recruitment conducted primarily through gaming-related social media communities where players regularly exchange information and share gaming experiences. Each participant who completed the questionnaire received a 1 RMB incentive.

A total of 910 responses were collected. To ensure data relevance, participants who had not purchased any virtual items in the past three months were excluded, yielding a filtered sample of 710 responses. After further screening for incomplete submissions, missing data, and abnormally short completion times, the final dataset consisted of 502 valid responses, representing a valid response rate of 55%. As summarized in "Table 1", among the 502 valid participants, 73.1% were male, and 83.7% were between 18 and 25 years old. Additionally, 78.3% held a bachelor's degree or above. Regarding gaming behaviour, 46.2% of

respondents reported playing games for 1 to 3 hours per day on average.

Table 1. Descriptive Statistics

Items	Characteristics	Frequencies	Percentage
Gender	Male	367	73.11%
	Female	135	26.89%
Education Level	High school degree or below	29	5.78%
	Bachelor's degree	388	77.29%
	Master's degree or above	85	16.93%
Age	Under 18	11	2.20%
	18~25	420	83.70%
	26~30	47	9.40%
	31~40	24	4.80%
Average Daily Play Time	Less than 0.5 hour	34	6.80%
	0.5–1 hour	141	28.10%
	1–3 hours	232	46.20%
	More than 3 hours	95	18.90%
Monthly Game Spending	≤ 200 RMB	251	50.00%
	200-500 RMB	179	35.66%
	500-1000 RMB	49	9.76%
	≥ 1000 RMB	40	4.58%
In-Game Social Interaction	Yes	492	98.00%
	No	10	2.00%
Virtual Item Purchase Preference	Functional items	104	20.72%
	Both Functional and Non-functional items	240	47.81%
	Non-functional items	158	31.50%

3.2 Measurement

The empirical model of this study includes four core variables. Among them, game identification, psychological ownership, and player satisfaction are treated as latent variables and measured using established multi-item scales. Virtual item type preference is categorized based on the functional characteristics of the items purchased: players who reported purchasing only functional items (e.g., weapons, tools, and performance-enhancing equipment) were classified into one group, and those who purchased only non-functional items (e.g., cosmetic skins, apparel, visual effects) were classified into another. All three latent variables were measured using a 7-point Likert scale, ranging from 1 (“strongly disagree”) to 7 (“strongly agree”).

Game identification was measured using a 5-item scale adapted from L. Wang, Sun, et al., (2022) and Badrinarayanan et al., (2015). The items were originally derived from the organizational identification scale developed by Ashforth & Mael, (1989). Psychological ownership was measured using 3 items adapted from Tan & Yang, (2022). Player satisfaction was assessed using 4 items adapted from W.-T. Wang & Chang (2014), capture players’ overall satisfaction with virtual items after purchase.

3.3 Data Analysis Method

This study employed Structural Equation Modelling (SEM) to test the proposed research model, following the two-step approach recommended by Anderson & Gerbing, (1988), which involves separate assessments of the measurement model and the structural model. To examine the significance of the mediation effect, the bootstrapping method was applied (S. F. Cheung & Cheung, 2024). Moderation effects were tested using multi-group structural equation modelling (MGSEM). In line with methodological guidelines for multi-group analysis, measurement invariance across groups was first assessed to ensure configural and metric equivalence. Subsequently, moderation effects were evaluated by comparing path coefficients across groups and

conducting chi-square difference tests to determine whether structural relationships varied significantly (Evermann, 2010).

4. RESULTS

4.1 Measurement Model

4.1.1 Confirmatory Factor Analysis Result

Given that all latent variables in this study were measured using Likert-type scales, the Diagonally Weighted Least Squares (DWLS) method was employed for estimation. Results from the confirmatory factor analysis (CFA) indicate a good model fit: $\chi^2 = 132.118$, df = 51, $p < 0.001$; the chi-square to degrees of freedom ratio (χ^2/df) was 2.59, below the recommended threshold of 3. All fit indices met acceptable standards: CFI = 0.997, TLI = 0.996 (both > 0.90), RMSEA = 0.056 (90% CI = [0.045, 0.068], < 0.08), and SRMR = 0.041 (< 0.08). These results confirm that the measurement model exhibits good construct validity and can be used for subsequent structural analysis.

