



# Cumulative childhood trauma and mobile phone addiction among chinese college students: role of self-esteem and self-concept clarity as serial mediators

Yunzi Xie<sup>1</sup> · Yinqi Shen<sup>1</sup> · Jixia Wu<sup>1</sup>

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## Abstract

Mobile phones have become an indispensable part of people's lives, and their use has been exacerbated by the COVID-19 pandemic. However, mobile phone addiction has also become a growing concern. This study investigates how cumulative childhood trauma relates to mobile phone addiction among Chinese college students, and the subsequent role of self-esteem and self-concept clarity. A sample of Chinese college students ( $N=620$ ) were investigated using the Childhood Trauma Questionnaire-Short Form, the Mobile Phone Addiction Tendency Scale, the Rosenberg Self-Esteem Scale, and the Self-Concept Clarity Scale. The results showed that: (1) cumulative childhood trauma significantly and positively predicted mobile phone addiction among college students; (2) self-esteem mediated the association between cumulative childhood trauma and mobile phone addiction; and (3) self-esteem and self-concept clarity had a sequential mediating effect on the relationship between cumulative childhood trauma and mobile phone addiction. Thus, this study is a reminder to focus on the combined role of multiple adverse experiences and self-system factors in the intervention of mobile phone addiction.

**Keywords** Cumulative childhood trauma · Mobile phone addiction · Self-esteem · Self-concept clarity · College students

## Introduction

With information technology's progress and COVID-19's perpetuation, mobile phones have become indispensable in daily life. However, while they bring convenience to the public, they also have hidden disadvantages, such as mobile phone addiction (MPA). MPA refers to strong uncontrollable impulses and cravings to use mobile phones (Liu et al., 2020). It is closely correlated with health and interpersonal challenges (Li et al., 2020). A meta-analysis showed that MPA's prevalence in China ranged from 13.5 to 67.0% (Xiong et al., 2021), and that college students are among the high-risk groups (Guo & Huang, 2020). Compared to

Chinese middle school students with limited mobile phone use, college students have sufficient time and freedom to use their mobile phones. Thus, the exploration of college students' MPA deserves attention.

According to the Interaction of Person-Affect-Cognition-Execution (I-PACE) Model (Brand et al., 2019), the formation of addictive behaviors can be thought as a consequence of the interactions between predisposing variables and individual specific reactions to the internal and external world, with adverse childhood experiences being one of the general predisposing variables. Existing research has shown that childhood trauma can significantly predict college students' MPA (Forster, Rogers, Sussman, Yu, Rahman et al., 2021; Liu et al., 2020). The Self-determination Theory (Ryan & Deci, 2000) proposes that individuals are motivated to meet their basic psychological needs. Those who have experienced childhood maltreatment often have difficulty growing up with adequate love and relationship needs and are more likely to adopt fast strategies that emphasize immediate gratification (Figueredo et al., 2006). Mobile phones can provide users with access to instant rewards

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Yunzi Xie and Yinqi Shen are the co-first authors.

✉ Jixia Wu  
wujixia@suda.edu.cn

<sup>1</sup> Department of Psychology, School of Education, Soochow University, Suzhou 215123, China

and gratification due to their convenience and rich content (Wang et al., 2017), which may drive individuals with traumatic experiences to seek compensation in the virtual world (Ma et al., 2020), thereby increasing the risk of MPA.

The Cumulative Risk Model (Finkelhor et al., 2007) proposes that in real life environments, different risk factors often co-occur; examining a single risk factor may lack ecological validity and overestimate its effects. Several studies have confirmed that the amount of overlap in risk factors is a non-negligible predictor of addictive behavior (Li et al., 2016; Liu et al., 2022). Childhood trauma has also been shown to occur cumulatively, for instance, Garon-Bissonnette et al. (2022) found that the overlapping incidence of child trauma subtypes is close to 50%. Cumulative childhood trauma (CCT) refers to the quantity of childhood traumas that an individual has experienced (Haselgruber et al., 2020). Compared to the childhood trauma's type, duration, and frequency, the quantity of trauma types (i.e., CCT) is considered to have a stronger influence on individuals' psychology (Briere et al., 2008), and can also predict problem behaviors (Haselgruber et al., 2020; Hébert et al., 2018). However, existing studies on the relationship between childhood trauma and MPA have predominantly focused either on a single subtype of abuse or on the overall level of abuse. To our knowledge, no study has explored the relationship between CCT and MPA. Therefore, this study proposes Hypothesis 1: *CCT is positively associated with college students' MPA.*

