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Exploring user-avatar bond profiles: Longitudinal impacts on internet gaming disorder[☆]

Taylor Brown [a,*], Raffaela Smith [a], Daniel Zarate [a], Mark D. Griffiths [b], Vasileios Stavropoulos [a,c]

[a] Applied Health, School of Health and Biomedical Sciences, RMIT University, Australia
[b] Director of the International Gaming Research Unit, Psychology Department, Nottingham Trent University, United Kingdom
[c] Department of Psychology, National and Kapodistrian University of Athens, Greece

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ABSTRACT

Avatars serve as the virtual embodiment of users, facilitating their online interaction, with potential positive and negative effects. These effects range from enhancing social and personal development to facilitating disordered gaming patterns. As past literature has identified different disorder gaming patterns based on the connection an individual has with their avatar (referred to as the User-Avatar Bond [UAB]), the present study explored the gaming disorder risk based on a gamer's UAB profile. To investigate this, the present study comprised 565 online role-playing gamers ($M_{age} = 29.3$, $SD = 10.6$). Participants completed the User-Avatar Bond Questionnaire and the Internet Gaming Disorder Scale-Short-Form over two waves, six months apart. Latent profile analysis was employed which identified four distinct UAB profiles: Identified Gamers, Compensated Gamers, Detached Gamers, and Differentiated Gamers. ANOVAs were conducted to assess differences in IGD behaviours within the profiles across the two waves. The findings suggested a significant difference between the profiles and IGD, where heightened avatar identification and compensation levels may act as risk factors for IGD behaviours. These findings provide crucial insight regarding the role of UAB in IGD development, treatment, and prevention.

1. Introduction

Online gaming and digital media use have become essential in modern society, with an estimated five billion online daily users (Internet World Statistics [IWS], 2021). The integration of immersive elements, such as avatars and virtual worlds, into social media platforms has greatly enhanced their engagement potential (Stavropoulos, Dumble, et al., 2022). Online gaming and digital media use can be healthy and beneficial (Van Deursen & Helsper, 2018). For example, online gaming provides opportunities for personal development, the cultivation of social interactions, and enhanced academic achievements (Li et al., 2023). However, some individuals may experience excessive and dysfunctional digital media use and disordered video gaming (Duong et al., 2020). Consequently, empirical research examining excessive digital media and disordered video gaming has expanded over the past two decades. However, theoretical consistency in the field remains elusive (Anderson et al., 2017).

Various terms, such as 'problematic [or pathological] internet use', 'internet addiction', 'technological addiction', 'digital addiction', 'compulsive internet use' and 'cyberspace addiction' (among others), have been used to describe problematic digital usage (Caplan, 2002; Davis, 2001; Griffiths, 1995, 1998; Samaha et al., 2019; Stavropoulos et al., 2022). In response to evolving concepts and diagnostic criteria, the American Psychiatric Association (APA) included 'internet gaming disorder' (IGD) in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; APA, 2013) as a provisional disorder warranting further research. Moreover, the World Health Organization, 2019 formally included 'gaming disorder' in the eleventh revision of the *International Classification of Diseases* (ICD-11). Considering the scope of the present study, the DSM-5 IGD conceptualization will be adopted to ensure consistency with the majority of the literature over the past decade and to allow comparability with past national and international findings (Burleigh et al., 2018; Cerniglia et al., 2019).

Despite variations in diagnostic definitions, several theoretical frameworks converge, positing that IGD is a product of the intricate interplay between individual attributes (such as motivational styles),

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* Corresponding author. 264 Plenty Rd, Mill Park, Victoria, 3082, Australia.
E-mail address: taylor.brown@rmit.edu.au (T. Brown).

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environmental influences, and factors inherent to the games themselves (Anderson et al., 2017; Király et al., 2023; Rho et al., 2017). For example, self-determination theory (SDT; Mills and Allen, 2020) suggests that gaming motivation depends on fulfilling three psychological needs (i.e., competence, relatedness, and autonomy). Therefore, when a gamer's psychological needs are not met in other realms, they are likely to compensate through gaming, which for a small minority, may become problematic (Fraser et al., 2023). Douglas et al. (2008) expanded this notion by conceptualizing problematic online gaming as an addiction driven by factors that 'push' and 'pull' users online. 'Push' factors include personality, family, friends, psychological factors, and needs, which lead individuals to disengage from real-life experiences. 'Pull' factors involve attractive features such as anonymity, user convenience, and immersive virtual environments that may promote digital dependency and adverse outcomes, such as sleep disruptions, conflicts with education and/or occupation, and relationship problems. For example, someone lacking physical strength might develop a virtual character embodying their ideal self, acting as a 'push' factor to engage online and fulfil their real-life need. Similarly, continued engagement with their online gaming further 'pulls' some users into disordered gaming.

While researchers agree that disordered gaming involves intricate interactions among the users, their real-life, and virtual context, some scholarly interest has emerged considering the users' relationships and attachments to their virtual-self-representation as a significant IGD factor (Alexandraki et al., 2018; Green et al., 2021; Stavropoulos et al., 2020). Consequently, the term 'User-Avatar Bond' (UAB) has been recently introduced to illustrate this notion (Stavropoulos et al., 2020).

1.1. User-avatar bond: conceptualizations and impacts

The UAB refers to the psychological connection a gamer forms with their virtual representation, commonly known as the 'avatar' (Sibilla & Mancini, 2018). This bond encompasses the emotional, cognitive, and behavioral facets of the user's virtual engagement (Praetorius et al., 2021; Rahill & Sebrechts, 2021). Blinka (2008) endeavored to incorporate key theoretical concepts associated with the projective and captivating dynamics between gamers and their avatars. In this context, the avatar allows gamers to adopt various identities, often reflecting potentially repressed aspects of their psyche (Burleigh et al., 2018). Blinka (2008) determined three main channels through which the gamer forms a psychological connection to their avatar. Firstly, *identification* involves the gamer merging their self-perception with their virtual embodiment. Secondly, *immersion* suggests that the avatar's in-game needs precede the gamer's thoughts. Thirdly, the *compensation* channel allows gamers to offset real-life shortcomings in appearance and character traits through their avatars.

