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# Unraveling complexity of celebrity worship and its associations with mental health among emerging adults in China

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The digital media and the celebrity-making industry have drastically fueled celebrity worship, an evolving and complex human behavior. However, existing studies seem to oversimplify celebrity worship as a continuum ranging from normal to pathological. This study addresses this gap by developing a framework to classify distinct fan types and validate them with empirical data. A nationwide online survey was conducted with 806 Chinese emerging adults who acknowledged having a favorite celebrity. Six fan profiles were identified through Latent Profile Analysis. We then compared our classification with the widely used Celebrity Attitude Scale (CAS) to predict mental health outcomes among all participants and by gender. Results revealed significant differences across fan types on anxiety and the psychological well-being sub-dimension. The CAS score was not significantly associated with anxiety or depressive symptoms. Associations between fan types and mental health outcomes varied by gender. These findings highlight the complex nature of celebrity worship.

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## Introduction

The culture of celebrity worship has gained prominence since the early 2000s, prompting researchers to delve into the significance of celebrities in the lives of their fans, especially among youth and young adults (Brooks 2021). Nowadays, celebrities are commonly considered individuals from the modern entertainment industry who have become famous for their work or actions (De Backer 2012) and attract massive public attention (Turner 2013). McCutcheon and Aruguete (2021) observed the increase in celebrity worship in the United States between 2001 and 2021 partly due to the enhanced access to information about celebrities on social media. As China's leading media platform for celebrity-fan interaction, Weibo reported that entertainment celebrities had over 19.2 billion person-time followers in 2018, with youth and young adults born after 1990 and 2000 (i.e., emerging adults) comprising the major fan base (AIMAN and Weibo 2019). Arnett proposed the concept of emerging adults to describe the age period between the end of compulsory schooling (approximately 18 years) and the onset of adult commitments (around 29 years), such as obtaining employment, marriage, and parenthood (Arnett 2000; Arnett et al. 2014). This transitional stage is marked by instabilities and challenges. Notably, emerging adults' attachment to celebrities can exert a significant influence on their identity development and intimacy formation (Stever 2011a: 1), thereby potentially affecting their mental health and even long-term personal growth. The pattern of celebrity worship among emerging adults remains an intriguing area that warrants further exploration.

Existing studies exploring celebrity worship from an individual perspective have predominantly relied on the Absorption-Addiction Model, which suggests that fans with a weak identity, underdeveloped boundary structures, or a lack of meaningful relationships are prone to establish a fan identity and gain a sense of fulfillment by becoming psychologically invested with a celebrity; such absorption runs a risk of becoming addictive and leading to more extreme behaviors (McCutcheon et al. 2002; 2003). Developed in line with the Absorption-Addiction Model (McCutcheon et al. 2002), the Celebrity Attitudes Scale (CAS) has become the most used scale for measuring the celebrity worship level (Brooks 2021). An underlying premise of CAS is to see celebrity worship as a continuum from normal to abnormal, reflecting the tradition in celebrity worship studies that pathologize celebrity worship and portray fans as being driven by madness or unhealthy obsessions (Duffett 2013). Numerous quantitative studies depending on CAS have linked celebrity worship to poorer mental health (e.g., psychological well-being, depression and anxiety, Brooks 2021).

However, researchers have challenged the pathologization of celebrity worship, advocating for its recognition as an integral aspect of ordinary social and cultural life (Jenkins 2007; Sandvoss 2005; Sandvoss et al. 2017), and posit that it should be regarded as a normal part of adult development, contributing to the exploration of intimacy and identity (Adams-Price and Greene 1990; Stever 2011a: 1). On the one hand, Cheung and Yue (2018) argued that the three dimensions of CAS (i.e., entertainment-social, intense-personal and borderline-pathological) frequently show high inter-factor correlations and convergence, while fans with high levels of interest in their favorite celebrities without active engagement in celebrity worship may not be captured (Stever 2011b). On the other hand, a recent study targeting early adults who like K-Pop in Indonesia found no significant association between CAS score and psychological well-being (Oktavinita and Ambarwati 2022). The developers of the CAS have also acknowledged that celebrity worship is not necessarily accompanied by higher levels of psychopathy (Maltby and Day 2017). Further investigations are warranted to revisit the dominance of

the CAS in celebrity worship related research and its association with mental health.

**Classification approach.** Classification has become an informative approach in celebrity worship research (Stever 2009; Thorne and Bruner 2006). In China, marketing researchers Jia et al. (2020) explored five fan segments by investigating their differences in motives and marketing impact: casual fans (playful, limited marketing impacts); fascinated fans (aspirational, fervent purchasers); devoted fans (sense of belonging, voluntary marketer-promoters and fervent purchasers); dysfunctional fans (identification with celebrity, rally pro); and reflective fans (solid self-identity, celebrity image-shapers). Such a pattern is also evident in the "Fan Economy 4.0 Era White Paper" (AdMaster and Weibo Marketing Research Institute 2019) released by Weibo, which divided fans into three categories (i.e., loyal fans, medium fans and mild fans) and five levels, primarily based on their consumption ability. Similarly, there are also marketing scholars outside of China who classified fans based on fan involvement and behavior into Sympathizer, Enthusiast and Fanatic (Honsel et al. 2011). However, the existing classifications of fan types lack a robust theoretical foundation and have not been empirically validated. These classifications hold an entertainment market perspective on fans' value to celebrities, which often rely on unidimensional factors (e.g., commercial purchase ability), but fail to provide a comprehensive understanding of fans.

Meanwhile, the pattern of celebrity worship in China appears distinct from what McCutcheon et al. (2002) described in the Absorption-Addiction Model. Studies have elucidated the digital fandom, where fans are "datafied" and driven by marketing strategies and algorithmic culture in China (Fung 2019; Yin 2020, 2021; Zhang and Negus 2020). As celebrities' popularity is quantified by the traffic data (*Liuliang*流量) contributed by fans (He and Li 2023), fans have gained a voice and stepped up from being merely celebrity worshipers to active participants in celebrity-making (Yan and Yang 2021). Despite variations in fan practices across fan communities, the concept of "platformized language games" has gained remarkable significance within Chinese social media (Yin and Xie 2021); these technological practices on social media platforms, such as "like" and "share", shape fans' participatory cultures. The evolving nature of this environment inevitably affects fans' emotions, motivations, identities, and associated worshiping behaviors. However, despite its importance, existing literature on fan classification has not fully examined the worship patterns of fans within the context of digital fandom. Our proposed classification framework seeks to develop a theory-based classification of contemporary fans in the context of digital fandom. By doing so, we aim to present a more comprehensive and relevant portrayal of fans in the current landscape.

## Theoretical background of fan classification

**Para-social theory.** The emergence of social media has fundamentally blurred the line between "real" and "imaginary" relationships (Click et al. 2013). Havitz and Dimanche (1997) outlined three levels of relationships about individuals' remote connections with celebrities: through para-social interaction, audiences may develop a sense of intimate connection with a celebrity; the highest level of this connection is referred to as a "para-social relationship", a one-sided emotional and cognitive bond individuals developed towards celebrity, often extending beyond specific interaction (Rubin and Perse 1987). In the communities of digital fandom, para-social interaction is performed, displayed, and shared among fans in greater depth and

intensity. Accordingly, Hills proposed to use “multi-social interaction” to describe the complex and multifaceted interactions that occur in the celebrity worship process (Hills 2015; Yin and Xie 2021). Here, multi-social interaction refers to the interaction underpinning fan-fan interactions while also being subordinated to specific fan-cultural discourse. Following Hills’ conceptualization, this study first addresses multi-social interaction in the context of digital fandom. We comprehensively examine the dynamics of fan-fan and fan-celebrity interactions, considering both online and offline domains.