In addition, the mechanism between CCT and MPA is still unclear. According to the Self-System Processes Model (Sandler, 2001; Connell & Wellborn, 1991), single or cumulative risk factors affect self-system processes, which in turn affect individuals' assessment of and response to risk in future adverse situations. The positive self-system is a valuable protective resource, however, childhood cumulative risks can hinder the development of individual self-system competencies, and increase the degree of difficulty for individuals in seeking basic psychological needs and using adaptive strategies, ultimately leading to maladaptive outcomes (Sandler, 2001). Self-esteem and self-concept clarity are important factors in the self-system (Schwartz et al., 2012; Kawamoto, 2020; Kong et al., 2021). Self-esteem (SE) refers to one's overall sense of worthiness as a person (Rosenberg, 1979), which represents the individual's overall evaluation of the self and reflects the content level of the self-concept (Yıldırım & Arslan, 2020). Self-concept clarity (SCC) refers to the certainty, coherence, and stability of an individual's perception of self (Campbell et al., 1996), which reflects the structure level of the self-concept (Yıldırım & Arslan, 2020). SCC and SE are closely related (Campbell, 1990; Xu, 2007) and together comprise the individual's perceptions and beliefs about themselves (Crujisen

et al., 2023). Meanwhile, SE and SCC are also considered as risk variables closely related to addictive behaviors in the I-PACE model (Brand et al., 2019; Servidio et al., 2021). Therefore, this study introduced SE and SCC to further explore the mediating mechanism between CCT and MPA.

Childhood trauma experiences are considered to be one of the predicting factors of SE in adults (Sachs-Ericsson et al., 2010), with individuals who have experienced multiple types of trauma showing lower SE (Arata et al., 2005; Fasciano et al., 2021). According to the attachment theory (Oshri et al., 2017), self-worth is formed through repeated interactions with important others, and family members' positive feedbacks and evaluations are the main source of high self-worth (Pinquart & Gerke, 2019). Individuals with cumulative experiences of neglect and abuse hardly obtain positive interactions and feedbacks from their families, and tend to show lower SE (Fasciano et al., 2021). In addition, SE is also one of the important predicting factors of MPA (Wang et al., 2017; You et al., 2019). Based on the pathways model of problematic mobile phone use (Billieux et al., 2015), individuals with lower SE are more likely to seek reassurance and interpersonal compensation through mobile phones. Furthermore, people are commonly motivated to maintain positive self-evaluation (Steel, 1988), and mobile phones provide an appropriate platform for individuals with low SE to gain affirmation and respect to re-evaluate themselves (Kong et al., 2021; You et al., 2019), this excessive dependence on mobile phones may increase the risk of MPA. Previous studies demonstrated the role of SE in the relationship between cumulative risk and Internet addiction (Li, 2017); this study further examines the role of SE between CCT and MPA and proposes Hypothesis 2: *SE plays an independent mediating role in the relationship between CCT and MPA.*

Research also showed that adverse childhood experiences negatively predict adults' SCC (Vartanian et al., 2016), while accumulated childhood trauma is negatively correlated with college students' SCC (Carrillo-Alvarez, 2022). According to the Identity Destruction Model (Vartanian et al., 2018), childhood traumatic experiences may deprive individuals of experiences that contribute to the development of self-identity, thereby hindering the integration of their self-concept. Furthermore, different subtypes of childhood traumatic experiences may be associated with different self-concept feedback (Murthi et al., 2006; Carrillo-Alvarez, 2022), causing CCT to bring about more inconsistent feedback compared to a single subtype, leading to a more fragmented and ambiguous self-concept (Streamer & Seery, 2015), which will reduce SCC. Moreover, SCC has been proved to be closely related to MPA (Servidio et al., 2021; Kong et al., 2021). On the one hand, individuals with low SCC are more inclined to rely on the external environment

to deal with problems (Campbell, 1990), which can increase the risk of technological addiction, such as online games and internet addiction (Green et al., 2021; Quinones & Kakabadse, 2015). On the other hand, individuals with low SCC might indulge in information-seeking and social interaction on their mobile phones in an attempt to obtain feedback about their self-concept (Quinones & Kakabadse, 2015). These may increase the risk of MPA. Thus, Hypothesis 3 is proposed: *SCC mediates the relationship between CCT and MPA*.