The degree to which a player experiences a physical and emotive connection with their avatar has been suggested as a significant risk factor for developing IGD (Burleigh et al., 2018; Casale et al., 2022). The transient immersion experienced through adopting an alternate self induces a propensity for excessive gaming, consequently facilitating escapism from real-life constraints (Lemanager et al., 2020). Thoroughly customized avatars progressively deviate from the user's self-image, facilitating higher rates of compensation and engagement (Green et al., 2021). This phenomenon has been observed to interfere with self-concept clarity as the user tends to favor their avatar's characteristics over their own (Takano & Taka, 2022).

Previous research has provided important preliminary evidence indicating the importance of UAB concerning the development of IGD (Mancini et al., 2019; Morcos et al., 2021; Stavropoulos et al., 2019, 2020; Szolin et al., 2022). However, only a minority of studies have considered the multifaceted nature of the UAB, addressing significant variations across gamers in the characteristics of this user-avatar relationship (Stavropoulos et al., 2020). These studies often used latent profile analysis (LPA), a statistical technique that identifies subgroups within a population by examining patterns of responses to examine the possibility of coexisting UAB elements among gamers and distinctly influencing the risk of IGD (Cerniglia et al., 2019; Saritepeci et al., 2022). For example, Stavropoulos et al. (2020) utilised LPA and the User-Avatar Bond Questionnaire (UAB-Q; Blinka, 2008) to identify three distinct UAB profiles: 'differentiated gamers' (DGs; 43.76%), 'identified gamers' (IGs; 24.54%), and 'fused gamers' (FGs; 31.94%). Interestingly, disordered gaming behaviors were significantly lower for DGs, incrementally higher for IGs, and highest among FGs, underlining the substantial relationship between UAB and IGD. Similarly, Kovacs et al. (2022) identified different levels of comorbid anxiety, stress, and depression among gamers, with higher IGD risk more prevalent among those in the highly distressed subgroups. These findings have provided valuable insights for clinical treatment practices in addressing disordered gaming related to the UAB.

However, it is important to note that research on the UAB has extensively used cross-sectional designs, restricting the capacity to assess behavioral changes over time, particularly in the dynamic context of online gaming (Bouna-Pyrrou et al., 2018; Kim et al., 2023). In line with past studies that showed different UAB profiles exhibiting different IGD behaviors concurrently (e.g., Kovacs et al., 2022; Stavropoulos et al., 2020), it is important to advance this area by examining these relationships over time and highlighting the prospective risk of IGD. Given the nascent nature of IGD research and the consistent identification of video game structural characteristics, such as UAB, as potential risk factors (Alexandraki et al., 2018; Green et al., 2021; Griffiths & Nuyens, 2017; Stavropoulos et al., 2020; Szolin et al., 2022), employing a longitudinal design becomes imperative. Such an approach is essential to elucidate the temporal sequence and direction of causality between the UAB and IGD (Wartberg et al., 2019). This is particularly pertinent considering the fluid nature of both the UAB and IGD risk trajectories over time, which are known to vary significantly (Gao et al., 2022; Szolin et al., 2022). Therefore, in addressing this notable research gap, the present study aimed to extend the study by Stavropoulos et al. (2020) by adopting a longitudinal framework. This will enable a more in-depth exploration of UAB profiles within gaming communities, assessing their role as a potential risk and protective factors in the development and progression of IGD behaviors.

1.2. The present study

Previous research has shown a clear relationship between the UAB and disordered gaming (Mancini et al., 2019; Szolin et al., 2022). However, these associations remain largely unexplained due to the disproportionate reliance on cross-sectional methodology (Mancini and Sibilla, 2017; T'ng & Pau, 2021). As these effects may take place at the individual level, the advancement of knowledge necessitates incorporation of longitudinal designs. This approach provides the opportunity to monitor intraindividual variations of concurrent and prospective disordered gaming risk.

Building on past cross-sectional studies, which demonstrated how different UAB profiles exhibit varying IGD behaviors concurrently, as aforementioned, it is important to advance the field by examining these relationships over time. Importantly, a longitudinal approach can potentially show how the risk of IGD varies prospectively across different UAB profiles (e.g., over six months), which can have significant implications for IGD prevention strategies. Therefore, the present study addressed this research gap by longitudinally exploring the relationship between UAB variations and disordered gaming behaviors. More specifically, the present study aimed to (i) expand on the study by Stavropoulos et al. (2020) investigating various UAB profiles among both adult and adolescent gamers over time, and (ii) examining the roles these diverse UAB profiles play in shaping the development of disordered gaming behaviors. The present study used LPA to examine a longitudinal dataset of gamers, assessed at two distinct time points, six months apart. To facilitate these aims, the following research questions (RQs) and hypotheses were proposed.

- *RQ1*: What is the number of UAB profiles that optimally describe the sample at Wave 1 concerning their identification, immersion, and compensation UAB dimensions?
- *RQ2*: What is the size/proportion of the different UAB profiles based on the selected dimensions?
- *RQ3*: What is the best way to characterize the sample in terms of their types of UAB profiles?
- *RQ4*: How do these identified UAB profiles vary in terms of their gaming disorder behaviors concurrently (Wave 1) and over time (i.e., six months later in Wave 2)?

It was also hypothesized that participants classified across different UAB profiles would significantly differ regarding their disordered gaming behaviors experienced concurrently (Wave 1) and over time (i.e., six months later in Wave 2).

2. Method

2.1. Participants

The sample comprised 565 participants (84.16% adults and 15.84% adolescents) who engaged in online role-playing games. Participant ages ranged from 12 to 68 years ($M = 29.3$, $SD = 10.6$). Participants were recruited from various sources, including academic institutions, public and Catholic schools in Victoria, gaming communities within Australia (e.g., Aus Gaymers Network), specific gaming venues (e.g., Fortress Melbourne), and online gaming forums (e.g., AusGamers), as well as through advertising on *YouTube*.

The present study received ethical approval from several organizations, including the (a) Victoria University Human Research Ethics Committee (application no. HRE21-044) (b) Department of Education and Training of The Victorian State Government, Australia (application no.2022_004542), and (c) Melbourne Archdiocese of Catholic Schools (application no. 1179). Plain language information statements outlining the aims and potential risks of the study were provided to participants, ensuring they understood their rights prior to providing informed consent. This information was first provided to parents/guardians of participants aged below 18 years, to ensure ethical consent was obtained.