4.1.2 Measurement Invariance Analysis

To test the moderating effects of virtual item type preference on the effects of psychological ownership and game identification on player satisfaction, multi-group structural equation modeling (MGSEM) was conducted. A necessary prerequisite for valid multi-group comparisons is measurement invariance—i.e., that the measurement structure is consistent across groups (Vandenberg & Lance, 2000).

This study followed the equivalence testing framework to assess measurement invariance. Since the analysis focuses on differences in path coefficients rather than latent mean comparisons, and error variance invariance is beyond the scope of the current study, only configural invariance and metric invariance were tested (Evermann, 2010; Jiang et al., 2017).

Virtual item type preference was assessed using a multiple-choice item where respondents indicated the types of virtual goods they had purchased, including weapons or tools, character skins or effects, in-game characters, and loot boxes. To ensure clear group delineation, a subset of 262 valid responses was extracted, including only those respondents who selected either functional items exclusively (e.g., weapons/tools) or non-functional items exclusively (e.g., skins/effects). This subset consisted of 104 participants preferring functional items and 158 preferring non-functional items. Measurement invariance testing was conducted using the *equaltestMI* package in R (Jiang et al., 2017). For virtual item type preference, configural and metric invariance were assessed sequentially to evaluate whether the factor structure and loadings were equivalent across groups.

The results of these analyses are summarized in "Table 2". The configural invariance model for the functional virtual item group showed $RMSEA_t$ = 0.120, which is below the cut.10 boundary fit critical value (cut.10 = 0.124), with the model fit rated as mediocre; for the non-functional virtual item group, $RMSEA_t$ = 0.085, which is below the cut.08 reasonable fit critical value (cut.08 = 0.105), and the model fit was rated as good (fair). Therefore, with an $RMSEA_t$ of 0.120 and a mediocre fit, the configural invariance was supported by the equivalence test. The metric invariance model showed an $RMSEA_t$ = 0.120, which is below the cut.08 reasonable fit critical value (cut.08 = 0.142), and the model fit was rated as good (fair). Therefore, with an $RMSEA_t$ of 0.120 and good model fit, the metric invariance was supported by the equivalence test.

Table 2. Measurement invariance test results

Group	Model	εt	RMESAt	cut.01	cut.05	cut.08	cut.10	GoF
Virtual Item Type Preference	Configural Model 1	0.368	0.120	0.058	0.080	0.105	0.124	mediocre
	Configural Model 2	0.183	0.085	0.058	0.080	0.105	0.124	fair
	Metric Invariance Model	0.065	0.120	0.100	0.118	0.142	0.160	fair

a * GoF denotes goodness-of-fit. Configural Model 1 refers to participants who preferred functional virtual items, while Configural Model 2represents those who preferred non-functional virtual items.

4.1.3 Common Method Bias

To assess potential common method bias, this study conducted Harman's single-factor test (Podsakoff et al., 2003). The one-factor model yielded a chi-square value of 1085.561 with 54 degrees of freedom ($p < 0.001$), which indicated a significantly poorer fit compared to the proposed

three-factor model. The fit indices of the single-factor model were CFI = 0.958, TLI = 0.948, RMSEA = 0.195 (90% CI = [0.185, 0.205]), and SRMR = 0.114, all of which failed to meet conventional thresholds for acceptable fit. These results suggest that common method bias is unlikely to pose a significant threat to the validity of the findings, and the measurement model demonstrates good overall reliability.

4.1.4 Reliability and Validity

The reliability of the measurement instruments was evaluated using Cronbach's alpha coefficients and composite reliability (CR). As shown in "Table 3", all latent constructs demonstrated Cronbach's alpha and CR values above the commonly accepted threshold of 0.70, indicating good internal consistency.