In addition, the relationship and direction of the two self-system variables, SE and SCC, are considered in the present study. Although their reciprocal relationship has been demonstrated in previous research (Wu et al., 2010), some longitudinal studies have shown that the cross-lagged effect from SE to SCC is stronger than the converse (Crujisen et al., 2023; Wu et al., 2010; Yang & Brown, 2016), which implies that SE is an important predictor of SCC (Kawamoto, 2020). Different levels of SE provide different bases for the development of SCC (Campbell, 1990; Wu, 2009), which can be explained by the abstract integration facet of self-concept structural integration (Du et al., 2023), that people need to maintain positive self-integrity at the level of overall self-concept (Steel, 1988). However, the negative self-concept of individuals with low SE often conflicts with the need to maintain positive self-integrity, which makes it more difficult to integrate their positive and negative life experiences, thus triggering lower SCC. Based on this evidence, the hypothetical model in this study considers the path direction from SE to SCC. Moreover, some research has demonstrated the mediating role of SE between negative experiences and SCC (Streamler & Seery, 2015; Nezelek & Plesko, 2001), as well as the mediating role of SCC between SE and adaptive problems (Duan, 2020), which provide additional empirical evidence for the serial mediating role of SE and SCC. Thus, Hypothesis 4 is proposed: *SE and SCC play a serial mediating role between CCT and MPA*. The multiple mediation model proposed by Hypotheses 1–4 is shown in Fig. 1.

## Methods

### Participants and procedure

Six hundred and twenty-six college students were recruited from two universities in Chongqing and Chengdu, in the southwest of China. Participants completed the survey on Wenjuanxing (a Chinese survey website) during May 2021. Six participants were removed using the three validity items in the Childhood Trauma Questionnaire-Short Form, by referring to the screening method prescribed by Gerdner and Allgulander (2009). The final sample comprised 620 valid participants (319 males, aged 17~24,  $M_{age} = 19.69$  years).

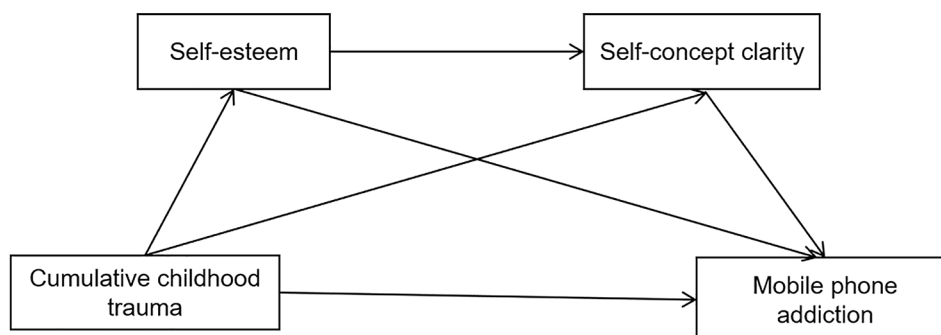
### Measures

#### Childhood Trauma Questionnaire

CCT was assessed using the Childhood Trauma Questionnaire-Short Form (CTQ-SF; Bernstein et al., 2003), a 28-item measure that comprises five subscales (emotional-, physical-, and sexual abuse; and emotional- and physical neglect), and a validity scale. The participants rated their experiences on a 5-point Likert-scale (1 = never true, 5 = very often true); higher scores indicate higher levels of childhood abuse. Good validity and reliability was reported on the CTQ-SF among Chinese college students in a previous study (Tian, Liu, & Li, 2017). The Cronbach's alpha for the scale in this study was 0.91.