Existing studies addressing para-social relationship in the context of celebrity worship have provided valuable insights. Drawing on previous research that considered both fan-oriented factors (e.g., motivations) and celebrity-oriented factors (e.g., physical attractiveness) that influence the para-social process, Schramm and Hartmann (2008) proposed the parasocial interaction process model that distinguishes perceptual-cognitive, affective and behavioral response towards a media figure. Specifically, the perceptual-cognitive response comprises processes such as personal perception or evaluation; the affective response relates to positive and negative feelings towards the persona and emotion evoked by them; the behavioral response covers users’ verbal, nonverbal and para-verbal behaviors and behavioral intention. Later, in line with the model proposed by Schramm and Hartmann, Tukachinsky and Stever (2018) described the possible measures for each para-social relationship development stage from cognitive, affective and behavioral perspectives. Similarly, Soukup (2006) observed that the strong para-social relationship between fans and celebrities was nurtured by feelings of identification, liking and attraction.

Integrating the existing theories and scales, the para-social relationship in this study is treated as a broad concept. The measurement of para-social relationship comprises related components rather than using a single existing scale with vague conceptual distinction. The composition of para-social relationship in this study follows and slightly expands the parasocial interactions process model. Specifically, the behavioral perspective in the model is measured as multi-social interaction mentioned above; the affective perspective is discussed as attachment, which refers to fans’ internal emotional and psychological bonding with celebrities (e.g., feeling like a friend/romantic attachment, perceived intimacy, Saldanha et al. 2020); the cognitive perspective is interpreted as identification. Finally, this study adds social, physical and task attraction to cover celebrity-oriented stimuli. These three components are inter-related but represent different aspects of para-social relationship.

**Identification.** Identification plays a crucial role in fans’ para-social relationship with celebrities, with shared identification forming the basis of celebrity worship (Soukup 2006). Studies have shown that popular media fans develop both individual and social/group identities (Groene and Hettinger 2015; Taylor 2014; Vinney et al. 2019). More specifically, fan identity can be further delineated into being a fan of a specific celebrity and being in the situation of worshipping a celebrity. The former can be referred to as Fanhood identity (Groene and Hettinger 2015), with highly identified fans placing greater emphasis on incorporating their fan state into their self-concept (Madrigal 1995; Wann et al. 2000). Identification with a celebrity can be further parsed into being like a celebrity (i.e., similarity) and wanting to be like a celebrity (i.e., wishful, Stever 2017). Similarity identification refers to fans’ recognition of sharing similar values or qualities with their idol. Wishful identification refers to an individual’s desire to be more like or act like a media character (i.e., role model, Feilitzen and Linné 1975; Hoffner and Buchanan 2005). Furthermore, in the digital fandom context, fans frequently congregate

and form virtual communities centered around their shared love and identification with celebrities. These digital communities serve as platforms for fans to engage in various activities aimed at expressing their unwavering support for their idols. As time progresses, the fans’ identification with the fan group they belong to becomes an integral component of celebrity worship and is considered within our classification framework.

**Attachment.** Attachment to celebrities can significantly shape identity development (Adams-Price and Greene 1990; Boon and Lomore 2001) and motivate celebrity worship. Following Saldanha and colleagues’ brand attachment study, attachment in this study is defined as “a multi-faceted property of the relationship between fan(s) and celebrity that includes a deep psychological and emotional connection” (Saldanha et al. 2020). The construct of attachment in this study is mainly built on Stever’s work (2009) and the parasocial interactions process model (Schramm and Hartmann 2008). Stever outlined various types of attachment commonly observed among fans, such as *romantic attachment* (i.e., seeing a celebrity as a potential romantic partner) and *friend/filial attachment* (i.e., interest in the celebrity as a friend or potential family member in a context that is clearly not romantic). Meanwhile, the PSI process model provides an affective perspective of attachment that relates to emotions evoked by the celebrity and feelings toward the celebrity (Tukachinsky 2010). Taken together, affective attachment towards a celebrity can be considered to comprise sympathy (e.g., admiration, love) and empathy (e.g., compassion, feeling upset if the celebrity is upset).

**Attraction.** Strong feelings of attraction to a celebrity promote the investment of resources such as time and money (Horton and Wohl 1956). Such emotional reactions to the celebrity can increase a fan’s self-rating of fan interest in a celebrity (Stever 1991). Most studies of celebrity or media persona attraction have followed McCroskey and McCain’s delineation of types of attraction into three dimensions: social, physical and task (McCroskey and McCain 1974; Rubin and Step 2000). Physical attraction is based on the celebrity’s physical image or appearance (Zhang et al. 2021); social attraction relates to personal liking; task attraction relates to celebrities’ talents and capabilities in their chosen field (Stever 2009). These types of attraction also emerge as the most frequently mentioned by fans in qualitative narratives that identify their reasons for becoming a fan (Stever 2009). This study adopts these attraction definitions and framework to explore their roles in patterns of celebrity worship. Moreover, celebrities’ personalities have been highlighted as attractive qualities (Okdie and Ewoldsen 2018; Schramm and Hartmann 2008). Hence, we also integrate personality attraction into our framework.

**The current study.** This study aims to increase our understanding of diverse patterns of celebrity worship without assuming them to be pathological or problematic. In this study, the working definition of celebrity worship refers to the phenomenon of individuals developing identification, attachment and perceived attraction towards a specific celebrity and engaging in multiple interactions related to the celebrity in the digital context. This study 1) proposes a fan classification framework based on previous theoretical and empirical research (summarized in Supplementary Material 1); 2) validates the proposed fan classification with latent profile analysis (LPA) using data from an online survey among Chinese emerging adults; 3) compares the proposed fan classification with CAS in predicting mental health outcomes (i.e., depressive symptoms, anxiety, life satisfaction and psychological well-being).

## Methods

**Respondents and procedure.** An online survey was administered to emerging adults aged 18–29. Recruitment information and access links to the online questionnaire were posted on the main social media platforms (e.g., Weibo, WeChat) in mainland China. Only those who indicated having a favorite entertainment celebrity were eligible to participate and were invited to provide the celebrity's name and answer follow-up questions related to that celebrity. Respondents provided informed consent at the beginning of the questionnaire by clicking on the confirmation button. A minimum response time control and some trap questions were deployed to ensure the quality of the feedback. As an incentive, participants who completed the questionnaire and passed the quality control received a compensation of 15 RMB.

**Measurement.** The questionnaire sought information about respondents' sociodemographic characteristics, general celebrity worship status (e.g., time of worshipping), cognitive-affective emotion involvement with the celebrity (i.e., fanhood identity, fan group identity, identification, attachment, and perceived attraction of the celebrity) and online/offline interaction and supportive behaviors. All measurements showed satisfactory internal consistency (see Supplementary Material 4 for detail).

**General celebrity worship status.** Respondents were asked to provide information regarding the length of their involvement in celebrity worship, previous experience of worshipping other celebrities, rate the time and money they spent on celebrity worship using a scale ranging from 1 (minimal) to 10 (substantial), and provide an approximate amount of money they have spent cumulatively on celebrity worship. An open-ended question at the end of the questionnaire invited respondents to share the impact they perceived from their idols or celebrity worship experience. We also adapted the most used scale in previous celebrity worship studies, the CAS, as a comparison. The Chinese version of CAS contains 27 items which were divided into four dimensions (Peng et al. 2010) and we specifically chose 11 items in Full identify and Pathological margin dimensions. These dimensions align with the original CAS scale's intense-personal and borderline-pathological levels. These two levels were found to be associated with clinical features such as depression and anxiety (Brooks 2021). Each item was responded on a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree).

**Fanhood identity.** Fanhood refers to the identification of an individual with a particular fan interest and/or with other fans sharing the same interest. First, we asked respondents if they perceived themselves as a fan of the celebrity; only those doing so proceeded to answer subsequent questions. We adapted the 15-item fanhood measure developed by Groene and Hettinger (2015). Items were translated into Chinese by a bilingual researcher, translated back into English, and checked by another bilingual researcher. The research team discussed and resolved inconsistencies in the translations. The final fanhood measurement removed Item 1: *I am connected to others with the same fan interest*, as it was considered a semantic repetition of Item 4: *I feel a strong sense of ties with others of the same fan interest* after translation into Chinese. Responses to each item used a five-point Likert scale, with a higher total score for all 14 items indicating a higher level of identification. Respondents who did not consider themselves fans were given a zero score.

