



Carver and Whites' BIS/FFFS/BAS scales and domains and facets of the Five Factor Model of personality

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ARTICLE INFO

Article history:

Received 22 October 2010
 Received in revised form 28 February 2011
 Accepted 4 March 2011
 Available online 3 April 2011

Keywords:

Reinforcement Sensitivity Theory
 NEO-PI-R
 Five-Factor Model
 Personality
 Motivation
 Behavioral activation
 Behavioral inhibition
 BIS
 BAS
 FFFFS

ABSTRACT

Few empirical studies have investigated the relationship between Gray's Reinforcement Sensitivity Theory (RST) and the Five-Factor Model (FFM) of personality. In a large sample of undergraduates ($N = 779$), we examined the relationship between FFM domains and facets and the revised RST (see Gray & McNaughton, 2000). Regression and partial correlation analyses indicated that only FFM Agreeableness discriminates between the BIS and FFFS. Other differences at the facet level were found for Neuroticism facets of Self-Consciousness and Angry Hostility (negatively), Agreeableness facets of Compliance and Modesty, and Conscientiousness facets of Self-Discipline and Deliberation. These findings emphasize social inhibition and constraint in the BIS, compared to the FFFS.

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1. Introduction

Jeffrey Gray's Reinforcement Sensitivity Theory (RST; Gray, 1970, 1982, 1991; Gray & McNaughton, 2000) and the Five-Factor Model (FFM; Costa & McCrae, 1992) are two well-established models of personality that have developed from widely different backgrounds. Gray's RST is one of the most influential biologically based theories of personality available. RST serves as an application of animal learning research to individual differences in human personality (Bijttebier, Beck, Claes, & Vandereycken, 2009). Gray (1982) theorized that the fundamental basis of personality is individual differences in sensitivities of the "brain-behavioral systems" underlying approach and avoidance behavior. Conversely, the FFM originated from the lexical approach to personality and serves purely as a descriptive model of personality measuring five robust factors: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness (Costa & McCrae, 1992). Today, the FFM is considered to be one of the most comprehensive, empirically driven theories of personality.

Although RST and the FFM have different origins, they have been applied to similar research topics, including psychopathology and

normal personality. Yet despite this, few empirical studies have examined the relationship between RST and the FFM, specifically (Mitchell et al., 2007; Smits & Boeck, 2006). The current study is an investigation of Gray's revised RST (Gray & McNaughton, 2000) and its relationship to the domains and facets of the FFM.

In his original 1982 theory, Gray proposed three systems of emotion that drive motivated behavior – the Behavioral Approach System (BAS), the Behavioral Inhibition System (BIS), and the Fight–Flight System (FFS). The BAS (Gray, 1982) was originally hypothesized to be sensitive to *conditioned* appetitive stimuli and mediate responses to conditioned signals of reward and conditioned signals of relieving non-punishment. The BIS (Gray, 1982) was originally thought to mediate responses to conditioned signals of punishment and conditioned signals of frustrative non-reward. Additionally, the BIS was believed to be activated by extreme novelty, stimuli of high intensity, and instinctive fear stimuli (e.g., snakes and blood). These stimuli induce behavioral inhibition, increase arousal, and heighten attention, creating the subjective experience of anxiety (Smillie, Pickering, & Jackson, 2006). Gray's (1982) remaining system, the FFS, was hypothesized to be sensitive to *unconditioned* aversive stimuli, resulting in unconditioned defensive aggression (fight) or escape behavior (flight). Fight and flight were respectively associated with the emotional states of rage and fear, but they were never openly connected with personality (Jackson, 2003). As the FFS was essentially a secondary pun-

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ishment system, having a remarkably similar role as the BIS, the distinctiveness of the BIS and FFS in the original RST was less than clear (Smillie et al., 2006).

In 2000, a major revision to RST was published in Gray and McNaughton's *The Neuropsychology of Anxiety*. Under the recent revision, the BAS still functions as a reward system, but it is now responsive to *all* appetitive stimuli, conditioned and unconditioned. Other than this distinction, the BAS is largely unchanged in the revised version of RST (Corr, 2004). The FFS becomes the Flight–Fight–Freeze (FFFS) System and is responsive to all aversive stimuli, conditioned and unconditioned – the FFS adopts the punishment system role that was characteristic of the BIS in the original version of RST (Corr, 2004). Flight and freezing are unconditioned responses to distal threat stimuli, and fight is an unconditioned response to proximal threat stimuli. Importantly, FFS activity is characterized by fear and panic.

According to Gray and McNaughton (2000), the revised BIS is no longer thought to mediate reactions to conditioned aversive stimuli. Instead, it is responsible for the resolution of goal conflicts involving the BAS and the FFS. Goal conflicts can emerge in scenarios including both reward and threat (i.e., both the BAS and the FFS have been activated) (Corr, 2004). If reward outweighs threat, the BIS will resolve the conflict by engaging the BAS and inhibiting the FFS, resulting in approach. If threat outweighs reward, the BIS will further activate the FFS and inhibit the BAS, resulting in avoidance (Bijttebier et al., 2009). Goal conflict is not restricted to approach–avoidance conflicts, however: approach–approach conflicts and avoidance–avoidance conflicts can also occur (Bijttebier et al., 2009).