The calculation of a cumulative childhood trauma index in this study was based on the dichotomy applied by Haselgruber et al. (2020). Participants' experience across these five types of childhood trauma was based on the cutoffs provided by Bernstein et al. (2003). Each trauma type was coded as "experienced" (p. 1) or "not experienced" (p. 0) and collated to obtain the CCT index. The results ranged from 0 to 5.

Fig. 1 Conceptual model



## Mobile phone addiction tendency scale

MPA was assessed using the Mobile Phone Addiction Tendency Scale (MPATS; Xiong et al., 2012) and rated on a 5-point Likert scale (1 = very inconsistent, 5 = very consistent) that comprises 16 items across four dimensions, including withdrawal symptoms, salience, social comfort, and mood changes. Higher scores indicate a stronger tendency toward MPA. The scale's reliability and validity for use among Chinese college students was previously verified (Zhang et al., 2019). The Cronbach's alpha in this study was 0.91.

## The Rosenberg Self-Esteem Scale

SE was assessed via the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), using a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree) that included 10 items. Higher scores indicate a stronger SE. Owing to the cross-cultural differences, question eight was deleted in accordance with the stipulations of Tian (2006). Good reliability and validity of the revised scale among Chinese college students was previously verified (Yan et al., 2021). The Cronbach's alpha in this study was 0.74.

## Self-Concept Clarity Scale

SCC was assessed via the Self-Concept Clarity Scale (Campbell et al., 1996), using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) that included 12 items. Higher scores indicate a greater SCC. The scale has good reliability and validity among Chinese college students (Li et al., 2019). The Cronbach's alpha in this study was 0.86.

## Ethical procedures

The study was approved by the Ethics in Human Research Committee at the authors' institution. Written consent was obtained from all the participants, who were informed of the principles of voluntariness, autonomy, and confidentiality, and their ability to withdraw from the study at any time.

**Table 1** Descriptive statistics and correlations for all study variables

Variables	<i>M</i> ± <i>SD</i>	1	2	3	4
1. Cumulative childhood trauma	1.45 ± 1.57	—			
2. Self-esteem	2.79 ± 0.47	-0.43**	—		
3. Self-concept clarity	3.11 ± 0.72	-0.12**	0.22**	—	
4. Mobile phone addiction	2.45 ± 0.86	0.25**	-0.23**	-0.34**	—

\*\* $p < 0.01$ .

## Data Analysis

First, SPSS version 21.0 was applied for common method bias, descriptive statistics, and Pearson's correlation analyses. Second, AMOS version 23.0 was used to verify the conceptual model. Third, the PROCESS macro (Model 6) for SPSS was used to test the indirect effects (Hayes, 2013). The bootstrap 95% bias-corrected confidence intervals were estimated from 5000 samples. When the confidence intervals did not include 0, the parameters were statistically significant.

## Results

### Common Method Bias

Common method biases were tested using the Harman single-factor method. The results showed that there were 11 factors with eigenvalues > 1. The first factor explained 21.96% of the total variation. There was no serious common method bias in this study (Podsakoff et al., 2003).

### Descriptive statistical results

Table 1 presents the descriptive statistics and correlation matrix for all the study's variables. The correlation analyses show that the CCT was negatively correlated with both SE and SCC and positively related to MPA. SE and SCC were negatively correlated with MPA. There was a significant positive correlation between SE and SCC. The t-test analyses showed gender differences for CCT ( $t = 3.45, p < 0.05$ ), SCC ( $t = 4.33, p < 0.05$ ) and MPA ( $t = -3.22, p < 0.05$ ), but none for SE ( $t = 0.28, p > 0.05$ ).