**Fan group identity.** We also asked respondents if they had joined any fan support group. Those who were fan group members

responded to seven items measuring their collective identity towards the fan group (e.g., their attitudes towards the group and the emotional significance of their social group to them). These items were adapted from the Fandom Collective Self-esteem Scale developed by Luhtanen and Crocker (1992), which was used in a previous Chinese study and showed good reliability and validity (Sha 2020). We only included seven positive scoring items from this Scale: two items from the Membership dimension (e.g., *I am a worthy member of the group I belong to*); two items from the Private dimension (e.g., *I feel good about the group I belong to*); and three items from the Identity dimension (e.g., *the group I belong to are an important reflection of who I am*). A higher sum score represents a higher level of identification with the celebrity. Respondents who were not members of a fan group were given a score of zero.

**Identification with the celebrity.** The celebrity-persona para-social identification scale (CPI) measures how respondents identify with a celebrity (Brown 2007). The CPI contains 20 items, each responded on a five-point Likert scale to measure respondents' wishful identification (e.g., *I look to [celebrity] as a role model*) and similarity identification (e.g., *[celebrity] and I share many of the same values*). The CPI was translated into Chinese and cross-checked by bilingual researchers. A higher sum score indicates a higher level of identification with the celebrity.

**Attachment to the celebrity.** A total of 18 items derived from previous related studies (Cheung and Yue 2011; Claessens and Bulck 2015; Rubin and Perse 1987; Schramm and Hartmann 2008; Tukachinsky 2010) were used to measure various dimensions of attachment to the celebrity, including, friend attachment (e.g., *I talk about [celebrity] like I talk about my friends*); filial attachment (e.g., *I feel connected to [celebrity] as I do to my family*); romantic attachment (e.g., *I wish [celebrity] to be my lover*); sympathy (e.g., *One simply has to like [celebrity]*); and empathy (e.g., *I always felt compassion for [celebrity]*). A five-point Likert scale measured responses on all items, with a higher sum score indicating a higher level of attachment in each dimension.

**Attraction to the celebrity.** Perceived attraction towards the celebrity was measured with reference to McCroskey and McCain (1974) and Tukachinsky (2010) in three dimensions, including social attraction (e.g., *I would like to have a friendly chat with [celebrity]*), physical attraction (e.g., *[celebrity] is very sexy looking*) and task attraction (e.g., *I think [celebrity] is an expert*). We added personality attraction to measure the extent to which respondents were attracted to the celebrity's personality (e.g., *[celebrity] personality is very attractive to me*). A five-point Likert scale measured responses on all items, and a higher score indicated deeper attraction.

**Online and offline supporting behaviors.** The research team designed the measurement of supporting behaviors according to the observation of fan behavior and with reference to previous celebrity worship studies in China (Dan 2020; He and Li 2023; Jia 2018; Sha 2020). Twelve items measured online behaviors, including both general interactions, such as browsing relevant information and comments on posts related to the celebrity, and more intensive supporting behaviors, such as *Kongping* (the spamming and manipulation of online comments), *Caoshuju* ("rocketing the data", the manipulation of data traffic), etc. (Yin and Xie 2021; Zhang and Negus 2020). Participants were also asked to provide details about any conflicts happened due to their engagement in celebrity worship to better contextualize the digital fandom. Ten items measured



offline supporting activities, including both general behaviors, such as attending concerts or purchasing endorsed merchandise, and relatively extreme behaviors, such as stalking, taking out a loan to finance celebrity worship, etc. A five-point Likert scale measured responses on all items, and a higher sum score indicated greater investment.

**Mental health outcomes.** Depressive symptoms were measured by the two-item Patient Health Questionnaire (Gilbody et al. 2007) and anxiety was measured by the two-item General Anxiety Disorder (Kroenke et al. 2007); items were rated on a four-point Likert scale (from 1 = Never to 4 = Almost everyday). The 18-item Ryff's psychological well-being scale was used to measure psychological well-being (Ryff and Keyes 1995). The psychological well-being scale has six dimensions including Autonomy, Environmental Mastery, Personal Growth, Positive Relations with Others, Purpose in Life and Self-acceptance. A seven-point Likert scale measured responses on all items, and a higher sum score indicated greater well-being. In addition, we asked participants to rate their life satisfaction on a five-point scale from very dissatisfied to very satisfied. Considering the health of the participants would affect their behavior involvement in celebrity worship, we also asked participants to rate their self-perceived health from 1 (very bad) to 5 (very good).

**Statistical analysis.** Statistical analysis was performed by R (version 4.2.1) running in Rstudio and Statistical Package for Social Science (version 26). We first conducted Exploratory Factor Analysis (EFA) using the Unweighted Least Squares method with Promax rotation and Kaiser–Meyer–Olkins (KMO) normalization to examine the validity of the measures of cognitive-affective involvements towards the celebrity and online/offline behavior. We retained solutions for KMO > 0.60 and significant Bartlett test ( $\chi^2$ ). In line with the recommendations from the parallel analysis, and guided by our framework, we deleted, divided, or combined the original measures whenever applicable. For example, the results suggested a two-factor structure for the CPI, although the original scale was designed to be unidimensional. In light of the previous literature (Stever 2017) and the content of the items, we named the two CPI factors as *similarity identification* and *wishful identification*. Similarly, the online and offline supporting behaviors were divided into two separate components. Friend attachment and filial attachment are sufficiently related to be considered a single main component named as “friendliness attachment.” Similarly, empathy is closely related to sympathy after deleting one item (i.e., *I could not comprehend the feelings he/she shows*). Minus the deleted item, we combined empathy and sympathy into a single main component we named “affection” (see Supplementary Material 2 for detailed EFA results).

Next, similarity identification, wishful identification, two online supporting components (general online support and intensive online support), two offline supporting components (general offline support and intensive offline support), affection, friendliness attachment, romantic attachment, four types of attraction, and the total investment of time and money were used as indicators for LPA. Prior to the LPA, the Mahalanobis distance approach (Leys et al. 2018) was used to detect multivariate outliers. All indicators were standardized to enhance latent profile labeling and interpretability (Morin et al. 2016). The practical “mclust” (Scrucca et al. 2016) and “tidyLPA” packages (Rosenberg et al. 2018) were used to classify potential celebrity worship profiles. The fit of the latent profile was assessed using several statistical fit indices, including information criteria, likelihood-based tests, and entropy index. Lower values of information

criteria, such as Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC), indicated a better model fit. Likelihood-based tests, such as the BLRT, rendered a  $p$  to compare the models with  $k$  and  $k-1$  classes; a non-significant value of  $p$  provided support for the  $k-1$  class model vs. the  $k$ -class model (Nylund et al. 2007). The entropy index was used as an indicator of how well individuals were classified in the model, with values more than 0.80 indicating “good” classification (Clark and Muthén 2009). Interpretability of the fit was also based on significant class membership probabilities.

The “mclust” package was used to determine the final optimal model based on the BIC index, which was recommended by several studies as the most reliable indication of model fit (Nylund et al. 2007; Vermunt and Magidson 2002). Deciding the best-fitting model solution involves an integrative approach to considering statistical adequacy, the meaning of profiles, and each solution's theoretical conformity (Hofmans et al. 2020; Levin et al. 2022; Spurk et al. 2020). Following the model determination, multivariate analysis of covariance (MANCOVA) was undertaken to compare all the variables included in the LPA model, social-demographic variables, CAS scores and mental health outcomes to identify any significant differences in these variables across profiles. The comparison of each continuous variable between profiles was performed by one-way variance analyses with a Bonferroni post-hoc test. The Eta Squared index ( $\eta^2$ ) was calculated to obtain the magnitude of the observed differences upon variables included in LPA model (values between 0.0099 and 0.0588 indicated a small effect size; values between 0.0588 and 0.1379 indicated a medium effect size; and values more than 0.1379 indicated a large effect size, Cohen 1988). Categorical variables comparisons were conducted using  $\chi^2$  tests with Cramer's V effect size.