Validity was assessed through content validity, convergent validity, and discriminant validity. To ensure content validity, the questionnaire was pretested and refined through interviews with undergraduate students majoring in game-related fields and experienced players at a university in Beijing. These consultations helped ensure that the measurement items were conceptually accurate and contextually appropriate.

Convergent validity was evaluated using standardized factor loadings, composite reliability (CR), and average variance extracted (AVE). As shown in Table 3, all standardized loadings were significant ($p < 0.001$), ranging from 0.65 to 0.85. CR values exceeded 0.70, and AVE values were all above 0.50, thereby supporting convergent validity.

Discriminant validity was assessed using both the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). According to the Fornell–Larcker criterion, the square roots of the AVEs for all constructs—game identification (0.794), psychological ownership (0.848), and player satisfaction (0.801)—were greater than the corresponding inter-construct correlations (game identification and psychological ownership = 0.548; game identification and player satisfaction = 0.718; psychological ownership and player satisfaction = 0.759). This confirms satisfactory discriminant validity.

Additionally, HTMT values were below the 0.85 threshold: 0.529 for game identification and psychological ownership, 0.710 for game identification and player satisfaction, and 0.749 for psychological ownership and player satisfaction. These results further support the discriminant validity of the measurement model.

Table 3. Confirmatory factor analysis results

Construct	Item	M	SD	λ	α	CR	AVE
Game Identification	GI1: When someone criticizes the game I play, I feel personally insulted.	4.484	1.728	0.717	0.875	0.881	0.630
	GI2: The success of the game I play feels like my own success.	4.777	1.621	0.774			
	GI3：When someone compliments the game I play, I feel personally praised.	4.952	1.557	0.839			
	GI4：I care about how others perceive the game I play.	4.558	1.664	0.858			
	GI5：I feel embarrassed when the media criticizes the game I play.	4.466	1.726	0.773			
Psychological Ownership	PO1：I feel that these in-game virtual items belong to me.	5.52	1.325	881	0.850	0.854	0.720
	PO2：I have a strong sense of personal ownership over these in-game virtual items.	5.247	1.407	0.795			
	PO3：I feel like I possess these in-game virtual items.	5.46	1.227	0.866			
Customer Satisfaction	CS1：Overall, I am satisfied with the quality and related services of virtual products.	5.301	1.311	0.881	0.844	0.855	0.642
	CS2：Considering the price, I am satisfied with the virtual products.	4.755	1.492	0.720			
	CS3：If the quality of the virtual products exceeds my expectations, I feel satisfied with them.	5.321	1.334	0.764			
	CS4：The virtual products I use have met my expectations.	5.247	1.230	0.829			

4.2 Structural Model Analysis Result

4.2.1 Structural Model and Direct Effect

The structural model demonstrated a good overall fit, with all model indices falling within acceptable thresholds (χ^2 = 132.118, df = 51, p < 0.001; χ^2/df = 2.59 < 3; CFI = 0.997 > 0.90; TLI = 0.996 > 0.90; RMSEA = 0.056 < 0.08, 90% CI = [0.045, 0.068]; SRMR = 0.041 < 0.05).

As shown in "Table 4", game identification exerted a significant positive effect on player satisfaction (β = 0.432, p < 0.001), supporting Hypothesis 1. Psychological ownership also had a significant positive effect on player satisfaction (β = 0.522, p < 0.001), confirming Hypothesis 2. Furthermore, psychological ownership significantly predicted game identification (β = 0.548, p < 0.001), thereby supporting Hypothesis 3.

Table 4. Mediation analysis results

Path No.	Path	Standardized Effect (β)	95% CI	p Value
1	GI → CS	0.432	[0.321, 0.540]	< 0.001
2	PO → CS	0.522	[0.410, 0.635]	< 0.001
3	PO → GI	0.548	[0.459, 0.634]	< 0.001
4	PO → GI → CS	0.237	[0.172, 0.306]	< 0.001
5	Total Effect (Path 2 + Path 4)	0.759	[0.685, 0.827]	< 0.001

a * GI = Game Identification; PO = Psychological Ownership; CS = Customer Satisfaction (Player Satisfaction). Standardized effects were estimated via bootstrapping with 95% bias-corrected confidence intervals. All paths are significant at p < .001.