A priori power analysis indicated a minimum sample of 477 participants was needed for a 0.18 effect size, $\alpha = 0.05$, $1\text{-}\beta = 0.95$, and three groups. Missing values of analyzed variables ranged between 3% (0.5% current age) to 16% (2.83% Item 12 User-Avatar-Bond-Scale) and were missing at random in the overall dataset ($MCAR_{test} = 38.4$, $p = 0.14$; Little, 1988). Table 1 provides further demographic information at Wave 1.

Attrition between waves was 276 participants (48.8%) and therefore it was studied with low to moderate effect-sizes[1] being revealed regarding gender ($\chi^2 = 4.26$, df = 6, $p = 0.642$, Cramer's V = 0.08), sexual orientation ($\chi^2 = 7.75$, df = 4, $p = 0.1$, Cramer's V = 0.13), ancestry ($\chi^2 = 8.94$, df = 4, $p = 0.063$, Cramer's V = 0.13), romantic relationship engagement ($x^2 = 3.76$, df = 4, $p = 0.44$, Cramer's V = 0.08), educational status ($\chi^2 = 11.2$, df = 7, $p = 0.129$, Cramer's V = 0.15), employment status ($\chi^2 = 7.58$, df = 6, p = 0.27, Cramer's V = 0.12), gaming years (Welch's $t = 3.5$, df = 526, $p < 0.001$, Cohen's $d = 0.29$), average daily gaming time during the week (Student's $t = 0.873$, df = 555, $p = 0.38$, Cohen's $d = -0.07$), average daily gaming time during the weekend (Student's $t = 0.159$, df = 553, $p = 0.87$, Cohen's $d = 0.01$), social media usage years (Student's $t = 2.5$, df = 556, $p = 0.01$, Cohen's $d = 0.21$), average daily social media usage time during the week (Student's t = −2.31, df = 543, $p = 0.02$, Cohen's $d = -0.19$), average daily social media usage time during the weekend (Welch's $t = -2.4$, df = 501, $p = 0.01$, Cohen's $d = -0.21$) and age (Student's t = 4.967, df = 560, $p < 0.001$, Cohen's $d = 0.41$; see Appendix 2, Tables 1–7).

[1] Note: Cohen's *d*, very small~0.01, small~0.20, medium~0.50, large, 0.80, very large~1.20 (Sawilowsky, 2009); Cramer's V, >0.25 = very strong, >0.15 = strong,>0.10 = moderate, >0.05 = weak, >0 no or very weak (Akoglu, 2018).

Table 1
Participant demographics and gaming use information at Wave 1.

Variable	N	Mean/ Proportion	SD	Range
Age	562	Mean: 29.3	10.6	Min: 12, Max: 68
Years spent gaming	556	Mean: 5.62	4.49	Min: 0, Max: 30
Daily gaming time during the week (hrs)	557	Mean: 2.23	1.82	Min: 0, Max: 15
Daily gaming time during the weekend (hrs)	555	Mean: 3.39	2.40	Min: 0, Max: 18
Gender	565			
Male (cisgender)	283	0.501		
Female (cisgender)	259	0.458		
Male (transgender)	4	0.007		
Female (transgender)	1	0.002		
Nonbinary	12	0.021		
Not Listed	3	0.005		
Prefer not to say	3	0.005		
Sexual orientation	488			
Heterosexual-Straight	359	0.736		
Homosexual	36	0.074		
Bisexual	75	0.154		
Asexual	5	0.010		
Other	13	0.027		
Ancestry	565			
Aus./Engl.	412	0.552		
Chinese	20	0.035		
German	7	0.012		
Indian	10	0.018		
Other	118	0.209		

Note. H_a is proportion ≠ 0.5.

2.2. Procedure

Participants completed online surveys to assess demographic information. These were emailed to participants through an online *Qualtrics* link, paired with a non-identifiable code to ensure anonymity. The UAB-Q and IGDSF-9 were completed through this link. This process was conducted in two waves, one occurring immediately, and the other six months later. Additional information concerning the procedure is outlined in the Supplementary file (see Appendix 1).

2.3. Measures

In addition to collecting demographic details and information about internet use, the study employed several psychometric scales (see below).

2.3.1. User-Avatar-Bond Questionnaire (UAB-Q; Blinka, 2008)

The UAB-Q was employed to assess different gamer-avatar bond dimensions. The 12 UAB-Q items are answered on a five-point Likert scale, ranging from 1 (*Disagree Strongly*) to 5 (*Agree Strongly*). The instrument examines three factors: identification (four items: "*Both me and my character are the same*"), immersion (five items: "*Sometimes I think just about my character while not gaming*"), and compensation (three items: "*I would rather be like my character*"). The total score and subscale scores were calculated by summing the points assigned to the respective items, with higher scores reflecting more pronounced UAB experiences. As displayed in Table 2, the scale's identification and immersion factors demonstrated good internal consistency in the initial wave. The compensation factor exhibited suboptimal, yet acceptable, internal

Table 2
Reliability across the waves for both measures.

Measures	McDonald's ω	McDonald's ω	Composite reliability	Composite reliability
	Wave 1	Wave 2	Wave 1	Wave 1
UAB-Q	0.81	0.76	0.82	0.89
Identification	0.73	0.79		
Immersion	0.73	0.76		
Compensation	0.66	0.71		
IGDS9-SF	0.86	0.87	0.85	0.87

Note. McDonald's omega (ω) coefficients are presented as they provide a more accurate measure of reliability compared to Cronbach's alpha (α). Past literature evaluating the performance of Cronbach's alpha under a one-dimensional model using Monte Carlo simulations has demonstrated that omega is a superior choice, particularly in the presence of skewed items and small sample sizes (Trizano-Hermosilla & Alvarado, 2016).

consistency (Barbera et al., 2021). The UAB-Q was selected because it is frequently used in avatar research and has displayed good reliability in past literature (Burleigh et al., 2018; Stavropolous et al., 2019; 2020, 2023). Moreover, its development, which specifically involved comparative investigations between adolescent and young adult populations (Blinka, 2008), affirmed its appropriateness for both groups in the present study.[2] This appropriateness for both demographic groups has been consistently supported in subsequent studies, confirming its validity across diverse age groups in the present study (Brown et al., 2024; Eddy et al., 2024; Hein et al., 2024; Morcos et al., 2021). Moreover, the UAB-Q showed appropriate reliability and discriminant validity (e.g., non-significant and negligible correlation with extroversion as assessed by the MINI questionnaire [$r = -0.019$; $p = 0.758$]). For a detailed view of the UAB-Q, please refer to Supplementary Fig. 1, where the full questionnaire is provided.

