



# The effects of behavioral inhibition/approach system as predictors of Internet addiction in adolescents

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## ARTICLE INFO

### Article history:

Received 12 January 2012

Received in revised form 26 May 2012

Accepted 23 July 2012

Available online 20 August 2012

### Keywords:

Internet addiction

Behavioral addiction

Behavioral Inhibition System

Behavioral Approach System

## ABSTRACT

This study aimed to determine how the Behavioral Inhibition System (BIS) and the Behavioral Approach System (BAS) affect Internet addiction in adolescents. Two hundred and eleven high school students participated in this study and completed the Young's Internet Addiction Test (IAT), BIS/BAS scales, and several self-administered questionnaires about depression, anxiety, and impulsivity. Hierarchical regressions showed that BIS and  $BAS \times BIS$  emerged as significant predictors of IAT; however, only BAS-fun seeking subscale predicted IAT among BAS related subscales. In further analyses, the BAS-fun seeking subscale was mediated by impulsivity and anxiety, and BIS was mediated by anxiety and depression. The current findings imply that BIS and BAS interdependently influence vulnerability to Internet addiction through both shared (anxiety) and different (depression and impulsivity, respectively) pathways.

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## 1. Introduction

Internet addiction, categorized as a behavioral addiction, is defined as an individual's inability to control his or her Internet use, and this addiction may lead to serious impairments in psychological and social functioning, and many adolescents with Internet addiction suffer from poor school functioning (Beard & Wolf, 2001; Griffiths, 1997; Ko, Yen, Chen, Chen, & Yen, 2005; Young, 1996).

To explain addictive behaviors, a number of previous studies have adapted Gray's (1991, 1993) Reinforcement Sensitivity Theory (RST) which provides the basis for human motivation and action postulating two basic and independent biologically-based dimensions of motivation and personality (e.g. Franken & Muris, 2006a; Franken & Muris, 2006b; Franken, Muris, & Georgieva, 2006). One of these is represented by Behavioral Activation (or Approach) System (BAS), which responds to stimuli of reward or termination of punishment with a positive response and approach behavior. BAS consists of tapping strong and quick goal pursuit (Drive), receptivity to reward (Reward Responsiveness), and the desire for new and potentially rewarding experiences (Fun Seeking) (Carver & White, 1994). Because BAS is not a unified construction in relation to psychopathology, it is important to attend to each component of BAS carefully (Johnson, Turner, & Iwata, 2003; Loxton & Dawe, 2001).

The other one is represented by the Behavioral Inhibition System (BIS), which responds to punishment or termination of rewards with fear or anxiety (usually predisposition to anxiety) and withdrawal/avoidance behavior. The revision of RST (Gray & McNaughton, 2000) included the Fight-Flight-Freeze System (FFFS) which motivates avoidance and escape behaviors in response to aversive stimuli, and induces the fear. This study refers to BIS/FFFS as BIS since these two functioning are actually combined in the BIS inventory (Corr, 2004). The thing more focused in this study is that a Joint-Subsystems Hypothesis (JSH; Corr, 2002) proposing that BIS and BAS are interdependent on each other so cannot be considered separately.

Though small controversial and inconsistency remains, major findings of previous studies on the RST and addictions have suggested that high levels of BAS sensitivity predispose psychopathological conditions that are characterized by a pathological engagement in compulsive and approach behaviors, such as substance/alcohol abuse (Dawe, Gullo, & Loxton, 2004; Franken et al., 2006). Furthermore, according to the JSH, low BIS would exacerbate the effects of high BAS (Corr, 2002); however, in contrast to the role of BAS, the role of BIS-related scales in addiction has remained unclear. In Hundt, Kimbrel, Mitchell, and Nelson-Gray's study (2008), high BAS predicted alcohol use and drug use. In contrast, low BIS predicted drug use only (see also Kimbrel, Nelson-Gray, & Mitchell, 2007). Moreover, one study suggested that pathological gambling-related behaviors tended to be stronger in those with low scores on BIS as well as high scores on BAS (Kim & Lee, 2011); however, others found no relationship of BIS and alcohol abuse-related variables (Johnson et al., 2003).

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In contrast to other addictive behaviors, previous studies on Internet addiction tended to emphasize the role of BIS rather than BAS. In a comparison study between Internet addiction and alcohol use (Yen, Ko, Yen, Chen, & Chen, 2009), Internet addiction was associated with harmful alcohol use among college students. However, college students with Internet addiction had higher scores on BIS and BAS-fun seeking subscales, while college students with harmful alcohol use had higher scores on BAS-drive and fun-seeking subscales, and lower scores on BIS. Similarly, Internet addiction has been found to be more likely to be associated with BIS than with BAS (Meerkerk, van den Eijnden, Franken, & Garretsen, 2010). Another study concluded that problematic Internet use in adolescents show some similarities with substance use in respect to high BIS except for the strength of the relationships and the role of BIS (Giles & Price, 2008). Only one recent research concluded that higher BAS and fun seeking are risk factors for Internet addiction among adolescent (Yen et al., *in press*). As mentioned, BIS, especially with high scores, is more likely to have an important role in Internet addiction than BAS is, while BAS, sometimes with low BIS, have an important role in other addictive behaviors such as pathological gambling which is known to have similar features with Internet addiction (Young, 1998). These opposing results may imply the core feature of Internet addiction which is distinguished from other addictions with respect to the role of 'anxiety' (Campbell, Cumming, & Hughes, 2006).