4.2.2 Mediation Analysis

To test the mediating role of game identification in the relationship between psychological ownership and player satisfaction, the *manymome* package in R was used to conduct a bootstrap-based mediation analysis (S. F. Cheung & Cheung, 2024).

As reported in "Table 4", the indirect effect of psychological ownership on player satisfaction through game identification was β = 0.237, with a 95% confidence interval of [0.172, 0.306], which does not include zero, indicating a statistically significant mediating effect. The direct effect of psychological ownership on player satisfaction was β = 0.522, 95% CI = [0.410, 0.635]. The total effect, combining both direct and indirect paths (psychological ownership → player satisfaction, and psychological ownership → game identification → player satisfaction), was β = 0.759, 95% CI = [0.685, 0.827].

The indirect effect accounted for 31.2% of the total effect, suggesting that game identification partially mediates the relationship between psychological ownership and player satisfaction, thus supporting Hypothesis 4.

4.2.3 Robustness Test of Direct and Indirect Effects

To assess the robustness of the proposed model, the direct and indirect effects were re-examined using the subsample (n = 262) drawn from the measurement invariance analysis. Results from confirmatory factor analysis (CFA) demonstrated satisfactory model fit for both the full sample (*N* = 502) and the subsample (*N* = 262). Specifically, for the full sample, the fit indices were: CFI = 0.997, TLI = 0.996, RMSEA = 0.056, and SRMR = 0.041. For the subsample, the fit indices were similarly strong: CFI = 0.996, TLI = 0.995, RMSEA = 0.060, and SRMR = 0.051. All factor loadings exceeded 0.60 and were statistically significant (p < 0.001) in both samples, and inter-factor correlations exhibited high consistency across groups, supporting the measurement model's stability.

The structural model analysis also yielded acceptable fit indices across both samples. As with the measurement model, the structural model showed CFI = 0.997, TLI = 0.996, RMSEA = 0.056, and SRMR = 0.041 for the full sample, and CFI = 0.996, TLI = 0.995, RMSEA = 0.060, and SRMR = 0.051 for the subsample. While the magnitude of direct path coefficients varied slightly between the two groups, the direction and statistical significance of each effect remained consistent. These findings indicate that the model is both applicable and robust across different sample compositions.

4.2.4 Moderation Analysis

To examine the moderating effects of virtual item type preference, this study employed multi-group structural equation modeling (MGSEM)

using the subsample (N = 262) in R (Evermann, 2010). As a prerequisite for valid multi-group comparison, measurement invariance across item preference groups was established in advance (see Section 4.2), and the robustness of the structural model was confirmed across both the full sample (N = 502) and the subsample (N = 262).

In the moderation analysis, a baseline model was first specified with no equality constraints imposed on path coefficients across groups. Next, a constrained model was estimated in which the structural path coefficients were set to be equal across groups. The chi-square difference test ($\Delta\chi^2$) between the baseline and constrained models was used to determine whether virtual item type preference significantly moderated the structural paths from psychological ownership to satisfaction and from game identification to satisfaction.

As shown in "Table 5", the results of the multi-group structural equation modeling indicate that item type preference–based constrained models exhibited acceptable overall model fit (CFI, TLI, RMSEA, and SRMR). However, compared to the respective unconstrained baseline models, the fit of the constrained models deteriorated significantly.