2.3.2. *The Internet Gaming Disorder Scale-Short-Form (IGDS9-SF; Pontes & Griffiths, 2015)*

The IGDS9-SF is a concise nine-item scale that assesses the adverse impacts of gaming within the preceding 12-month period based on the DSM-5 criteria for IGD (APA, 2013). The items are answered on a five-point Likert scale, ranging from 1 (*Never*) to 5 (*Very Often*). The scores on each of the items are summed, resulting in total scores ranging from 9 to 45. Higher scores indicate a higher prevalence of IGD behaviors. As displayed in Table 2, the IGDS9-SF exhibited good internal reliability in both Wave 1 and Wave 2. The IGDS9-SF was selected due to its consistent use and high reliability reported in the literature, its alignment with the DSM-5 criteria for IGD, and its proven appropriateness across diverse age groups, including adolescents and adults (Gomez et al., 2019; Monacis et al., 2016; Pápay et al., 2013; Pontes & Griffiths, 2016a, 2016b; Stavropoulos et al., 2018; Poon et al., 2021). Moreover, the IGDS9-SF showed appropriate reliability and discriminant validity (e.g., non-significant and negligible correlation with openness as assessed by the MINI questionnaire [r = - 0.027; p = 0.596]). For a detailed view of the IGDS9-SF, please refer to Supplementary Fig. 2, where the full scale is provided.

2.4. *Statistical analyses*

The study began with an initial pool of 627 participants. During the screening process, 62 respondents were excluded, due to: spam (n=19), lack of consent (n=12), failing validity questions (n=9) or insufficient responses (n=22). Therefore, the final sample comprised 565 adults and adolescents engaged in online role-playing games.

To address the research questions, the UAB dimensions were assessed as indicators for a sequence of latent profile analysis (LPA) models using the TidyLPA CRAN software in RStudio (Rosenberg et al., 2018). LPA identifies underlying subgroups within a dataset, providing an understanding of heterogeneity in the population based on a distinct characteristic (in the present study UAB-Q items were utilised; Eshima, 2022). TidyLPA software was selected for its capacity to estimate optimal associations among indicators across diverse profiles, including means, variances, and covariances. The LPA modelling utilised a maximum likelihood estimator (MLE) to determine the probability of profile membership among gamers, considering their UAB characteristics. The TidyLPA analyses conducted enabled the concurrent estimation and comparison of various parameters across different profiles in three modes: (i) unrestrictive estimation; (ii) uniform parameter values; and (iii) constraint of parameters to zero.

LPA was selected for the present study over other algorithms (e.g., cluster analysis) due to its ability to identify different parameterization combinations. Additionally, this approach not only facilitated the accurate determination of the number of profiles, but it also enabled their precise characterization based on diverse profile combinations of quantity and parameter estimation (see Supplementary Table 1).

To determine the best-fitting model, a sequence of fit indices must be evaluated. In this analysis, the following fit indices were assessed: (i) Akaike's Information Criterion (AIC); (ii) Approximate Weight of Evidence (AWE); (iii) Bayesian Information Criterion (BIC); (iv) Classification Likelihood Criterion (CLC); and (v) Kullback Information Criterion (KIC), with lower values indicating better model fit. Additionally, standardized entropy (h) was examined to determine the heterogeneity across latent profiles, with >0.6 as evidence of poor heterogeneity and <0.80 as evidence of good heterogeneity (Kovacs et al., 2022). A description of the fit indices is provided in Supplementary Table 2.

Finally, to address RQ4, two successive one-way analyses of variances (ANOVAs) were employed to investigate differences in IGDS9-SF scores between the UAB profiles at Wave 1 and Wave 2. Given that the current analysis included a categorical independent variable and a continuous dependent variable, an ANOVA was selected as the most appropriate statistical analysis. Additionally, post-hoc analysis was performed using the Bonferroni criterion to detail the observed differences.

3. Results

3.1. *Number of UAB profiles*

To address RQ1, regarding the optimal number of latent profiles in regard to the UAB dimension, the fit indices were compared across several models (see Table 3). Based on this initial step, the most suitable solution was the class-invariant unrestricted parameterization (CIUP) model with four profiles. This model was selected based on its suitability across AIC, BIC, AWE, CLC, and KIC fit indices (Akogul & Erisoglu, 2017). In other words, the model showing less noise/errors (i.e., lower AIC, BIC, etc.) had four profiles with equal variation values between (i.e., covariance) and within (i.e., variance) profiles.

As shown in Table 4, while the CIUP model with five profiles yielded a smaller AIC value, the CIUP model with four profiles was found to have a high level of classification accuracy and significant BLRT-p value. In other words, because higher entropy values represent higher heterogeneity across profiles, the model with four profiles was selected because it allowed the identification of clearly different and unique UAB profiles. The observed entropy for this model exceeded the recommended threshold of 0.76, indicating an accurate classification of the four

[2] To further assess the validity of this instrument, the present study conducted a correlation analysis to evaluate discriminant validity. More specifically, the relationships between the User-Avatar Bond Questionnaire (UAB-Q) and the Proteus Effect Scale (PES; Van Looy et al., 2012) were investigated. Positive correlations between the UAB-Q and the PES were interpreted as indicative of significant relationships. Detailed results of this analysis can be found in the Supplementary files (Appendix C).

Table 3
TidyLPA model solutions.

Model	Number of profiles	AIC	BIC	AWE	CLC	KIC
CIDP	2	21744.64	21905.11	22248.87	21672.34	21784.64
CIDP	3	21440.91	21657.75	22122.94	21342.56	21493.91
CIDP	4	21305.88	21579.1	22165.69	21181.52	21371.88
CIDP	5	21156.33	21485.93	22193.9	21005.96	21235.33
CIUP	2	21056.8	21503.49	22463.36	20852.62	21162.8
CIUP	3	21037.88	21540.95	22622.29	20807.61	21156.88
CIUP	**4**	**20743.14**	**21302.59**	**22505.31**	**20486.87**	**20875.14**
CIUP	5	20730.57	21346.4	22670.59	20448.2	20875.57

Note. An analytic hierarchy process, based on the fit indices AIC, AWE, BIC, CLC, and KIC (Akogul & Erisoglu, 2017), suggested the best solution using class-invariant unrestricted parameterization (CIUP) model with four classes.

