



## Psychometric evaluation of the behavioral inhibition/behavioral activation system scales and the sensitivity to punishment and sensitivity to reward questionnaire in a sample of eating disordered patients

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### ABSTRACT

Gray (1987) proposed two systems underlying much of our behavior and personality. One system (Behavioral Inhibition System, BIS) relates to avoidance or withdrawal behavior, whereas the other system (Behavioral Approach System, BAS) relates to approach behavior. Underreactivity and overreactivity of those systems have been presumed to explain a broad range of psychopathologies. Despite the increasing interest and use of questionnaires measuring BIS and BAS reactivity in psychopathological research, studies examining psychometric qualities of these measures in clinical samples are scarce. This study evaluated the psychometric properties of the BIS/BAS Scales and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) in eating disordered patients. Structural validity is investigated by means of Confirmatory Factor Analysis. Convergent validity is examined by investigating associations with conceptually related personality traits. For the BIS/BAS Scales, CFA favors a five-factor structure in line with a recent revision of Gray's theory (Gray & McNaughton, 2000). For the SPSRQ, sufficient support was found for a two-factor structure. Reliability and validity of both instruments are in line with previous reports.

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### 1. Introduction

A great deal of human behavior is motivated by obtaining rewards or avoiding punishment. According to Gray's (1987) Reinforcement Sensitivity Theory (RST), three specific brain systems are involved in these two fundamental types of behavior, namely approach and avoidance. One system, the Behavioral Approach System (BAS), deals with appetitive stimuli and is engaged in approach behavior, whereas the other two systems, the Behavioral Inhibition System (BIS) and the Fight–Flight System (FFS), deal with aversive stimuli and are engaged in avoidance or withdrawal behavior. The BIS relates to avoidance of conditioned aversive stimuli whereas the FFS relates to avoidance of unconditioned aversive stimuli. Gray suggested that individual differences in BAS and BIS reactivity give rise to the personality dimensions of Impulsivity and Anxiety respectively. Individuals with high BAS reactivity are more prone to engage in approach behavior and experience positive affect in situations with stimuli that are associated with reward. They are supposed to exhibit higher levels of impulsivity and more likely engage in risk-taking behaviors (Car-

ver & White, 1994). Persons with high BIS reactivity are expected to exhibit greater levels of anxiety, to tend towards cautiousness and to more likely engage in avoidance behavior.

Gray's RST was recently updated (Gray & McNaughton, 2000). In the revised Reinforcement Sensitivity Theory (rRST), the role of the BAS remains relatively unchanged. The BAS still mediates reactions to appetitive stimuli and relates to approach behavior. The Fight–Flight–Freezing System (FFFS) is responsible for mediating reactions to all aversive stimuli, conditioned and unconditioned, and relates to avoidance and escape behaviors. The BIS is responsible for the resolution of goal conflicts (e.g., between BAS-approach and FFFS-avoidance). Individual differences in personality and behavior are presumed to be based on differences in reactivity of these three systems. High BAS reactivity is associated with optimism, reward orientation and impulsiveness. Persons with high FFFS reactivity exhibit greater levels of fear and are more likely to engage in avoidance behavior. High BIS reactivity is related to worry-proneness and anxious rumination (Corr & McNaughton, 2008).

Several authors explored the hypothesis that extreme levels of reactivity in Gray's systems are related to psychopathology (Bijttebier, Beck, Claes, & Vandereycken, in press). Research suggests that specific profiles of FFFS, BAS and BIS functioning characterize specific disorders: elevated FFFS reactivity is typically found in phobia

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and panic, elevated BAS reactivity in addictive behaviors and elevated BIS reactivity in generalized anxiety and obsessive-compulsive disorder (Corr & McNaughton, 2008).

Several researchers studied BIS and BAS reactivity in individuals with eating disorders (ED). Bulimia nervosa patients (Kane, Loxton, Staiger, & Dawe, 2004) as well as anorexia nervosa patients (Claes, Nederkoorn, Vandereycken, Guerrieri, & Vertommen, 2006) showed higher BIS reactivity than normal controls. Bulimia patients also reported higher BAS reactivity than normal controls. Studies on dysfunctional eating in other samples (e.g., university students) showed that heightened sensitivity to both reward and punishment was predictive for dysfunctional eating (Loxton & Dawe, 2001). Heightened BAS reactivity was positively related to food craving and BMI (Franken & Muris, 2005), whereas heightened BIS reactivity was related to unhealthy weight loss (Mussap, 2006).

To study individual differences in BIS and BAS reactivity several self-report instruments have been developed. The two most frequently used questionnaires are the BIS/BAS Scales (Carver & White, 1994) and the SPSRQ (Torrubia, Ávila, Moltó, & Caseras, 2001). The BIS/BAS Scales tap BIS reactivity or three types of BAS reactivity. The BIS scale (7 items) measures concerns regarding the possible occurrence of negative events and the sensitivity to such events when they occur. The BAS Reward Responsiveness scale (BAS-RR; 5 items) measures the degree to which (the expectation of) rewards lead to positive emotions. The BAS-Drive scale (BAS-D; 4 items) measures the tendency to actively pursue appetitive goals. The BAS Fun Seeking scale (BAS-FS; 4 items) measures the tendency to seek out and approach impulsively potentially rewarding activities. The SPSRQ taps Sensitivity to Punishment (SP; 24 items) and Sensitivity to Reward (SR; 24 items). An important limitation of both instruments is that they have been designed to measure behavioral inhibition and activation as conceptualized in Gray's original RST. Thus far, it is unclear how these measures map onto the constructs from the revised RST. Given that the theoretical implications of the RST revision for BAS are only minor, the BAS scales and the SR scale may still be useful to measure BAS reactivity. BIS reactivity, however, is now considered to be spread across BIS-Anxiety and FFFS, which is inconsistent with the unidimensional BIS and SP scales. Recently, Heym, Ferguson, and Lawrence (2008) and Poythress et al. (2008) have successfully separated out BIS-Anxiety and FFFS items in the BIS/BAS Scales.