Next, sociodemographic variables and general celebrity worship status (i.e., length of celebrity worship time) were included one by one in a multinomial logistic regression (MLR) analysis to see whether factors had a significant impact on different profiles. We then interpreted each profile based on the result of the MANCOVA, MLR and the messages left by respondents. Finally, univariate linear regression was performed to examine the potential association between socio-demographic variables, fan types, CAS scores and mental health outcomes, significant ( $p < 0.05$ ) or margin significant variables ( $p < 0.1$ ) were then incorporated in multivariate linear regression to test the association between fan types, CAS scores and mental health outcomes. Since we found differences in fan classification by gender during our analysis, and given the inconsistencies found in past research on the association between gender and celebrity worship (Brooks 2021), we run the linear regressions for males and females separately to delineate the gender differences.

## Results

**Sample characteristics.** A total of 806 respondents passed the quality control. Fifty-five were identified as outliers and excluded, leaving 751 for the final analysis, of whom 83.1% identified as female. Most respondents had completed tertiary education, with 58.6% holding a bachelor's degree and 32.1% completing a master's or higher degree. More than half of the respondents were students (61.5%), single (67.8%), and heterosexual (76.8%). Regarding general celebrity worship status, 72.7% of the respondents self-identified as fans of their idols; a substantial portion had worshiped their idols for an extensive period, with 44.1% indicating a celebrity worship duration of 1–5 years and 25.3% reporting a duration of 5–10 years. Most respondents had worshiped more than one celebrity in the past. All respondents

reported secondary creative behaviors (e.g., editing pictures and/or videos of the celebrity).

**LPA model solution.** Prior to LPA, all adapted scales were psychometrically tested through EFA, and their reliability was examined through Cronbach's  $\alpha$  internal consistency measure. The results confirmed the reliability of all measurement scales. Meanwhile, the EFA analysis supported the selection of variables that were later included in the LPA analysis. The results of mclust suggested a five to seven profiles solution with a six profiles solution having the smallest BIC value. Given that existing qualitative studies have also identified five to six fan types, we selected the six profiles solution with lower AIC and BIC, high entropy (0.93) and high mean class member probabilities (0.94), although solutions with more than six profiles were recommended based on BLRT values. Notably, with the six profiles solution, even the lowest mean posterior classification probability of 0.817 exceeded the recommended threshold level of 0.80 (Spurk et al. 2020, see Supplementary Material 3 for the detailed LPA model results). An analysis of variance test with the scores of the variables included in the LPA model was performed to ensure the robustness of the solution. On all the variables, significant differences were demonstrated ( $p < 0.001$ ). Supplementary Material 3.3 shows the scores of all concerned variables across six profiles and the proportion of each profile across respondents.

**Interpretation of the profiles.** We labeled each profile and interpreted them according to the following data: 1) summary statistics across profiles for the 17 variables included in LPA (Table 1); 2) the distribution of sociodemographic characteristics and general celebrity worship status across the six profiles (Supplementary Material 5); 3) respondents' messages in the open question; 4) previous classification and naming of fans proposed by Jia et al. (2020). We list the naming and the interpretation of each profile in Table 2.

First, Superfans reported the highest levels of celebrity identification, fanhood identification, fan group identification, engagement in interaction and supporting activities. This group of fans also reported higher financial status (50% having a monthly disposable income exceeding 5000 RMB) to enable their proactive involvement in celebrity worship activities. Thus, we use "super" to denote this group's high level of commitment and their financial power in supporting the celebrity. Fanatical Fans were highly attracted to the celebrity, especially their appearance; they also tended to be the youngest of the six fan types and were involved in more intensive or even extreme supporting activities.

Next, Devoted Supporters and Ordinary Fans shared similar medium scores of identifications, attachment, and perceived attraction, but the Devoted Supporters were significantly more engaged in interaction and supporting activities than the Ordinary Fans. For the Ordinary Fans, the term "Ordinary" is used in contrast to "Super", "Fanatical" and "Devoted" to describe a group whose emotional and behavioral commitment is at an ordinary level for a fan base. It is worth noting that there is a clear discrepancy in the emotional commitment level between Devoted Supporters and Superfans and Fanatical Fans, but the behavioral investment level of Devoted Supporters is even comparable to Fanatical Fans. Previous studies have suggested that fans are encouraged within the fan groups, either voluntarily or coercively, to engage more in online data creation (e.g., posts and comments) to enhance their idol's visibility on social media (He and Li 2023; Yan and Yang 2021; Zhang and Negus 2020). Accordingly, we speculate that the high level of investment in support activities from Devoted Supporters may partially stem from being more motivated by the fan group and the data-driven fandom. Hence,

we searched for "fan groups" as keywords in fans' messages and found a possible explanation. Of the 388 messages, nine mentioned "fan group", six from Devoted Supporters. Most messages referring to fan groups described the negative atmosphere of celebrity worship culture and the impact of the fan groups. For example, one respondent wrote:

*My mood is very easy to change because of the movement of the fan group, I have done somethings that once I thought I would not do, including Kongping, Fanhei (challenging negative comments about the celebrity) and confronting other fan groups. I even took time off school during the pandemic to go to a concert and engage in offline supporting activities. It's always a very new experience, taking up most of my energy and money.*

By reviewing the messages shared by Devoted supporters, we discovered that they tended to perceive a greater influence from the fan group and/or the digital fandom culture. This perception drove them to devote more, even in the absence of a high level of emotional commitment to the celebrity.

The remaining two groups of respondents were more admirers than fans. These respondents did not self-identify as fans of celebrities, although the Infatuated Admirers still exhibited notable emotional investment in celebrities. Infatuated Admirers' emotional commitment was comparable to that of Devoted Supporters and Ordinary Fans; they even perceived a higher level of physical attraction of celebrities than the latter two. However, such infatuation might be temporary, and their attraction may switch to other celebrities, as they reported more past celebrity worship experiences and more shorter-term celebrity worship (see Table 3 and Supplementary Material 5). Finally, Casual Admirers were the least emotionally and behaviorally invested and were more attracted to celebrities' expertise than their physical appearance. Their average age was the oldest among all fan types, and they rarely engaged in supporting activities, tending only to attend a concert or show to appreciate the celebrity's performance.

**Latent profiles and sociodemographic characteristics.** Ordinary Fans were in the middle between fans and admirers and the least invested of the fan groups. Hence, Ordinary Fans were used as the reference group in the MLR (Table 3). Respondents' sociodemographic characteristics varied across fan types. The average age of Fanatical Fans was significantly lower than Ordinary Fans ( $uOR = 0.87, p < 0.001$ ), while the Casual Admirers were older on average ( $uOR = 1.16, p < 0.001$ ). Female respondents were more likely to be Devoted Supporters (27.6% of all female respondents) and Ordinary Fans (24.7% of all female respondents). Male respondents were more likely to be Fanatical Fans (23.7% of all male respondents) and Infatuated Admirers (21.2% of all male respondents (see Supplementary Material 5 for details). Among Superfans, the percentage of males was higher than other types of fans. Meanwhile, Superfans comprised significantly more non-student working people ( $uOR = 3.13, p < 0.001$ ), possibly account for their higher disposable income. There are also significantly lower percentage of master's or higher degree holders among Superfans ( $uOR = 0.21, p < 0.001$ ), who accounted for nearly half (49.9%) of the Casual Admirers. Infatuated Admirers and Casual Admirers were significantly more likely not to be single ( $uOR = 1.79-1.87, p < 0.05$ ), and Superfans were significantly more heterosexual ( $uOR = 6.97, p < 0.001$ ).