Table 4
Tidy LPA analysis of model.

Model	Profiles	AIC	BIC	Entropy	N Min [a]	BLRT p [b]
CIUP	4	20743.14	21302.59	0.87	0.13	0.01

Note.
[a] Score is based on the most likely class membership with it representing the proportion of the sample assigned to the smallest class (Rosenberg et al., 2018).
[b] *p*-value for the bootstrapped likelihood ratio test (Rosenberg et al., 2019).

profiles with above 80% correctness (Larose et al., 2016).

3.2. Size of profiles

To address RQ2, descriptive analysis was applied to the four profiles to determine frequencies. The proportion of the sample estimated in each profile was 37.17% for Profile 1 ($n = 210$), 34.87% for Profile 2 ($n = 197$), 15.22% for Profile 3 ($n = 86$), and 12.72% for Profile 4 ($n = 72$).

3.3. Profiles across the indicators

To address RQ3, Table 5 presents the standardized means (z-scores) across the four profiles considering their differing characteristics of the UAB dimensions, i.e., identification (IDQ), immersion (IMQ), and compensation (CQ) scores in Wave 1. As shown in Fig. 1, the standardized values of the four profiles showed distinctive features. For Profile 1, participants were consistently above the mean on all four identification questions and close to the mean (less than half a standard deviation above the mean) on immersion and compensation questions (+1.2SD to −0.1SD; see Table 5). The participants in Profile 1 had particularly high scores on Item IDQ 2 (“*My character skills and abilities are like mine, but somewhat greater*”). Therefore, Profile 1 was named ‘Identified Gamers’ (IGs). Profile 2 displayed consistently low scores in identification and immersion yet distributed within the range of half a standard deviation above the mean in all compensation questions (+0.3 SD to +0.6 SD). Participants in this profile were half a standard deviation above the mean (0.6SD) on Item CQ12 (“*Being like my character would help me in some situations of my real life*”). Therefore, Profile 2 was named ‘Compensated Gamers’ (CGs). Profile 3 consistently distributed within the range of half a standard deviation below the mean on all items, except for one item. More specifically, participants in Profile 3 were half a standard deviation above the mean (0.6 SD) on Item CQ10 (“*My character possesses totally opposed skills and abilities to my own*"). To reflect this distancing from their avatar, Profile 3 was named ‘Detached Gamers’ (DetGs). Finally, participants in Profile 4 were distributed within the range of one standard deviation (below the average) across all UAB dimensions (−1.4 SD to −0.2 SD). Profile 4 was therefore named ‘Differentiated Gamers’ (DGs).

3.4. Profiles across the variables

To address RQ4, which examines the differences between IGD behaviors and UAB scores within each of the four profiles (IGs, CGs, DetGs, and DGs) in Wave 1 and Wave 2, two one-way ANOVAs were run with α set at 0.05. The ANOVA findings for IGD in Wave 1 had a significant impact on IGD scores among the profiles, $F(1, 558) = 11.2$, $p < 0.001$, $\eta^2 = 0.028$. Post-hoc pairwise comparison test using a Bonferroni correction showed significant differences in IGD in Wave 1 between IGs [Profile 1] and DGs [Profile 4] ($p < 0.01$) where participants included in the IGs profile scored significantly higher. Similarly, participants in the CGs [Profile 2] scored significantly higher than DetGs [Profile 3] ($p < 0.05$). Finally, participants in the CGs scored significantly higher than DGs ($p < 0.01$).

Similarly, the ANOVA results for IGD in Wave 2 showed a significant difference between IGD scores among the profiles, $F(1, 288) = 6.92$, $p < 0.001$, $\eta^2 = 0.034$. The results of the Bonferroni post-hoc comparison showed a significant difference in IGD scores in Wave 2 where participants in the IGs profile scored significantly higher in IGD symptoms compared to the DGs ($p < 0.01$). Similarly, participants in the CGs profile showed significantly higher IGD symptoms than the participants in the DetGs profile ($p < 0.05$). Finally, participants in the CGs profile exhibited significantly higher IGD symptoms than participants in the DGs profile ($p < 0.01$). These results are presented in the boxplots in Appendix C, which show the mean IGD values at Wave 1 and Wave 2 for all four latent profiles.

4. Discussion

The primary objective of the present study was to identify and characterize UAB profiles among a cohort of 565 adolescent and adult gamers. Moreover, the study included a longitudinal assessment of the patterns of disordered gaming within these distinct groups. Latent profile analysis resulted in four distinct profiles. Each of these four profiles represented varying experiences of the avatar bond and were named Identified Gamers (IGs), Compensated Gamers (CG), Detached Gamers

Table 5
Standard scores across the profiles.

Profile	Profile number	IDQ1	IDQ2	IDQ3	IDQ4	IMQ5	IMQ6	IMQ7	IMQ8	IMQ9	CQ10	CQ11	CQ12
Identified Gamers	1	0.5	1.2	0.4	0.3	0.2	0	0.4	0.4	0.3	−0.1	0.2	0.3
Compensated Gamers	2	−0.1	−0.6	0.1	0	0.1	0.2	0.1	−0.1	0.2	0.3	0.4	0.6
Detached Gamers	3	−0.6	−0.8	−0.4	−0.6	−0.2	−0.1	−0.6	−0.4	−0.4	0.6	−0.7	−1.1
Differentiated Gamers	4	−0.5	−0.8	−1	−0.2	−0.6	−0.5	−0.6	−0.5	−0.8	−1.4	−0.8	−1.3

Note. Identification Question, Immersion Question and Compensation Question were abbreviated to IDQ, IMQ and CQ, respectively.