BIS and BAS are sometimes not only considered as predispositions of 'anxiety' and 'impulsivity', respectively (Gray, 1993), but highly related to the psychological well-being factor as well as neuroticism or emotional distress (Slessareva & Muraven study, 2004). Internet addiction is also correlated with depression and anxiety as well as impulsivity (Caplan, 2002; Davis, 2001; Johnson et al., 2003; Young & Rogers, 1998). Thus, it is important to consider that impulsivity, anxiety, and depression could influence the way BIS and BAS affect Internet addiction.

Our study assumed that BIS has an important role, and BIS and BAS interdependently play roles in vulnerability to Internet addiction in adolescents. To clarify the way BIS and BAS influence Internet addiction, we additionally tested indirect pathways including impulsivity, anxiety, and depression.

## 2. Methods

### 2.1. Participants

Data were collected from 211 (male = 112, female = 99) high school students in Seoul, South Korea. They completed anonymous and self-administered questionnaires after classes at their high schools they were given an explanation about research with no payment. Data from 10 (male = 6, female = 4) students who answered randomly were excluded from our study.

Based on Young's (1998) criteria, 7 participants (male = 4, female = 3) had scores of 70 or greater on the Internet Addiction Test (IAT), who were classified as the Internet addiction group. Their mean scores on IAT was 75.43 (SD = 6.16, range: 70–86) and the mean duration of Internet use was 4.00 h/day (SD = 3.54, range: 1–10) and 7.29 h/day (SD = 4.35, range: 4–16) on weekdays and weekends, respectively. Heavy Internet users whose IAT scores were from 40 to 69 based on Young's criteria were 48 in this study (male = 24, female = 24). Their mean scores on IAT was 48.83 (SD = 8.49, range: 40–69) and the mean duration of Internet use was 2.80 h/day (SD = 2.27, range: 0–10) and 3.45 h/day (SD = 2.93, range: 0–15) on weekdays and weekends, respectively. All participants' mean IAT score was 43.19 (SD = 14.42, range: 0–86). A group comparison on variables was not included since it is out of the main focus in this study.

### 2.2. Instruments

#### 2.2.1. Young's Internet Addiction Test (IAT)

Items are rated on a 5-point scale on which 1 = very rarely and 5 = very frequently. Total scores were calculated according to Young's (1998) method, with possible scores for all 20 items ranging from 20 to 100. The Cronbach's *alpha* coefficient for the current sample was 0.94.

#### 2.2.2. Behavioral Inhibition System/Behavioral Approach System (BIS/BAS) Scales

We used BIS and BAS scales (Carver & White, 1994) to assess sensitivity to rewards and punishment. BIS and BAS scales consist of 20 items rated on a 4-point Likert scale from "totally agree" to "totally disagree." BIS scale consists of seven items and the BAS scale consists of 13 items. The BAS scale can be subdivided into three subscales: fun-seeking (BAS-fun; four items), reward responsiveness (BAS-reward; five items), and drive (BAS-drive; four items). The Cronbach's *alpha* coefficient for the current sample was 0.86.

#### 2.2.3. Barratt Impulsiveness Scale 11 (BIS 11)

Barratt Impulsiveness Scale 11 (BIS 11) (Barratt, 1985) assessed impulsivity (Cronbach's *alpha* coefficient = 0.84). This instrument includes three subscales: cognitive impulsiveness (e.g., "I get easily bored when solving thought problems"), motor impulsiveness (e.g., "I do things without thinking"), and non-planning impulsiveness (e.g., "I am more interested in the present than in the future").

#### 2.2.4. Beck Depression Inventory (BDI)

Beck Depression Inventory (BDI) (Beck, Ward, & Mendelson, 1961) is a 21-item self-report questionnaire in which each item consists of four statements indicating different levels of the severity of a particular symptom experienced during the past week. Scores for all 21 items are summed to yield a single depression score. The internal consistency of the BDI is 0.91.

#### 2.2.5. Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988) consists of 21 symptoms that are rated on a 4-point scale measuring the severity of certain symptoms experienced during the past week. Scores for the 21 items are summed to yield a single anxiety score. The internal consistency of the BAI is 0.91.

## 3. Results

### 3.1. Correlations among variables

Statistical analysis was conducted with SPSS 18.0 throughout this study. First of all, Pearson's correlation analysis was conducted for all variables included in this study. The IAT scores were correlated with grade (year of education), spending time online during weekdays and weekends, BAS-fun, BIS 11, BDI, and BAI.

In addition, BIS was positively correlated with BDI and BAI. BIS 11 was correlated with BAS-fun, but negatively correlated with BAS-drive. See Table 1 for more details.

### 3.2. Roles of BAS and BIS as predictors of IAT

Hierarchical regression analyses were conducted to test the roles of BIS and BAS scores and the score on each of the BAS-sub-scales as predictors of the IAT scores (Table 2). All scores of scales were standardized with Z-value. All regressions included Sex and Grade variables to control their effects on the IAT scores and Grade emerged as a significant predictor throughout regression analyses.

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