**Compare fan classification with CAS in predicting mental health outcomes.** A significant difference in CAS scores was observed among the six types of fans. In general, there was a

Table 1 Difference between the six profiles in terms of the study variables: Descriptive statistics, results of ANOVAs, and post hoc comparisons.									
1. Superfans (n = 24, 3.2%)	2. Fanatical Fans (n = 152, 20.2%)	3. Devoted Supporters (n = 195, 26.0%)	4. Ordinary Fans (n = 172, 22.9%)	5. Infatuated Admirers (n = 131, 17.4%)	6. Casual Admirers (n = 77, 10.3%)	ANOVA		Post hoc comparisons (non-significant difference pair) <sup>a</sup>	
						F	η <sup>2</sup>		
Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)				
37.96 (5.19)	37.66 (3.92)	31.57 (5.63)	32.85 (3.79)	31.27 (4.55)	23.96 (6.48)	92.15***	0.382	1&2, 3&4, 3&5, 4&5	
Wishful identification									
35.99 (3.76)	33.85 (4.42)	26.68 (5.87)	27.84 (4.10)	25.76 (4.31)	19.01 (5.07)	126.48***	0.459	3&4, 3&5	
Similarity identification									
28.04 (3.51)	23.47 (6.60)	12.41 (9.86)	13.06 (9.17)	7.75 (9.39)	3.73 (6.95)	86.72***	0.368	1&2, 3&4	
Fan group identification									
58.88 (5.79)	52.26 (6.24)	39.45 (9.35)	38.31 (6.16)	0.00 (0.00)	0.73 (3.61)	1470.30***	0.908	3&4, 5&6	
Fanhood identification									
26.33 (2.28)	24.86 (3.52)	20.43 (5.02)	20.17 (3.10)	19.95 (3.55)	14.99 (4.47)	76.89***	0.340	1&2, 3&4, 3&5, 4&5	
Friendliness attachment									
29.92 (2.95)	28.91 (3.73)	24.07 (5.00)	23.49 (3.05)	22.92 (3.78)	18.40 (4.81)	84.87***	0.363	1&2, 3&4, 3&5, 4&5	
Affection									
16.13 (2.49)	13.70 (3.81)	11.06 (4.49)	10.71 (3.06)	10.55 (3.69)	8.01 (4.04)	33.12***	0.182	1&2, 3& 4, 3&5, 4&5	
Romantic attachment									
9.13 (0.68)	9.32 (0.86)	8.82 (1.24)	8.42 (0.86)	8.66 (0.91)	7.88 (1.42)	24.07***	0.139	1&2, 1&3, 1&5, 3&5, 4&5	
Personality attraction									
8.71 (0.96)	8.60 (1.20)	7.49 (1.74)	7.40 (1.07)	7.27 (1.37)	6.61 (2.08)	26.15***	0.149	1&2, 3&4, 3&5, 4&5	
Social attraction									
8.88 (0.85)	9.15 (1.02)	8.52 (1.57)	8.55 (0.98)	8.36 (1.31)	8.13 (1.66)	8.84***	0.056	1&2, 1&3, 1&4, 1&5, 1&6, 3&4, 3&5, 4&5, 4&6, 5&6	
Task attraction									
12.83 (1.90)	13.05 (1.89)	11.59 (2.97)	11.63 (2.00)	11.78 (2.21)	9.09 (3.47)	27.28***	0.155	1&2, 1&3, 1&4, 1&5, 3&4, 3&5, 4&5	
Physical attraction									
39.08 (3.72)	33.71 (5.43)	25.76 (6.82)	22.35 (4.71)	20.14 (5.40)	19.12 (6.26)	142.36***	0.489	5&6	
Intensive online support									
17.08 (1.69)	16.90 (1.97)	16.36 (2.58)	15.69 (1.88)	14.66 (2.43)	13.92 (3.05)	27.07***	0.154	1&2, 1&3, 1&4, 2&3, 3&4, 5&6	
General online support									
20.04 (2.12)	15.91 (2.99)	11.93 (3.54)	10.44 (2.68)	8.76 (2.73)	8.03 (2.82)	152.44***	0.506	5&6	
Intensive offline support									
11.08 (1.98)	5.01 (1.22)	5.20 (1.66)	4.47 (0.89)	4.31 (0.67)	4.32 (1.04)	137.80***	0.481	2&3, 4&5, 4&6, 5&6	
General offline support									
2.16 (0.98)	0.46 (1.13)	0.44 (1.67)	-0.52 (0.86)	-0.83 (0.79)	-1.04 (0.90)	57.70***	0.279	2&3, 4&5, 5&6	
General financial investment									
1.07 (0.52)	0.59 (0.75)	0.34 (0.97)	-0.25 (0.73)	-0.65 (0.73)	-0.81 (0.95)	65.40***	0.305	1&2, 2&3, 5&6	
General time investment									
25.46 (2.59)	23.40 (3.92)	18.73 (4.65)	18.74 (3.54)	17.25 (3.67)	13.08 (4.28)	88.10***	-	1&2, 3&4,	
Full identification									
16.96 (4.83)	11.30 (3.01)	9.12 (3.18)	9.38 (2.37)	8.68 (2.52)	7.13 (2.48)	57.84***	-	3&4&5	
Pathology margin									

<sup>a</sup>p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001  
<sup>a</sup>Most of the comparisons are significantly different, only those with non-significant differences in comparisons are listed here.

**Table 2 Naming of each profile and interpretation.**

Name	Cognitive-affective emotion level	Fan/Fan group identity level	Behavioral investment level	Characteristics
Superfans	High	High	High	Higher financial capacity; solid fan identity, fan group identity, and identification with the celebrity; highly involved in a variety of supportive activities; the worshipping to one celebrity usually lasts a long time
Fanatical Fans	High	High	Medium-high	Younger age, highly captivated by the celebrity, most frequently involved in more intensive support activities
Devoted Supporters	Medium	Medium	Medium	Higher emotional attachment and attraction towards the celebrity compared to identification; higher investment in supportive activities, and frequently involved in more intensive support activities; overall investment level higher than cognitive-affective emotion intensity level; may perceive being subject to a higher level of influence from the fan group and/or the digital fandom culture
Ordinary Fans	Medium	Medium	Medium-low	Invested considerable emotions, time and money in supportive activities
Infatuated Admirers	Medium	Low	Low	Does not perceive self as a fan but is highly attracted to celebrity, especially through their appearance; low fan identification but higher fan group identification, may switch their infatuation between different celebrities and the infatuation may not last long
Casual Admirers	Low	Low	Low	Older, mostly do not perceive self as a fan, with low fan identity, fan group identify and identification with the celebrity; mainly attracted by the celebrity's expertise.