Gray and McNaughton's (2000) revision of RST has implications for the way the corresponding personality traits are conceptualized. In the revised RST, the role of FFS is given greater attention and a clear-cut distinction is made between anxiety (BIS) and fear (FFFS) (Bijttebier et al., 2009). The distinction is based on the concept of “defensive direction” (Corr, 2004). It is hypothesized that the function of anxiety is to cautiously motivate individuals towards danger, whereas fear is supposed to motivate individuals away from danger (McNaughton & Corr, 2004). The distinction between anxiety and fear proves important, because although anxiety was always believed to be the result of BIS activation, and fear the result of FFS activation, in reality the BIS had implicitly encompassed both emotions (Smillie et al., 2006). Thus, current so-called BIS scales are assessing a mixture of anxiety (BIS) and fear (FFFS). Corr and McNaughton (2008) recently highlighted the need to distinguish the BIS and FFS in the assessment and measurement of these constructs as the systems control different, if not opposite motivational tendencies.

A potential means to achieve separate BIS and FFS scales came from Heym, Ferguson, and Lawrence (2008). Heym et al. (2008) investigated Carver and White's (1994) BIS scale to determine whether it is better conceptualized as a two-factor model, incorporating BIS and FFS items, rather than a single factor reflecting solely the BIS. Results revealed that BIS and FFS are distinguished within Carver and White's (1994) existing BIS scale, supporting the revised RST (Gray & McNaughton, 2000). Heym et al.'s (2008) findings support Corr and McNaughton's (2008) call for re-evaluation and revision of existing BIS scales in light of the revised RST.

To date, only two studies have explored the relationship between RST and the FFM. Recently, Smits and Boeck (2006) examined the relationship between the FFM domains and Carver and White's Behavioral Inhibition and Activation scales (BIS/BAS; Carver & White, 1994). Findings indicated that the BIS is positively related to Neuroticism and negatively related to Extraversion. In terms of Carver and White's BAS subscales, all were positively related to Extraversion, while only BAS-Drive and BAS-Fun Seeking were negatively related to Neuroticism.

As a followup to Smits and Boeck's (2006) research, Mitchell et al. (2007) explored the relationship between the RST-based personality traits and both domains and facets of the FFM, as measured by the Revised NEO-Personality Inventory (NEO-PI-R; Costa & McCrae, 1992). The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001) was the chosen measure of RST. Mitchell et al. (2007) found Neuroticism, Agreeableness, and Conscientiousness to be positively associated with Sensitivity to Punishment (SP), and Extraversion and Openness to be negatively associated with SP. Additionally, Extraversion and Neuroticism were positively associated with Sensitivity to Reward (SR), whereas Agreeableness and Conscientiousness were negatively associated with SR. Contrary to hypotheses, Openness was not a significant predictor of SR. Overall, Neuroticism was the domain most strongly related to SP; Extraversion was most strongly related to SR. Nonetheless, weaker relationships were also found for SP with Extraversion, and SR with Neuroticism, consistent with the placement of Gray's major motivational dimensions in the context of Eysenck's (1967) trait theory.

The Smits and Boeck (2006) study and the Mitchell et al. (2007) study each have several limitations that make further investigation into the relationship between RST and the FFM a pertinent and worthy undertaking. Firstly, although Smits and Boeck used Carver and White's BIS/BAS scales as their measure of BIS and BAS, analyses were only performed at the domain level of the FFM. Mitchell et al. (2007) expanded on Smits and Boeck's work by examining both the domains and facets of the FFM in relationship to RST, but using the SPSRQ as their measure of SR and SP. Although neither the BIS/BAS or SPSRQ was designed to assess both the BIS and FFS, no author has offered a method for partitioning BIS and FFS variance, respectively, using the SPSRQ. Additionally, both studies examined Gray's original RST, failing to incorporate the revised RST into their study design. It follows that an investigation of the revised RST in relationship to the FFM at both the domain and facet level, and that parsing the BIS/FFFS into separate measureable constructs is of timely importance.

The aim of the current study was to explore the relationship between the domains and facets of the FFM and the revised RST subsystems: BIS, FFS, and BAS. To do this, we divided Carver and White's (1994) BIS scale into BIS and FFS subcomponents, based on findings reported by Heym et al. (2008). The benefits of utilizing a BIS and FFS scale as opposed to just a BIS scale were twofold. Firstly, it provided us with the opportunity to conduct the first investigation into the FFM and the revised RST. Secondly, it allowed us to examine the utility of Carver and White's BIS/BAS scales in assessing the revised RST.

2. Method

2.1. Participants

The sample consisted of 779 student participants (47.4% female and 52.6% male) from a Midwestern liberal arts university with an average age of 19.73 ($Sd = 2.77$) years. Racial/Ethnic composition was American Indian (6.8%), African–American (5.6%), Caucasian (83.8%), and Asian or Pacific Islander (3.8%).

3. Materials

Behavioral Inhibition and Activation scales (BIS/BAS; Carver & White, 1994): The BIS/BAS scales are a 20-item questionnaire designed to measure sensitivity of these two motivational systems. The BIS scale consists of 7 items measuring apprehensive anticipation (e.g., “I worry about making mistakes”). For this study, the BIS scale was divided into a 4-item BIS and a 3-item FFS scale, consis-

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