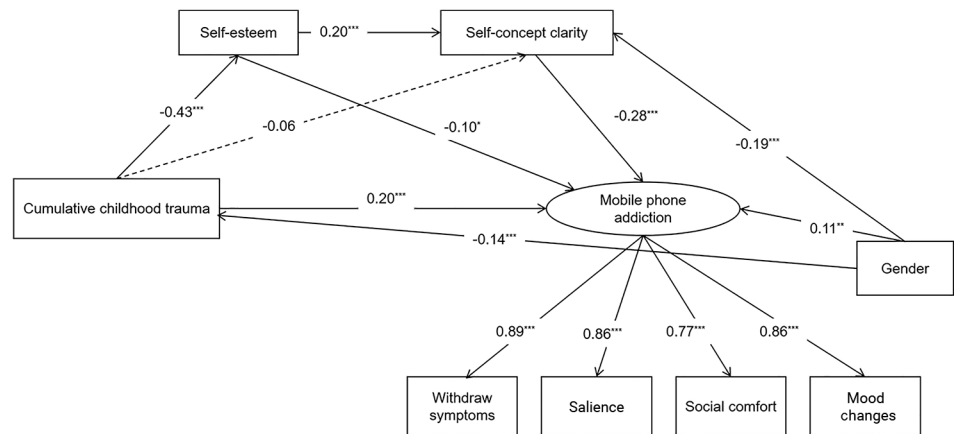
### Sequential mediation model analysis

A confirmatory factor analysis was applied to examine the proposed model's structure. We controlled for gender differences in CCT, SCC, and MPA. The results showed a good fit with the data, wherein  $\chi^2 = 74.614, df = 15, p < 0.001$ , CFI = 0.971, NFI = 0.964, GFI = 0.972, AGFI = 0.932, TLI = 0.945, RMSEA = 0.080 (90% CI = [0.063, 0.099]), SRMR = 0.031.

Figure 2 shows the test results for each path in the multiple mediation model. CCT significantly positively predicted MPA and significantly negatively predicted SE. SE significantly positively predicted SCC, and negatively predicted MPA. SCC significantly negatively predicted MPA; however, CCT did not significantly predict SCC.

The indirect effects among the study variables are shown in Table 2. SE's mediating effect on the relationship between

**Fig. 2** The serial multiple mediation of SE and SCC between CCT and MPA  
 Path coefficients are shown as standardized regression coefficients. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$



**Table 2** Indirect effects and 95% confidence intervals (CI) for the pathway

Model Pathways	Effect	SE	95% CI		Relative mediating effect
			Lower	Upper	
CCT→SE→MPA	0.040	0.019	0.004	0.079	14.71%
CCT→SCC→MPA	0.015	0.011	-0.005	0.040	5.51%
CCT→SE→SCC→MPA	0.024	0.007	0.012	0.040	8.82%
Total indirect effects	0.079	0.020	0.042	0.119	29.04%

Bootstrap = 5000

Abbreviations: CCT, cumulative childhood trauma; SE, self-esteem; SCC, self-concept clarity; MPA, mobile phone addiction

CCT and MPA was significant (indirect effect=0.040,  $p < 0.05$ ; 95% CI [0.004, 0.079]). SCC’s mediating effect on the relationship between CCT and MPA was not significant (indirect effect=0.015,  $p > 0.05$ ; 95% CI [-0.005, 0.040]). The sequential mediating effect of SE and SCC on the relationship between CCT and MPA was significant (indirect effect=0.024,  $p < 0.05$ ; 95% CI [0.012, 0.040]). The combination of SE and SCC was established as a serial mediator between CCT and MPA.

### Discussion

This study preliminarily examines the relationship between CCT (as an external risk factor) and college students’ MPA from the perspective of cumulative risk, and the mediating roles of SE and SCC (as self-system variables) in this relationship. Compared to previous studies in which total or mean scores were used to represent the level of childhood trauma, CCT reflects a more significant level of trauma (points were only scored if the cut-off value was reached) and a more diverse range of trauma types. The results of the descriptive statistics on CCT also showed that college students experienced more than one type of childhood maltreatment on average, which validates the cumulative occurrence of childhood maltreatment experiences. Further results showed that CCT significantly predicted MPA

(supporting hypothesis 1), which provided preliminary evidence confirming the relationship between the two. As shown by the Self-determination Theory (Ryan & Deci, 2000) and the Life History Theory (Figueredo et al., 2006), cumulative traumatic experiences in childhood drive individuals to choose short-term strategies in life, and mobile phones provide a convenient tool to compensate for psychological needs and escape from real problems and negative emotions (Wang et al., 2015), which increases the risk of MPA. This finding also reminds us that cumulative effects of childhood abuse and the development of targeted intervention measures in preventing and treating MPA should be emphasized.