**Table 3 Sociodemographic differences across fan types.**

	Superfans		Fanatical fans		Devoted supporters		Infatuated admirers		Casual admirers	
	Coef	uOR	Coef	uOR	Coef	uOR	Coef	uOR	Coef	uOR
Age	0.09	1.09	−0.14***	0.87	0.00	1.00	0.04	1.04	0.14***	1.16
Gender (Male as reference)										
Female	−1.82***	0.16	−0.85*	0.43	−0.07***	0.93	−0.88*	0.41	−1.48***	0.23
Not willing to disclose	−13.54***	0.00	−1.72	0.18	0.33	1.39	−14.50***	0.00	−14.08***	0.00
Education (Lower than Bachelor as reference)										
Bachelor	0.26	1.29	0.5	1.65	0.55	1.73	−0.10	0.91	0.33	1.39
Master and above	−1.56***	0.21	−0.57	0.57	0.56	1.75	−0.14	0.87	0.88*	2.41
Intimate relationship (Single as reference)										
Not single	−0.12	0.89	0.17	1.19	0.09	1.10	0.62**	1.87	0.58*	1.79
Employment status (Being student as reference)										
Not student	1.14***	3.13	−0.39	0.68	−0.11	0.90	0.03	1.03	0.37	1.45
Sexual orientation (Not heterosexual as reference)										
Heterosexual	1.94***	6.97	0.05	1.05	−0.31	0.73	0.41	1.50	−0.15	0.86
Monthly Income (0–2000 RMB as reference)										
2001–5000 RMB	1.76***	5.83	0.30	1.35	0.50	1.65	−0.02	0.98	−0.12	0.89
>5000 RMB	2.30***	10.00	0.25	1.28	0.33	1.39	0.19	1.21	0.40	1.49
Previous celebrity worship (Many as reference)										
Several	−1.18***	0.31	−0.41	0.67	−0.88*	0.41	−0.39	0.68	−0.40	0.67
None	−0.70*	0.50	0.25	1.28	−0.59	0.55	−0.55	0.58	−0.86**	0.42
Worshipping time (<1 year as reference)										
1–5 years	0.61	1.83	0.16	1.18	−0.11	0.89	−0.33	0.72	−1.06	0.35
>5 years	0.43	1.53	0.43	1.53	−0.44	0.65	−1.09***	0.33	−0.86*	0.43
>10 years	1.00**	2.72	0.43	1.53	−0.15	0.86	−1.19**	0.31	−1.02**	0.36
Self-perceived as fan (No vs Yes)	−5.81***	0.00	−2.88***	0.06	−22.77***	0.00	34.27***	<sup>a</sup>	25.11*	<sup>a</sup>

Ordinary Fans as reference.  
uOR unadjusted Odds Ratio.  
\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001  
<sup>a</sup>Too large to show.

gradual decrease in scores from Superfans to Casual admirers (Table 1). However, no significant difference was found between Devoted Supporters and Ordinary Fans ( $p = 1.000$ ), as well as between Superfans and Fanatical Fans ( $p = 0.295$ ) in terms of Full identification score; no significant difference was found between

Infatuated Admirers, Ordinary Fans and Devoted Supporters ( $p > 0.5$ ) in the Pathology margin score. Univariate analysis revealed that both fan classification and the two CAS scores were not significantly associated with depressive symptoms, life satisfaction and total score of psychological well-being (Supplementary



Table 4 Multivariate regression results of mental health outcomes.											
GAD			Personal growth			Positive relations with others			Purpose in life		
B (95% CI)	t	p	B (95% CI)	t	p	B (95% CI)	t	p	B (95% CI)	t	p
Age											
Gender (Male as reference)											
Female									−0.54 (−1.21, 0.13)	−1.58	0.115
Not willing to disclose									−0.99 (−3.25, 1.27)	−0.86	0.390
Education (Lower than Bachelor as reference)											
Bachelor			0.51 (−0.12, 1.14)	1.59	0.111	0.34 (−0.50, 1.17)	0.79	0.432	0.40 (−0.45, 1.24)	0.92	0.356
Master and above			0.58 (−0.09, 1.25)	1.71	0.088	0.73 (−0.18, 1.64)	1.59	0.113	0.79 (−0.11, 1.69)	1.72	0.086
Intimate relationship (Single as reference)											
Not single						0.74 (0.28, 1.31)**	3.01	<b>0.003</b>	0.30 (−0.22, 0.82)	1.15	0.251
Sexual orientation (Not heterosexual as reference)											
Heterosexual	−0.23 (−0.48, 0.02)	−1.80	0.073	0.32 (−0.11, 0.74)	1.46	0.144	0.97 (0.40, 1.54)**	<b>0.001</b>	1.91 (1.38, 2.52)***	8.60	<b>&lt;0.001</b>
Monthly Income (0-2000 RMB as reference)											
2001-5000 RMB											
>5000 RMB											
Self-perceived health	−0.64 (−0.77, −0.51)***	−9.54	<b>&lt;0.001</b>	0.73 (0.50, 0.96)***	6.28	<b>&lt;0.001</b>	1.45 (1.14, 1.75)***	9.38	<b>&lt;0.001</b>	1.35 (1.04, 1.65)***	<b>&lt;0.001</b>
Fan type (Ordinary Fans as reference)											
Casual Admirers	0.60 (0.21, 0.99)**	3.04	<b>0.002</b>				−1.20 (−1.99, −0.21)*	−2.43	<b>0.015</b>		
Infatuated	0.30 (−0.03, 0.63)	1.80	0.072				−0.77 (−1.53, −0.02)*	−2.02	<b>0.044</b>		
Admirers											
Devoted	0.47 (0.17, 0.76)**	3.07	<b>0.002</b>				−0.70 (−1.38, −0.02)*	−2.03	<b>0.043</b>		
Supporters											
Fanatical Fans	0.24 (−0.07, 0.56)	1.51	0.132				−0.23 (−0.96, 0.50)	−0.62	0.535		
Superfans	0.46 (−0.16, 1.08)	1.46	0.145				0.64 (−0.80, 2.08)	0.87	0.382		
CAS											
Full identification						−0.02 (−0.07, 0.02)	−1.07	0.286	−0.09 (−0.14, −0.04)***	−3.63	<b>&lt;0.001</b>
Pathology margin						−0.09 (−0.15, −0.04)**	−2.73	<b>0.006</b>			

\*p <0.05; \*\*p <0.01; \*\*\*p <0.001.  
p values that are statistically significant are shown in bold.

Material 6). After adjusting for significant sociodemographic variables (Table 4), we found fan classification remained significantly associated with anxiety and positive relations with others sub-dimension. Compared to Ordinary Fans, Casual Admirer ( $B = 0.60$ , 95% CI = 0.21, 0.99) and Devoted Supporters ( $B = 0.47$ , 95% CI = 0.17, 0.76) had significantly higher coefficients in predicting anxiety. Conversely, compared to Ordinary Fans, Casual Admirers ( $B = -1.20$ , 95% CI =  $-1.99$ ,  $-0.21$ ), Infatuated Admirers ( $B = -0.77$ , 95% CI =  $-1.53$ ,  $-0.02$ ) and Devoted Supporters ( $B = -0.70$ , 95% CI =  $-1.38$ ,  $-0.02$ ) had significantly lower coefficients in predicting positive relations with others. In addition, Full identification remained significantly associated with purpose in life ( $B = -0.09$ , 95% CI =  $-0.14$ ,  $-0.04$ ), and Pathology margin remained significantly associated with personal growth ( $B = -0.09$ , 95% CI =  $-0.15$ ,  $-0.04$ ).

**Gender differences in celebrity worship and associations with mental health.** After adjusting for significant sociodemographic variables, among male participants, we only found Superfans exhibited significantly higher coefficients in predicting life satisfaction compared to Ordinary Fans ( $B = 0.71$ , 95% CI = 0.12, 1.31); and both Full identification and Pathological margin were significantly associated with personal growth ( $B = -0.13$  to  $-0.14$ ,  $p < 0.05$ ) and purpose in life ( $B = -0.15$  to  $-0.16$ ,  $p < 0.05$ ). We also found that the Pathology margin was significantly associated with personal growth among female participants ( $B = -0.09$ , 95% CI =  $-0.16$ ,  $-0.03$ ). Meanwhile, we found significant differences among different types of female fans on depressive symptoms, anxiety, life satisfaction, self-acceptance and positive relations with others (Table 5). Compare to Ordinary Fans, Casual Admirers, Devoted Supporters and Fanatical Fans have significantly higher coefficients in predicting depressive symptoms ( $B = 0.36$  to  $0.46$ ,  $p < 0.05$ ), and Casual Admirers, Infatuated Admirers and Devoted Supporters have significantly higher coefficients in predicting anxiety ( $B = 0.38$  to  $0.80$ ,  $p < 0.05$ ), but significantly lower coefficients in predicting positive relations with others ( $B = -0.72$  to  $-1.17$ ,  $p < 0.05$ ). In addition, we found Devoted Supporters have significantly lower coefficients in predicting life satisfaction ( $B = -0.14$ , 95% CI =  $-0.28$ ,  $0.0$ ) and self-acceptance ( $B = -0.72$ , 95% CI =  $-1.37$ ,  $-0.06$ ).

