Brain behavioral systems, self-control and problematic mobile phone use: The moderating role of gender and history of use

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ABSTRACT

Problematic mobile phone use is getting increasing attention due to the popularity of mobile phone in recent years. The current study investigated 468 college students to explore the roles of the behavioral activation system (BAS), behavioral inhibition system (BIS) and self-control in problematic mobile phone use. Gender was found to moderate the relationship between BIS and problematic mobile phone use with decreased BIS associated with greater problematic cell phone use for males, but not females. For females, excessive mobile phone use was predicted by self-control and moderated by time since acquisition of mobile phone. That is, for high self-control females, the level of problematic mobile phone use was decreased as time to own mobile phone becomes longer, yet for low self-control counterparts the correlation was reversed. Our research provides evidence for the close association between BIS/self-control and problematic mobile phone use, indicating the critical moderating roles of gender and history of use in these links.

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1. Introduction

In the past few years, mobile phone has become one of the most influential technologies in people's life in China. Mobile phones undoubtedly make young people's life more convenient. However, the disadvantages of excessive mobile phone use have been demonstrated in many studies (Takao, Takahashi, & Kitamura, 2009; Junco & Cotten, 2012; Lepp, Barkley, & Karpinski, 2014). Thus, problematic mobile phone use characterized by physiological and psychological discomfort including withdrawal symptoms, social comfort as well as mood changes (Xiong, Zhou, Chen, You, & Zhai, 2012), has gained more and more attention in the past few years.

1.1. Problematic mobile phone use and gender

It has always been controversial on the link between gender and problematic mobile phone use. Since many studies did not observe gender difference in mobile phone overuse, they argued that culture and age rather than gender may be the critical factors influencing mobile phone use (Baron & Campbell, 2012; Bianchi & Phillips, 2005; Lepp et al., 2014). In contrast, other studies found that females are more likely to depend on mobile phone than males (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Takao et al., 2009). Use motivation and emotional involvement may partly account for this difference. Our unpublished

results demonstrated that despite of no gender difference in information-searching mobile phone use motive, females showed much higher use motivations for interpersonal, entertainment and shopping (Jiang, Xu, & Liu, 2016). Consistent with our results, other studies also found females tend to use mobile phone to establish and maintain social relationships, while males prefer to use it in the workplace or play games (Bianchi & Phillips, 2005; Billieux, Linden, D'acremont, Ceschi, & Zermatten, 2007; Rees & Noyes, 2007). Obviously, maintaining social relationships or shopping required more emotional engagement than searching information. Furthermore, females who score higher in the pathological mobile phone use tend to pay more attention to their emotions (Beranuy et al., 2009). Thus, the possibility of women's susceptibility could be that women deal with more emotion-involved issues with the phone and tend to engage in ruminating behavior about these issues.

1.2. BAS/BIS and addiction

Gray's biopsychological model focuses on two motivational systems, the behavioral activation system (BAS) and the behavioral inhibition system (BIS) reflecting the psychological orientation to rewarding and aversive stimuli respectively (Gray & McNaughton, 2000). Although many studies have shown higher BAS activation is associated with addiction (Giles & Price, 2008; Loxton, Nguyen, Casey, & Dawe, 2008; Yen, Ko, Yen, Chen, & Chen, 2009), the relationship between BIS and addiction is still a matter of disagreement. Some studies found that BIS sensitivity negatively predicted substance abuse and pathological gambling (Franken & Muris, 2006; Vitaro, Arseneault, & Tremblay, 1999).

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Nevertheless, almost the same amount of studies did not observe the relationship between BIS and problematic substance use (Loxton & Dawe, 2007; O'Connor, Stewart, & Watt, 2009). Moreover, in the past few years some studies reported that higher BIS activation is associated with alcohol abuse (Kambouropoulos & Staiger, 2004), problematic gambling (Loxton et al., 2008) and computer overuse (Giles & Price, 2008; Yen et al., 2009). The unusual combination of both heightened BAS activation and enhanced BIS sensitivity was demonstrated for addicts in these studies. Therefore, BIS may play two conflicting roles in addiction. Higher BIS could protect individuals from addiction through reduced risk-taking and rash impulsivity. Meanwhile, addiction behavior may function as a reinforcing activity alleviating negative emotion caused by enhanced punishment sensitivity in daily life.

1.3. Problematic mobile phone use and self-control

Several personality traits (i.e. extraversion, self-esteem) have been demonstrated to predict mobile phone dependence behavior (Bianchi & Phillips, 2005; Butt & Phillips, 2008). Self-control pertains to an individual's capacity to resist inner desires so that he or she can achieve a more optimal outcome (Tangney, Baumeister, & Boone, 2004). Since impaired self-control has been linked to various substance abuse and behavioral addictions (Kim, Namkoong, Ku, & Kim, 2008; Wilson & Maclean, 2013), recent studies examined the association between self-control and problematic mobile phone use. Considering impulsivity is an important potential contributory factor to self-control, impulsiveness was found to predict problematic mobile phone use positively (Billieux, Van Der Linden, & Rochat, 2008; Roberts & Pirog, 2013). Moreover, Khang found that compared to self-esteem and self-efficacy, self-control is the most significant predictor of problematic mobile phone use (Khang, Kim, & Kim, 2013; Khang, Woo, & Kim, 2012).