This study also found that SE could play a mediating role in this relationship between CCT and MPA, which supported Hypothesis 2. Specifically, multiple traumatic family environments and interaction experiences make it difficult for individuals to receive positive feedback and form secure attachments, resulting in negative cognitive evaluations of themselves (Ainsworth, 1989) and reducing their SE levels (Jaffee et al., 2007). Furthermore, individuals with lower SE levels are more likely to be frustrated in real interpersonal interactions and use their mobile phones to gain a sense of belonging, vent negative emotions (Billieux et al., 2015), or seek positive self-feedback. For example, they could increase others approval through social networking sites, or

achieve a virtual ideal state in the game world; all of this would lead to an increase risk of MPA (You et al., 2019).

The results showed that SCC significantly predicted MPA, but CCT did not significantly predict SCC, which only partially supported Hypothesis 3. First, SCC had a significant negative predictive effect on MPA, which is consistent with previous studies (Servidio et al., 2021; Kong et al., 2021), showing that individuals with lower levels of SCC are at higher risk for MPA. Second, the negative predictive effect of CCT on SCC was not significant in the hypothesized model. Further validation of the independent mediating role of SCC revealed a significant mediating effect of SCC between CCT and MPA ( $\beta=0.04$ , 95% CI = [0.02, 0.07]). This not only shows that SCC as a self-system factor can play an independent role in CCT and MPA, but also suggests that SE may play an important role in the relationship between CCT, SCC, and MPA, that is, CCT has an indirect effect on SCC through SE, which is consistent with the view that “SE provides the basis for the development of SCC” (Campbell, 1990; Wu, 2009). Considering the limitations of this study as a cross-sectional study and the possible differences in the mechanisms of the psychological effects of CCT on individuals compared to a single subtype (Arata et al., 2005), more in-depth exploration and comparison are warranted in the future.

The serial mediating role of SE and SCC was also verified in this study, which supports Hypothesis 4. Combined with the above discussion, this result reflects that SCC may play a role in the negative effect of CCT on SCC under the precondition that CCT has a significant effect on SE, which provides insight for the prevention and intervention of college students’ SCC and MPA. Besides, it also illustrates that SE and SCC, as important factors in the self-system, are not only closely related, but also have synergistic effects in the relationship between CCT and MPA. As revealed by previous research, CCT can further hinder an individual’s integration of self-concept by reducing the level of SE (Kwak et al., 2018), which triggers MPA. Finally, although previous studies have explored the mediating role of SCC between SE and adaptive problems (Duan, 2020), the present study further validated the role of SCC between SE and MPA, which enriched the related research on the mechanism between SE and MPA.

Several limitations should be considered in this study. First, the cross-sectional research design cannot allow for causal inference, the causal relationship between variables in the study needs to be further tested via longitudinal studies. Second, all the data were collected from self-reports. Although the sample has been screened by a validity scale, it is still difficult to avoid the possibility of factors such as subjective memory bias in the measurement of childhood maltreatment. Third, although the results initially confirmed

a significant relationship between CCT and MPA, the differences in the effects and mechanisms of CCT and specific types of childhood trauma remain to be further explored and compared. Fourth, although SE and SCC are important factors in self-system, they are both variables related to self-concept. Other variables, such as control and attachment beliefs (Sandler, 2001), can be added in the future to explore the role of other self-system variables between CCT and MPA in a more multidimensional perspective.

**Authors’ contributions** Yunzi Xie: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. Yinqi Shen: Conceptualization, Methodology, Software, Writing – original draft. Jixia Wu: Project administration, Supervision, Writing – review & editing. All authors contributed to the development of this manuscript, reviewed drafts, and approved the final version.

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**Data Availability** The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

**Code Availability** The code used for analyzing data are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** The authors have no conflicts of interest to declare that are relevant to the content of this article.

**Ethics approval** The procedures for human participants involved in this study are consistent with the ethical standards of the authors’ institution.

**Consent to participants** Informed consent was obtained from all participants included in the study.

**Consent for publication** All authors agreed to public this manuscript.

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