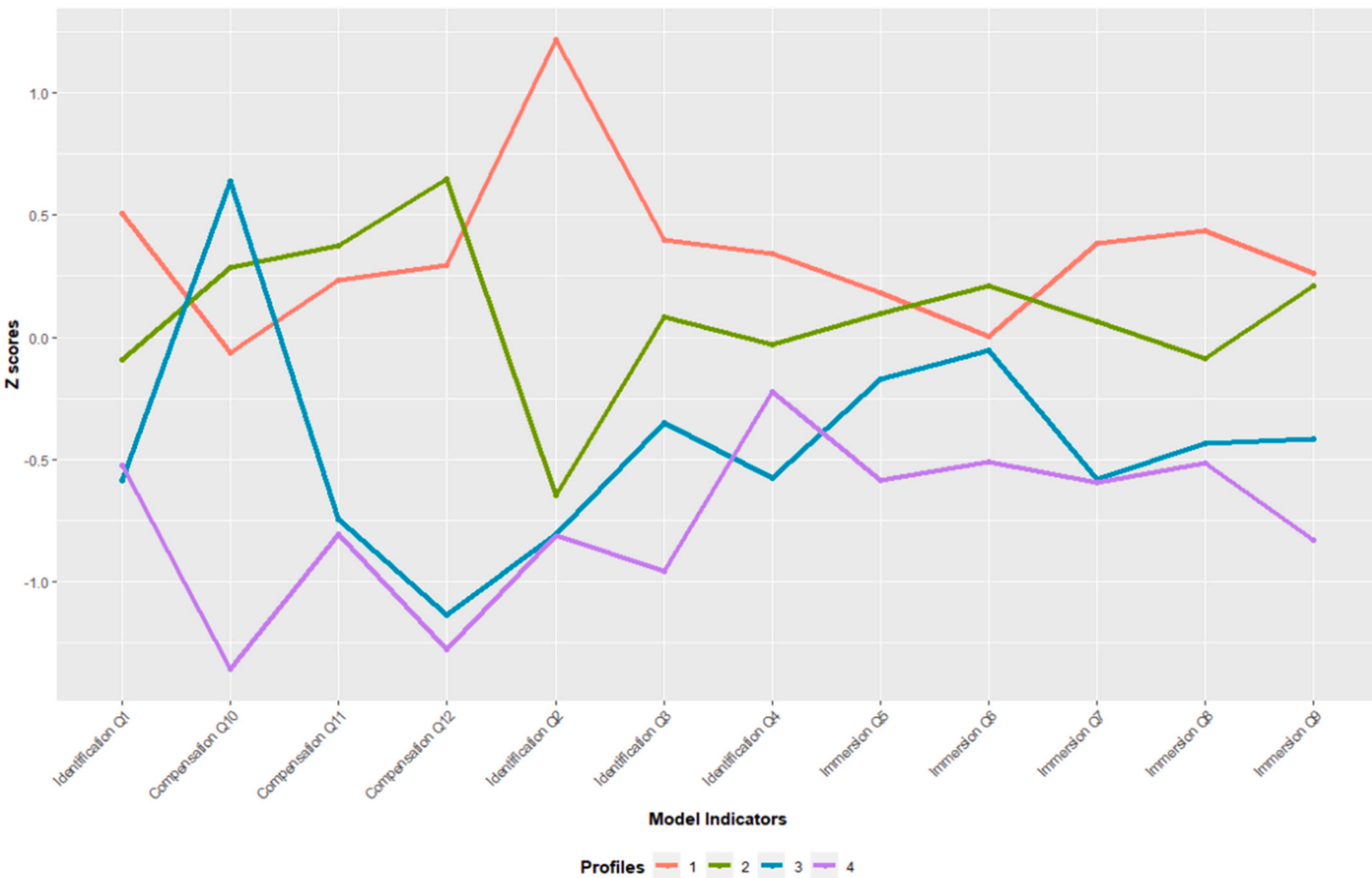

Fig. 1. *User-avatar bond latent profiles. Note.* The plot illustrates four distinct latent profiles, considering participants' UAB characteristics measured in standard deviations from the mean. These profiles are constructed based on items associated with Identification, Immersion, and Compensation. When observing the plot, the high lines signify individuals with high-UAB symptoms, the middle lines depict those with medium-UAB symptoms, and the lower lines represent individuals with low-UAB symptoms.

(DetGs), and Differentiated Gamers (DGs). The identification of a fourth profile (the DetGs) was unexpected. Two one-way ANOVAs were used to substantiate the hypothesized significant variations in participants' disordered gaming behaviors across the different UAB profiles, both at the initial assessment (Wave 1) and longitudinally six months later (Wave 2). Specifically, participants belonging to the IGs and CG latent UAB profiles showed higher likelihood of endorsing IGD symptoms. Thus, these findings corroborate the initial hypothesis, indicating that participants across different UAB profiles do indeed experience significant differences in disordered gaming behaviours over time. The results of two one-way ANOVAs, conducted to explore the relationship between IGD behaviors and UAB scores across the four profiles (IGs, CGs, DetGs, and DGs) at both time points, supported this hypothesis. More specifically, significant differences in IGD scores were identified among the profiles at Wave 1, with subsequent post-hoc Bonferroni analysis showing significant disparities between specific profiles. Similar patterns of significant differences were observed in Wave 2. Therefore, these findings corroborated the initial hypothesis, indicating that participants with different UAB profiles experienced significant differences in disordered gaming behaviors over time.

4.1. Identification of profiles (RQ1)

The analysis resulted in four distinct UAB profiles among gamers, each reflecting unique interactions with avatars. More specifically, 'Identified Gamers' exhibited high engagement, 'Compensated Gamers' exhibited lower identification but higher compensatory behaviors, 'Detached Gamers' exhibited significant psychological distance from their avatars, and 'Differentiated Gamers' exhibited minimal psychological connection across all dimensions. These findings, illustrating a spectrum from minimal to highly immersive avatar engagement, contribute nuanced distinctions to existing UAB research, such as that conducted by Stavropoulos et al. (2020), who identified three profiles among a large sample of *World of Warcraft* players (see Table 6).