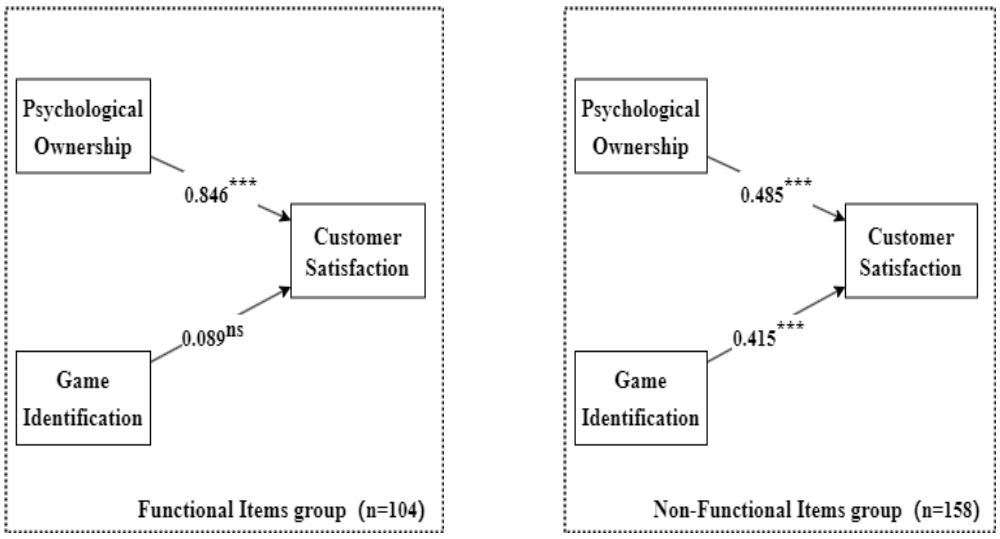
In the virtual item type preference groups, the difference was statistically significant ($\Delta\chi^2$ = 54.266, Δdf = 3, p < .001), suggesting that the structural relationships differ between players who prefer functional items and those who prefer non-functional items.

Taken together, these findings provide empirical support for the hypothesized moderating effects item type preference. Item type preference significantly moderated the two direct structural paths in the model—namely, *game identification → player satisfaction* and *psychological ownership → player satisfaction*.

Table 5. Moderation analysis results

Model	df	χ^2	$\Delta\chi^2$	Δdf	P ($\Delta\chi^2$)	CFI	TLI	RMSEA	SRMR
Baseline Model	102	161.373				0.996	0.995	0.067	0.061
Constrained Model	105	215.639	54.266	3	<0.001	0.992	0.990	0.090	0.069

a * Models represent item preference–based multi-group comparisons (i.e., functional vs. non-functional), respectively. Constrained models apply equality constraints on path coefficients across groups. df = degrees of freedom; $\Delta\chi^2$ and Δdf indicate chi-square and degree-of-freedom differences between baseline and constrained models.



(**a**) (**b**)

Figure 1 Path analysis of the relationships between psychological ownership, game identification, and customer satisfaction by virtual item type preference: (a) Functional Items Group (n = 104); (b) Non-Functional Items Group (n = 158).

To further examine the moderating effects, structural path coefficients were compared across subgroups. As illustrated in "Figure 1", virtual item type preference demonstrated significant moderating effects. The positive effect of game identification on player satisfaction was significant and stronger among players who preferred non-functional virtual items (β = 0.415, SE = 0.043, p

< .001), but not significant among those who preferred functional items (β = 0.089, SE = 0.119, *p* = .275), supporting Hypothesis 5a.

The effect of psychological ownership on player satisfaction was significantly stronger for players with a functional item preference (β = 0.846, SE = 0.085, *p* < .001) compared to those with a non-functional item preference (β = 0.485, SE = 0.039, *p* < .001), supporting Hypothesis 5b.

5. CONCLUSION

5.1 Research Findings

Grounded in social identity theory and psychological ownership theory, this study examined how the psychological bonds players form with games and in-game virtual items influence their post-purchase satisfaction. Four key findings emerged. First, game identification significantly enhances satisfaction with virtual items, especially among players who prefer non-functional items. Second, psychological ownership directly contributes to satisfaction, with a stronger effect observed among players who favor functional items. Third, psychological ownership strengthens game identification, suggesting a reinforcing relationship between feelings of possession and self-concept integration. Fourth, game identification partially mediates the relationship between psychological ownership and satisfaction, indicating that identification with the game is a key mechanism through which ownership drives positive evaluations. Together, these findings highlight a nuanced interplay between ownership, identity, and item type preference in shaping players' post-purchase experiences.