1.4. Problematic use behavior and history of use

Cross-sectional studies have found problematic Internet or mobile phone use behavior seems to increase over time. For example, the earlier students were exposed to the Internet, the more likely they were to have Internet addiction (Ni, Yan, Chen, & Liu, 2009; Yu, 2012). Having a mobile phone for a longer time is a predictor of greater actual and problematic use of the phone (Billieux et al., 2008). A longitudinal study also found that most of the pathological gamers (84%) were still pathological 2 years later, and in the 2-year time window, 1% of adolescents became new pathological gamers (Gentile, Hyekyung, & Albert, 2011). Yet, not all longitudinal studies support this view of point (Van Rooij, Schoenmakers, Vermulst, Van den Eijnden, & Van de Mheen, 2011). For example, some researchers observed an overall decreasing prevalence over 2-year or 18-month follow-up (King, Delfabbro, & Griffiths, 2013; Michael, Ruth, & Thorsten, 2014). Only a tiny amount (not >1%) of initially problematic users remained pathological and larger share of participants reported a transient form of problematic computer use (Strittmatter, Parzer, & Brunner, 2015; King et al., 2013; Michael et al., 2014). These findings suggest that computer overuse appears to be phasic rather than stable. Based on the disagreement, in the present study we will investigate the association between history of use and problematic mobile phone use in college students.

Even though there is a growing body of research investigating the role of BAS/BIS in addiction, however, little research has explored the possible relationship between problematic mobile phone use and BAS/BIS. Furthermore, previous studies have demonstrated the close relationship between self-control and BAS/BIS system, with undercontrollers characterized by overactive BAS and overcontrollers by overactive BIS (Gennady & Helena, 2006). Thus, in the present study, we will examine the predictive power of BAS/BIS/self-control for problematic mobile phone use in undergraduate students. Moreover, although gender difference has been observed in previous studies, no study has ever tested whether problematic mobile phone use in

males and females depend on different psychological predictors. Therefore, the present research will evaluate the moderating role of gender in these links.

2. Methods

2.1. Participants

The sample consisted of 510 undergraduate students from three universities in Yantai. All students possess mobile phones and use it to browse the Internet as their daily activity. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board, sponsored by the China Association for Science and Technology (CAST) and the Ministry of Health of the People's Republic of China. Questionnaires were administered to the participants in a classroom setting by a team of trained graduate students. 42 had to be excluded for not replying properly to all questionnaires, so the final sample consisted of 468 participants (211 males and 257 females). Participants in each grade include: Freshmen (n = 104, 22.2%), Sophomores (n = 136, 29.1%), Juniors (n = 123, 26.3%), and Seniors (n = 105, 22.4%). Additionally, participants display various time since acquisition of mobile phone: <6 months (n = 44, 9.4%), 6 moths–1 year (n = 84, 17.9%), 1 year–2 years (n = 148, 31.6%), 2 years–5 years (n = 140, 29.9%), >5 years (n = 52, 11.2%).

2.2. Instruments

2.2.1. Problematic mobile phone use scale (PMPUS)

The PMPUS is a 16-item 5 point-Likert scale developed based on Young's (1998) Internet addiction scale (Xiong et al., 2012; Young, 1998). 1 = strongly disagree, 5 = strongly agree. It consists of four subscales: (1) withdrawal symptoms (6 items, such as "I feel lost when I do not have my mobile phone with me"); (2) salience (4 items, such as "I am obsessed with my mobile phone"); (3) social comfort (3 items, such as "I prefer to communicate by phone rather than by face-to-face talk"); (4) mood changes (3 items, such as "I feel anxious if I have not checked for messages or switched on my mobile phone for some time"). Higher score on this measure indicates greater level of mobile phone overuse, with score reaching or exceeding 57 representing problematic mobile phone use. Both exploratory and confirmatory factor analyses supported the construct validity of the four subscales (Xiong et al., 2012). The PMPUS has strong internal consistency (Chronbach's α = 0.83) and good test–retest reliability (r = 0.91) (Xiong et al., 2012), performing well with undergraduate students (Chen et al., 2016; Xiong et al., 2012). In this study, α = 0.87 for PMPUS, 0.71–0.77 for the four subscales.

2.2.2. Behavioral inhibition/activation system scale (BIS/BAS scale)

Carver and White (1994) developed the BIS/BAS scale including 20 items to measure behavioral inhibition and behavioral activation. The Chinese version of BIS/BAS scale was revised by Li, Zhang, Jiang, et al. (2008). It includes 18 items after the deletion of item 1 ("Even if something bad is about to happen to me, I rarely experience fear or nervousness") and item 18 ("I have very few fears compared to my friends") from the original instrument. Thus, the BIS/BAS scale in our study is an 18-item 4 point-Likert scale questionnaire from 1 (strongly disagree) to 4 (strongly agree). The 5 BIS items form a single scale. The 13 BAS items constitute three subscales: Reward Responsiveness (5 items), Drive (4 items), and Fun Seeking (4 items). The scale has high validity and good reliability in Chinese adolescents (Li, Xu, & Chen, 2015; Li et al., 2008). In this study, α = 0.74 for the BIS scale, 0.69–0.73 for the three BAS subscales.

2.2.3. Self-Control Scale (SCS)

We adopted the Self-Control Scale based on Tangney's Self-Control Scale (Tangney et al., 2004). 19 items were preserved in view of cultural