A significant aspect of the present study's findings is the emergence of a fourth profile, 'Detached Gamers', not identified in Stavropoulos et al.'s (2020) study. This profile suggests a form of engagement where gamers maintain a clear psychological boundary between their real selves and their avatars, reflecting a detached interaction style. This profile emerged possibly due to the present study's structured sampling and in-depth analytical approach across 32 profile parameterizations, unlike the six profile parameterizations analyzed by Stavropoulos et al. (2020). This finding arguably highlights the value of a granular analysis approach in capturing diverse gamer interactions, enabling a deeper exploration that identifies the subtleties and complexities of gamer-avatar relationships not previously identified.

The present study's results echo the variability in gamer profiles identified in previous studies, which have reported three to five gamer profiles, depending on the focus and methodology of the research. For instance, studies by Kovacs et al. (2022), Lemmens et al. (2015). and Lee et al. (2017) identified three classes of gamers, while studies by Pontes et al. (2014), Billieux et al. (2015), and Colder Carras and Kardefelt-Winther (2018) identified up to five profiles, reflecting the complexity and diversity within gamer populations. Faulkner et al.'s (2015) findings also aligned with those of the present study, suggesting that when the global population of gamers is considered, a spectrum of

Table 6
Comparison of UAB profiles across two studies.

Characteristics	Present Study				Stavropoulos et al. (2020)			
Profile	Profile name	Proportion	Description	Impact on IGD	Profile name	Proportion	Description	Impact on IGD
1	Identified Gamers (IGs)	37.17%	Above mean on IDQ; close to mean on IMQ and CQ.	*Wave 1* Mean (Standard Deviation; SD): 17.1 (4.5) *Wave 2* Mean (SD): 17.2 (5.5)	Identified Gamers (IGs)	24.54%	Above the mean on IDQ; close to the mean on Proteus effect and IMQ; more than half a standard deviation below the mean for CQ.	Mean (SD): 17.97 (6.22)
2	'Compensated Gamers' (CGs)	34.87%	Low IDQ and IMQ; half a SD above the mean on CQ.	*Wave 1* Mean (SD): 17.6 (5.2) *Wave 2* Mean (SD): 17.2 (5.42)	Fused Gamers (FGs)	31.94%	High IDQ, IMQ, and CQ.	Mean (SD): 20.09 (7.58)
3	'Detached Gamers' (DetGs)	15.22%	Below the mean on IDQ, IMG, and CQ, besides item CQ10.	*Wave 1* Mean (SD): 16.4 (5.61) *Wave 2* Mean (SD): 15 (5.8)				
4	'Differentiated Gamers' (DGs)	12.72%	Ranged within 1 SD below the mean across all UAB dimensions	*Wave 1* Mean (SD): 15.8 (6.28) *Wave 2* Mean (SD): 15.2 (6.77)	'Differentiated Gamers' (DGs)	43.76%	Low across all UAB dimensions	Mean (SD): 8.26 (5.52)

Note. Identification Question, Immersion Question and Compensation Question were abbreviated to IDQ, IMQ, and CQ, respectively.

'four ± 1' profiles tends to emerge, highlighting the non-homogeneity among gamers. This variability underscores the importance of not treating gamers as a uniform group but rather recognizing the distinct ways they interact with their avatars.

By employing a longitudinal design and advanced analytical techniques, the present study's findings extend foundational insights into the UAB, underlining the necessity for continuous and adaptive research methodologies to effectively capture the evolving complexities of digital interaction within gaming environments. Nevertheless, further research is necessary to validate these explanations and understand the intricacies of these UAB profiles more comprehensively.

4.2. Profile proportions (RQ2)

The exploration of UAB profiles in the present study showed a varied distribution across four distinct profiles, with the most notable observation being the smaller proportion of DGs. This demographic represented only 12.72% of the sample, indicating a substantial variance when compared to Stavropoulos et al. (2020), where DGs comprised a much larger proportion of their cohort (i.e., approximately 44%). This variation suggests that engagement with avatars is not static and is influenced by broader social and technological trends, such as the expanding metaverse which encourages deeper immersion and connection within online spaces.

The present study's findings indicate that the recent developments in digital environments might be fostering more profound and complex interactions between gamers and their avatars, potentially explaining why the present study found a more active online engagement. Alternatively, the proportion of DG profiles between the two studies may also reflect the demographics of the population assessed, which was notably active during the COVID-19 pandemic—a period marked by a significant increase in online gaming activity and a corresponding rise in IGD symptoms among gamers (Alimoradi et al., 2022).

The contrast in the proportions of DGs between the two studies might be because the sample in the present study was not only more active online but also shared a stronger connection with their avatars. This increased engagement might be reflective of the psychological and social shifts brought on by the pandemic, where virtual interactions became more prevalent and critical to maintaining social connections. However, further research is needed to better understand these trends further and provide a richer insight into how these connections between the user and their avatar develop and evolve over time.

4.3. Characteristics of UAB profiles (RQ3)

The present study's findings indicated four diverse profiles of UAB within the studied gaming population, with each profile demonstrating qualitative differences in gamers' connection with their avatar. More specifically, participants in the IGs profile exhibited high identification with their avatar and moderate rates of immersion and compensation. This suggests those identified in this profile may experience a strong connection with their avatars, primarily using them for in-game actions and entertainment rather than to compensate for real-life deficiencies. This mirrors the findings by Stavropoulos et al. (2020), who also reported an IG profile, suggesting a segment of gamers are satisfied with their real-life identities and do not seek virtual compensation.

In contrast, participants classed as CGs displayed low identification levels and moderate compensation and immersion levels. This suggests that a proportion of the sample (34.87%) are engaging with their avatars as an idealized self-representation, which can lead to feelings of inadequacy and lesser identification compared to IGs. This phenomenon is similar to the 'Fused Gamer' profile described by Stavropoulos et al. (2020). The DetGs profile is a novel finding, with gamers characterized by a minimal emotional connection to their avatars, which they view as fundamentally different from their real selves. This lack of attachment suggests a utilitarian use of avatars to explore alter egos within safe virtual boundaries, a dynamic not extensively documented in existing gaming literature. These diverse UAB profiles underscore the non-uniformity within the gaming community and the varied psychological landscapes navigated by gamers in online media.

Finally, participants in the DGs profile identified less with their avatar, experienced decreased immersion in their avatar's in-game activities, and exhibited reduced compensation in the formation and use of their avatars. This type of gamer does not demonstrate any notable attachment to their avatar, nor their in-game experience. This profile displayed identical characteristics to the 'Differentiated Gamer' profile described by Stavropolous et al. (2020).