Discussion

This study established a comprehensive classification model by incorporating relevant theories and considering multiple dimensions of celebrity worship. Notably, the model incorporates online supportive behaviors to account for the current context of digital fandom. By validating the classification model with empirical data, this study not only sheds light on the intricate patterns of celebrity worship in the digital realm but also uncovers a significant misalignment between fans' emotional dedication and practical engagement, a revelation that reflects the impact of social culture on the celebrity worship experience. Moreover, our classification model discerns nuances in predicting mental health outcomes among diverse fan types, a capability notably absent in CAS. Unlike prior quantitative studies heavily reliant on CAS, our approach bridges a critical gap, offering fresh and valuable perspectives in celebrity worship research. The study generated a fan classification of six profiles: Casual Admirers, Infatuated Admirers, Ordinary Fans, Devoted Supporters, Fanatical Fans and Superfans. While some outcomes of our study align with previous qualitative research, our research also made new and distinctive discoveries. Given the notable commensurability with Jia's framework (Jia et al. 2020), we drew from Jia's work as a reference when naming our profiles. Specifically, the Casual Admirer in our study resonates with Jia's concept of Casual Fans

Table 5 Significant association between fan types and mental health outcomes of female participants (N = 624).

	PHQ			GAD			Life satisfaction			Self-acceptance			Positive relations with others		
	B (95% CI)	t	p	B (95% CI)	t	p	B (95% CI)	t	p	B (95% CI)	t	p	B (95% CI)	t	p
Age															
Education (Lower than Bachelor as reference)															
Bachelor	-0.17 (-0.56, 0.22)	-0.86	0.388												
Master and above	-0.29 (-0.71, 0.13)	-1.35	0.177												
Intimate relationship (Single as reference)															
Not single															
Sexual orientation (Not heterosexual as reference)															
Heterosexual	-0.24 (-0.49, 0.02)	-1.84	0.066	-0.21 (-0.49, 0.07)	-1.49	0.136									
Monthly Income (0-2000 RMB as reference)															
2001-5000 RMB	-0.15 (-0.40, 0.10)	-1.18	0.238	-0.21 (-0.48, 0.06)	-1.52	0.130									
>5000 RMB	-0.30 (-0.58, -0.01)*	-2.04	<b>0.041</b>	-0.30 (-0.60, 0.00)*	-1.98	<b>0.048</b>									
Self-perceived health	-0.64 (-0.78, -0.50)***	-9.10	<b>&lt;0.001</b>	-0.66 (-0.81, -0.51)***	-8.67	<b>&lt;0.001</b>	0.61 (0.54, 0.67)***	18.29	<b>&lt;0.001</b>	0.36 (-0.16, 0.88)	1.36	0.174	0.90 (0.33, 1.47)***	3.09	<b>&lt;0.001</b>
Fan type (Ordinary Fans as reference)															
Casual Admirers	0.46 (0.04, 0.88)*	2.16	<b>0.031</b>	0.80 (0.34, 1.25)***	3.43	<b>&lt;0.001</b>	-0.07 (-0.27, 0.13)	-0.68	0.500	-0.86 (-1.79, 0.07)	-1.81	0.071	-1.17 (-2.18, -0.16)*	-2.28	<b>0.023</b>
Infatuated Admirers	0.22 (-0.11, 0.56)	1.32	0.186	0.38 (0.01, 0.74)*	2.03	<b>0.043</b>	-0.08 (-0.24, 0.08)	-1.01	0.315	-0.16 (-0.90, 0.58)	-0.42	0.676	-0.85 (-1.65, -0.05)*	-2.08	<b>0.038</b>
Devoted Supporters	0.36 (0.07, 0.66)*	2.41	<b>0.016</b>	0.52 (0.20, 0.84)***	3.16	<b>&lt;0.001</b>	-0.14 (-0.28, 0.00)*	-1.97	<b>0.049</b>	-0.72 (-1.37, -0.06)*	-2.16	<b>0.031</b>	-0.72 (-1.43, -0.02)*	-2.01	<b>0.045</b>
Fanatical Fans	0.38 (0.05, 0.70)*	2.29	<b>0.023</b>	0.31 (-0.04, 0.66)	1.73	0.085	-0.08 (-0.23, 0.07)	-1.06	0.290	0.08 (-0.64, 0.79)	0.21	0.834	-0.47 (-1.25, 0.31)	-1.18	0.240
Superfans	0.16 (-0.56, 0.88)	0.44	0.664	0.30 (-0.49, 1.08)	0.74	0.457	0.07 (-0.27, 0.13)	0.38	0.704	0.78 (-0.83, 2.39)	0.96	0.340	1.05 (-0.70, 2.79)	1.18	0.239

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .  
p values that are statistically significant are shown in bold.

who only invest limited cognitive and emotional effort into knowing and bonding with the celebrity. Similarly, our Ordinary Fans, Devoted Supporters, and Fanatical Fans align with Jia's Fascinated Fans, Devoted Fans, and Dysfunctional Fans, respectively. To avoid pathologizing fans, we intentionally avoided using the term "dysfunction" as a label. Furthermore, our research suggested a novel profile of 'Infatuated Admirers' representing individuals who establish a deeper connection with the celebrity than Casual Fans yet exhibit a lower level of investment than Fascinated Fans. We did not observe Jia's Reflective Fan, who avoids fanatical behavior and maintains an arm's length relationship with the celebrity but forms the backbone of support for the celebrity, in our study. Rather, our results indicate that Superfans, who form the backbone of fan clubs and support the celebrity, still exhibit significant levels of fanatical behavior and scored the highest in CAS. This difference not only draws our attention to the heterogeneity of fans but also highlights the ever-changing and context-based patterns of celebrity worship in the current era.

**CAS reconsidered: mental health insights.** We did not find significant associations between CAS scores and depressive symptoms, anxiety, life satisfaction, and overall psychological well-being. This contradicts previous research findings (Brooks 2021; Maltby et al. 2001), indicating the weak robustness of CAS in assessing the impact of celebrity worship on fans' mental health. However, we did observe a negative association between CAS scores and personal growth and purpose in life, particularly among male participants. According to the Absorption-Addiction model, this implies that individuals who exhibit substantial engagement in celebrities' lives, increased empathy towards their successes and failures, over-identification with celebrities, and an obsession with the details of their lives are more likely to experience a lack of life goals and a diminished willingness to explore new experiences and make personal changes. This association between CAS scores and limited personal growth and purpose in life represents a novel finding not previously reported in the literature.

Furthermore, our classification model was able to elucidate differences between fan types in predicting various mental health outcomes, including depressive symptoms, anxiety, life satisfaction, self-acceptance, and positive relations with others. Interestingly, Superfans, despite having the highest CAS scores, did not report negative mental health outcomes compared to other fan types. Among male fans, Superfan also shows a higher level of life satisfaction. Instead, Casual Admirers with the lowest CAS scores reported greater levels of depressive symptoms and anxiety and less positive relations with others. These findings highlight the limitations of CAS as a crude assessment tool that primarily measures general affective identification towards celebrities while ignoring the intricate nuances and complexities involved in celebrity worship. Our results emphasize the potential impact of celebrity worship on individuals' sense of personal development and life goals, underscoring the need for more nuanced and comprehensive measures in future research.

Recently, the developers of the CAS have simplified it into a seven-item scale and established corresponding cut-off scores in their latest study (Zsila et al. 2024). They have also found more symptoms of depression, anxiety and stress among individuals who score higher than the cut-off. However, based on our findings, we express concern that the CAS and its simplified version may run a risk of overlooking the complex nature of celebrity worship. By reducing the measurement to a few items, it may become more challenging to identify individuals whose genuine worship significantly impacts their personal development and mental well-being. More crucially, this operationalization

could pathologize the fan groups who may not exhibit extreme worship behaviors.