5.2 Theoretical Contributions

This study makes four primary theoretical contributions.

First, prior research has predominantly examined overall game satisfaction either as an antecedent of in-game purchase intention (C. M. K. Cheung et al., 2015; Ho & Wu, 2012; Park & Lee, 2011b) or as a outcome of virtual item value outcome expectations after a purchase (W.-T. Wang & Chang, 2014). This study advances the literature by shifting the focus to players' satisfaction with in-game virtual items in the post-purchase stage, thereby offering a more targeted understanding of how satisfaction develops specifically in relation to purchased virtual goods.

Second, prior research has primarily explored how players' cognitive evaluations of purchased in-game virtual items influence satisfaction, often through the lens of outcome expectation and value confirmation (Mkedder et al., 2024; W.-T. Wang & Chang, 2014). This study extends the current literature by introducing an affective perspective, emphasizing the role of two interrelated psychological bond mechanisms—game identification and psychological ownership—and their combined influence on the formation of post-purchase satisfaction.

Third, although psychological ownership and identification have been shown to positively influence customer satisfaction in various consumer contexts (Li & Atkinson, 2020; Popp & Woratschek, 2017), these mechanisms have been rarely examined within digital environments. By regarding game identification and psychological ownership as antecedents of satisfaction with in-game virtual items, this study confirms that these two psychological bonds can meaningfully shape post-purchase evaluations, even when the target objects are intangible and digitally mediated. This finding expands the applicability of social identity and psychological ownership theories to the domain of virtual goods, demonstrating their relevance in understanding consumer behavior in non-physical consumption contexts.

Fourth, although prior literature has classified in-game virtual items into functional and non-functional categories ((Hamari & Keronen, 2017; L. Wang, Sun, et al., 2022)., limited research has examined how these distinctions shape psychological mechanisms underlying post-purchase evaluation. By introducing virtual item type preference (functional vs. non-functional) as a moderating variable, this study identifies the boundary conditions under which psychological ownership and game identification influence post-purchase satisfaction. This contributes to a more nuanced understanding of user heterogeneity in digital media environments and highlights the importance of considering individual preferences in interactive media consumption.

5.3 Practical Implications

This study also provides several practical insights for game developers, designers, and marketers seeking to enhance player satisfaction and optimize monetization strategies in media economies.

First, beyond the value confirmation perspective emphasized in prior literature, this study finds that players' post-purchase satisfaction is also influenced by the psychological bonds formed during gameplay. This suggests that developers should not only focus on the value attributes of in-game virtual items, but also consider how these items are designed, promoted, and displayed in-game to foster game identification and psychological ownership.

Second, the moderating effect of virtual item type preference indicates that developers and game operators should consider players' underlying motivations when designing and promoting virtual items. For players who prefer functional items, emphasizing features that enhance psychological ownership—such as control, customization, or progress-based rewards—may be more effective. In contrast, for players who favor non-functional items, strategies that strengthen game identification—such as aesthetic uniqueness, symbolic meaning, or social display—are likely to be more impactful. These insights support a more segmented approach to virtual item design and communication.

5.4 Limitations and Future Directions

Despite its contributions, this study has several limitations that suggest avenues for future research: First, the sample was largely composed of university students, and the study did not distinguish between game genres. This limits the generalizability of the findings. Future research should include more diverse player groups and explore genre-specific effects to enhance external validity. Second, the use of cross-sectional survey data prevents causal inference. To uncover temporal dynamics and causal mechanisms, future studies could adopt longitudinal or experimental designs. Third, although measurement invariance was tested, relatively lenient model assumptions were used in moderation analysis, which may reduce the reliability of conclusions. Future studies should apply more rigorous invariance testing and incorporate qualitative approaches to validate key psychological mechanisms. Fourth, this study focused only on two types of psychological bonds. Players may also form connections with game avatars, communities, or narratives. Future research should broaden the scope of psychological bond to explore multi-dimensional satisfaction mechanisms in digital gaming environments.

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