To our knowledge, only one study has examined psychometric properties of the BIS/BAS Scales in a clinical sample, more specifically outpatients with anxiety and mood disorders (Campbell-Sills, Liverant, & Brown, 2004) and no study has tested the psychometric properties of the SPSRQ in a clinical sample.

The current study aimed to provide a psychometric analysis of the BIS/BAS Scales and the SPSRQ in a sample of ED patients. Reliability and validity of both questionnaires were investigated. Structural validity was examined by means of CFA and convergent validity was investigated by associations with measures of conceptually related personality traits (e.g., Neuroticism, Extraversion). Based on previous studies (e.g., Caseras, Ávila, & Torrubia, 2003; Gray & McNaughton, 2000), we hypothesized that BIS scales would be positively related to Neuroticism and Anxiety and that BAS scales would be positively related to extraversion and impulsivity. With respect to BAS subscales, some studies (Carver & Miller, 2006; Franken & Muris, 2006) suggested that BAS-RR and BAS-D are related to impulses arising from heightened reward sensitivity, whereas BAS-FS is related to impulses stemming primarily from a lack of constraint (rash impulsiveness). Therefore, we expected the BAS-FS scale to be more strongly related to Eysenck's Impulsiveness scale than both, BAS-RR and BAS-D. With regard to BIS and BAS reactivity in ED subtypes, we expected that BAS functioning would be higher in bulimia and bingeing-purging anorexia patients than in restrictive anorexia patients, seeing much has been written on

impulsive traits in these ED subtypes (e.g., Claes, Vandereycken, & Vertommen, 2002; Dawe & Loxton, 2004). We also expect that BIS reactivity will be similar in all ED subtypes since clinical and epidemiological studies have consistently shown that the majority of ED patients experience one or more anxiety disorders (Claes et al., 2006; Kaye, Bulik, Thornton, Barbarich, & Masters, 2004).

## 2. Method

### 2.1. Participants

The sample consisted of 103 female eating disordered outpatients (mean age 25.5 years, SD = 8.8) living in the Dutch speaking part of Belgium. DSM-IV diagnoses (APA, 1994) were obtained using of a clinical interview in combination with the Eating Disorder Evaluation Scale (EDES; Vandereycken, 1993): 31.1% ( $n = 32$ ) was diagnosed as anorexia nervosa, restrictive subtype (AN-R), 16.5% ( $n = 17$ ) as anorexia nervosa, bingeing-purging subtype (AN-P), 33.9% ( $n = 35$ ) as bulimia nervosa (BN) and 14.6% ( $n = 15$ ) as eating disorder not otherwise specified (EDNOS). Four participants could not be assigned to one of these subtypes due to missing information on their eating habits.

Questionnaires were distributed through the therapist of the patients. After informed consent was given, participants anonymously filled out the questionnaires.

### 2.2. Instruments

The Behavioral Inhibition/Behavioral Activation System Scales (BIS/BAS Scales; Carver & White, 1994) are a 20-item self-report questionnaire designed to assess BIS reactivity and three types of BAS reactivity (Reward Responsiveness, Drive and Fun Seeking). All items are judged on a four-point scale ranging from 1 ('I strongly agree') to 4 ('I strongly disagree'). Cronbach's alphas of the Dutch version are reported by Smits and De Boeck (2006): BIS scale (0.82), BAS scale (0.73), BAS-RR (0.54), BAS-D (0.75) and BAS-FS (0.55).

The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Franken & Muris, 2006; Torrubia et al., 2001) consists of 48 items with a yes/no response format divided into two subscales, Sensitivity to Punishment (SP;  $\alpha = 0.84$ ) and Sensitivity to Reward (SR;  $\alpha = 0.70$ ).

The Eysenck Personality Questionnaire-Revised Short Scale (EPQ-R Short Scale; Eysenck, Eysenck, & Barrett, 1985) was administered to measure Neuroticism and Extraversion. Each scale consists of 12 items to be rated on a yes-no response scale.

Trait anxiety was assessed by the Trait scale of the State-Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). It consists of 20 items to be rated on a 4-point scale, ranging from "almost never" to "almost always". Higher scores indicate higher trait anxiety.

Impulsiveness was measured by the Impulsiveness and Venturesomeness scale of the Impulsiveness Questionnaire (IVE; Eysenck & Eysenck, 1991). The Impulsiveness scale taps the failure to evaluate risk, whereas the Venturesomeness scale measures behavior in which risk is perceived by an individual but yet accepted by the individual.

### 2.3. Analyses

Confirmatory factor analyses (CFAs), performed with LISREL 8.71 (Jöreskog & Sörbom, 2004) were used to test the factorial structure of the BIS/BAS Scales and SPSRQ. For the BIS/BAS Scales, 5 models were compared: A one-factor model, with all items loading to a general behavior regulation factor, a two-factor model conforming to Gray's theory, a four-factor model as proposed by the

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