4.4. Relationship between UAB profiles and internet gaming disorder

The present study demonstrated a significant relationship between higher UAB attachment and disordered gaming behaviors, observed both concurrently (Wave 1) and longitudinally (Wave 2). Profiles exhibiting greater avatar identification and compensation displayed higher scores on the IGDS9-SF, signifying elevated IGD behaviors. This observation is supported by previous research suggesting that avatar customization in role-playing games promotes the exploration of idealized characteristics, thereby enhancing the compensatory bond and deepening gaming engagement (Burleigh et al., 2018; Kang & Kim, 2020). Additionally, the motivation for achievement, often rooted in self-perceived inadequacy, leads gamers to seek fulfillment through avatar achievements, aligning with the compensatory internet use theory (CIU), which posits that excessive online activity occurs as a means to escape from real-life difficulties (Kardefelt-Winther, 2014; Snodgrass et al., 2018). Such a dynamic underscores how fulfilling psychological needs through gaming can exacerbate well-being issues and foster maladaptive attachments to virtual worlds (Ballou et al., 2022; Snodgrass et al., 2022).

The present study's findings further illuminate how specific UAB profiles, especially those involving high levels of identification and immersion such as the IGs and CGs, are significantly associated with increased IGD behaviors. This is primarily due to the immersive aspect of UAB, where players perceive their avatars' needs as their own, thereby facilitating a detachment from reality that heightens disordered gaming risks (Šporčić & Glavak-Tkalić, 2018).

By employing advanced analytical methods and a longitudinal design, the present study contributes critical insights into how the UAB can serve as a diagnostic indicator of gaming disorder risk. These insights highlight the potential of the UAB to act as a digital phenotype, paving the way for early detection and intervention strategies in disordered gaming (Brown et al., 2024; Stavropoulos et al., 2023).

By enhancing the understanding of these dynamics, the present study's findings not only validate but also expand the foundational understanding of the role of the UAB in gaming disorders. It emphasizes the importance of incorporating these insights into clinical practices and public health initiatives aimed at mitigating IGD. Further research is vital to more thoroughly explore the intricate relationship between the UAB and gaming disorders, particularly how avatars impact gamers' behaviors and mental health over time.

4.5. Limitations, future research, and implications

While the present study substantially contributes to the extant literature on avatar use in gaming, it is important to acknowledge specific limitations. Firstly, the composition of the sample in terms of age, gender, and cultural background may limit the generalizability of the findings to more diverse or broader populations (Na et al., 2017). Notably, the limited participation of adolescents in this sample inhibited the ability to capture potential variations in UAB experiences between adolescent and adult gamers, because higher avatar attachment has been observed among adolescents (Paulus et al., 2018). Additionally, the longitudinal scope of the present study, encompassing only two waves of data collection, may not sufficiently capture the dynamics and potential changes in UAB and IGD behaviors over a longer period. Longitudinal investigations often require three or more waves to more effectively assess trends and causal relationships over time (Ployhart and MacKenzie, 2014). This limitation is recognized and should be addressed in future studies by including additional data collection waves to enhance the understanding of these relationships. Further research is also recommended to explore the variation in UAB across age groups.

Additionally, the LPA employed here facilitated categorical rather than continuous comparisons of reported IGD behaviors. As such, subsequent analyses using regression and growth modeling may be necessary to allow for a more detailed understanding of how changes in the IGD risk over time are correlated with incremental increases in the user-avatar bond. This will help identify more nuanced dynamics within the UAB-IGD relationship. Secondly, the use of self-report scales introduces the potential for social desirability bias, where participants may adjust their responses to align with societal norms and expectations (Bergen & Labonte, 2020). To mitigate this, future research could benefit from a mixed-methods design that incorporates behavioral metrics related to avatars, such as time spent customizing avatars, and avatar interactions within virtual worlds. This approach would provide a more comprehensive understanding of the UAB without the limitations associated with self-report bias.

Nevertheless, the present study contributes uniquely to the understanding of the UAB. Firstly, the findings align with previous literature that identified UAB as a potential risk factor for IGD (Alexandraki et al., 2018; Green et al., 2021; Griffiths & Nuyens, 2017; Stavropoulos et al., 2020; Szolin et al., 2022). The present study indicated a strong relationship between identification and compensation aspects of UAB and disordered gaming patterns, both concurrently and prospectively. This highlights the significance of integrating UAB into disordered gaming treatments, emphasizing both identification and compensation.

Furthermore, the present study's findings suggest the incorporation of avatars in treatment approaches. This may include offering users a platform to discuss in-game achievements and explore how this influences their real-life perceptions (Stavroplous et al., 2020). Additionally, tailoring cognitive behavioral therapy to encompass users' emotions, thoughts, and behaviors related to emotional compensation and idealization is suggested (Han et al., 2020; Stevens et al., 2019).

In terms of practical implications, the present study recommends that future preventative policies highlight compensatory patterns of avatar attachments. Game developers can leverage these findings to prioritize minimizing discrepancies between avatars and users' actual selves (Zimmermann et al., 2023). Moreover, incorporating the screening of avatar metrics could facilitate the early detection of mental health concerns among gamers. These insights offer valuable guidance for the development of effective preventative strategies and interventions in the gaming community.

4.6. Conclusions

The present study found the UAB to be a relevant risk factor for disordered gaming behaviors. Four profiles emerged from the analysis, including that of the Detached Gamer, not previously identified in the literature (e.g., Stavropoulos et al., 2020). Each profile varied in their experiences of identification, immersion and compensation factors encompassed by UAB, with Identified Gamers and Compensated Gamers demonstrating heightened IGD behaviors. Therefore, the hypothesis was supported. These results support previous theories of compensatory patterns in maladaptive gaming (Snodgrass et al., 2018; Stevens et al., 2019). Overall, the findings provide further context to the development, intervention, and treatment of internet gaming disorder.

CRediT authorship contribution statement

Taylor Brown: Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Raffaela Smith:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization. **Daniel Zarate:** Writing – review & editing, Resources, Formal analysis, Data curation. **Mark D. Griffiths:** Writing – review & editing, Supervision, Conceptualization. **Vasileios Stavropoulos:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data and syntax are available with the submission.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2024.108340.

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