**Discrepancy between emotional commitment and practical engagement.** From an individual perspective, a crucial area of research involves differentiating between fans who exhibit problematic obsessions and experience psychological distress and those who stay healthy and adaptive. Classifying fans is an initial step towards distinguishing these groups, facilitating subsequent research into the psychological and behavioral implications associated with celebrity worship. Compared to the widely used Absorption-Addiction Model which depicts celebrity worship as a spectrum from low worship mainly for entertainment, a slightly higher level with intense identification, to the highest pathological level (McCutcheon et al. 2002), our classification effectively captures the subtle differences between fans' emotional commitment and their actual behavioral investment. This distinction, previously unaddressed in prior studies, sets our research apart in understanding the complexities of celebrity worship.

Our findings provide a novel insight into the discrepancy between emotional commitment and actual investment of time and money in supportive behaviors among Devoted Supporters and Casual Admirer. Previous research suggests that a fan's interaction enhances para-social relationship, and fan community attributes have a positive impact on celebrity trust and identification, which can enhance loyalty and encourage cooperation among fan community members (Kim and Kim 2017). However, Devoted supporters' high level of interaction did not correspond to a high level of emotional connection with the celebrity; they even held negative impressions of the fan community. On the other hand, Casual Admirers, who displayed lower emotional commitment to the celebrity, demonstrated relatively higher levels of time and financial investment. Both Devoted Supporters and Casual Admirer were found to be consistently predictive of depressive symptoms, anxiety, lower self-acceptance and lack of positive relations with others compared to other fan types, among all participants and among female participants. On one hand, our findings align with the Absorption-Addiction Model, which suggests that fans who possess a weak sense of identity or lack meaningful relationships may be more susceptible to psychologically investing in a celebrity. Factors such as low self-acceptance and a shortage of positive relationships may have contributed to the emergence of the current fan types observed in our study. For Casual Admirers with the highest predictive coefficients for depressive symptoms and anxiety, who have been engaging in celebrity worship for a shorter duration, they might find temporary relief from future depressive and anxious moods through celebrity worship. Future longitudinal studies are needed to help determine causality.

On the other hand, our findings could give rise to a hypothesis that it is not celebrity worship itself, but rather the mismatch between emotional commitment and actual investment to a celebrity, that affects fans' mental health. For instance, when an individual's emotional identification with a celebrity and their fan identification are closely aligned (i.e., Superfans), worshiping the celebrity becomes an enjoyable activity, and all related activities are rationalized as something they genuinely enjoy, which generates positive feelings. The higher level of life satisfaction by Superfans that we found in the male participants also provides support for this. Conversely, when emotional engagement is insufficient, the investment associated with celebrity worship may become burdensome and lead to negative emotions. The negative prediction of life satisfaction by Devoted Supporters that we found in the female participants could support this speculation. By considering both aspects, we gain a more comprehensive

understanding of the complex dynamics involved in celebrity worship and its impact on mental health.

Given the limitations of our study design and the limited information provided by respondents, we can only speculate that the mismatch between emotional commitment and actual investment may partially arise from the influence of data-driven fandom and collective actions of fan support groups in China. As the central social media platform for celebrity worship in China, Weibo has implemented specialized features to regulate and mobilize celebrity worship activities. The algorithmic rules employed by Weibo incorporate data labor (e.g., voting) into users' everyday media practices (Yin 2020) and ultimately serve the interests of the fandom economy market. Consequently, these algorithmic rules not only shape the way fans engage with celebrity worship on Weibo but also contribute to the reciprocal shaping of participatory cultures in China (Yin and Xie 2021). While a considerable number of fans have embraced and actively promoted this culture, some fans still experience a sense of unease or discomfort. Future study should aim to investigate the underlying factors contributing to the discrepancy between emotional commitment and actual investment in celebrity worship among different fan types, and further validate its association with mental health outcomes.

**Gender differences.** Gender is a frequently discussed factor in celebrity worship studies that conclude that celebrity worship is more prevalent among females than males (Brooks 2021). This could explain the predominance of female respondents in this study, as men may have been less inclined to participate due to the absence of a clearly favored entertainment star. Previous studies have suggested that female fans engage more in stargazing activities (Yan and Yang 2021) and scored higher than males on overall CAS measures (Huh 2012), while males reported higher levels of pathological celebrity worship (Chia and Poo 2009; Maltby et al. 2004; Reeves et al. 2012), consistent with the findings of this study. Contrary to Jia's research, which suggests that male fans are more rational than female fans, our study found that men constituted a significant percentage of Superfans and Fanatical Fans. Furthermore, our findings on the association between education level and celebrity worship align with Jia et al. (2020) observation that less well-educated fans tend to exhibit more intense or even extreme behaviors. Consistent with this, our study revealed a significantly lower percentage of graduates with a master's or higher degree among Superfans who invested most in intensive supportive activities. Conversely, a significantly higher percentage of higher education graduates was found among Casual Admirers, who exhibited more "rational" behavior.

Meanwhile, our study revealed gender differences in the association between fan types and mental health outcomes. Specifically, we observed variations in the prediction of depressive symptoms and anxiety across fan types, but these findings were more pronounced among female participants. In addition to Casual Admirers and Devoted Supporters, Fanatical Fans also showed a higher coefficient in predicting depressive symptoms, while Infatuated Admirers exhibited a higher coefficient in predicting anxiety and a lack of positive relations with others. However, it is important to note that the low percentage of males in our sample circumscribes the interpretation of these findings. To gain a more comprehensive understanding of potential gender differences in celebrity worship, future studies should strive to include a larger number of male fans. This would enable researchers to explore and elucidate the nuanced relationship between fan types, gender, and mental health outcomes, providing valuable insights into the intersectionality of these factors.

**Limitations and future directions.** The limitations of this study should be recognized. First, the predominance of relatively highly educated student respondents may restrict the generalizability of the findings despite the broader diversity compared to previous celebrity worship studies exclusively focused on university students. Second, it is important to acknowledge that our classification framework, although more comprehensive, necessitates a larger number of items for measurement, which may present challenges when attempting to replicate the measurement in future studies, thereby impacting the generalizability of the classification. However, this study can inform the optimization of future scales to measure celebrity worship. Meanwhile, this study provides a basis for further research on the effects of celebrity worship on different types of fans. By expanding upon our findings, future studies can investigate the consequences of celebrity worship and its implications for individuals' mental well-being and personal growth more deeply.

### Data availability

The datasets generated during and/or analyzed during the current study are not publicly available because they contain personal information but are available from the corresponding author on reasonable request.

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## Author contributions

DW: conceptualization, data collection, data analysis, investigation, manuscript writing; YH: conceptualization, supervision, investigation, manuscript writing.

## Competing interests

The authors declare no competing interests.

## Ethical approval

The questionnaire used for collecting data and methodology for this study has been approved by the Human Research Ethics Committee of the University of Hong Kong (EA230342), on August 7, 2023. The procedures used in this study adhere to the tenets of the Declaration of Helsinki and its subsequent amendments.

## Informed consent

All participants, as conscious adults, provided informed consent via the SurveyMars platform (wjx.cn) starting from August 9, 2023. Detailed information regarding the nature and objectives of the study was shared with participants, with explicit assurance that all data collected would be used solely for academic purposes. All participants have been fully informed that their anonymity is assured. To safeguard participant privacy, no personally identifiable information was requested or retained, ensuring the confidentiality of their responses. Participants were explicitly informed that the study posed no foreseeable risks, and they retained the right to withdraw from the survey at any stage without incurring any repercussions. Participants were then prompted to indicate their consent by selecting the appropriate option within the online questionnaire. Upon completion of the survey, each participant received compensation of CN ¥15 (approximately US \$2) through online cash transfer as a token of appreciation for their participation.

## Additional information

**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1057/s41599-024-04296-4>.

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