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Interrelationships of the Rothbart's temperament model constructs with revised-reinforcement sensitivity theory constructs

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ABSTRACT

Relationships between the constructs in Rothbart's temperament model and the revised-reinforcement sensitivity theory (r-RST) were examined. A group of 329 adults from the general population completed the Adult Temperament Questionnaire and the Behavioural Inhibition System/Behavioural Activation System Scales. Correlation analyses showed that temperament negative affectivity was relatively highly associated with the RST constructs of the behavioral inhibition system (BIS) and fight–flight–freeze system (FFFS) and temperament extraversion/surgency was relatively highly associated with the behavioral approach system (BAS) construct of reward responsiveness. Temperament effortful control showed no association with the RST constructs. The overlap between the constructs in Rothbart's temperament and r-RST models is discussed.

1. Introduction

Temperament is viewed in Rothbart's model as biologically based individual differences in reactivity and self-regulation (Evans & Rothbart, 2007; Rothbart, Ahadi, & Evans, 2000). For adults, the inclusion of the reactive constructs (extraversion/surgency and negative affectivity) was based on biological models of personality that showed the existence of biological systems associated with appetitive stimuli/positive affect and aversive stimuli/negative affect (Evans & Rothbart, 2007). Gray's (1982) original theory of personality, currently referred to as original-reinforcement sensitivity theory (o-RST), has appetitive stimuli/positive affect and aversive stimuli/negative affect as core personality dimensions (although a third system referred to as the fight–flight system is included in the theory). O-RST has now been substantially revised and expanded (Gray & McNaughton, 2000). The current study examined the relationships of Rothbart's temperament and revised-RST (r-RST) constructs in a group of adults from the general community.

In o-RST, personality is viewed as reflecting individual differences in the behavioral approach system (BAS) and behavioral inhibition system (BIS; Gray, 1982). Both the BAS and the BIS are conceptualized as motivational–emotional neurobiological systems linked to stimulus-driven activation, influenced by immediate incentive or affective responses. Thus these systems can be seen as involving automatic bottom-up reactive control processes (Carver & White, 1994; Gray, 1987; Müller et al., 2014; Voth et al., 2014). The BIS is postulated to be sensitive to punishment, frustrative non-reward, and novelty, and its activation is associated with anxiety and avoidance behaviors. The BAS is postulated to be sensitive to reward and non-punishment, and its activation is associated with positive emotions and approach and impulsive behaviors. In r-RST (Gray & McNaughton, 2000), the BAS has largely been unchanged compared to how the BAS was conceptualized in o-RST. Reactions to all types of punishment in r-RST are postulated to be mediated by the fight–flight–freeze system (FFFS). The FFFS is associated with the emotion of fear, and when activated leads to active avoidance. The revised-BIS (r-BIS) is not related to mediating reactions to punishment, as in the o-RST. Instead, it is hypothesized to be involved in resolving all sorts of goal conflicts, including approach–avoidance, approach–approach, and avoidance–avoidance conflicts. The associated personality consists of worry-proneness and anxious rumination. The BIS generates the emotion of anxiety, which entails cognitive and motivation processes involved in the inhibition of prepotent conflicting behaviors, the engagement of risk assessment processes, and cognitive processes involving attention and the scanning of memory and the environment to help resolve concurrent goal conflict. As r-BAS and r-FFFS are aligned to o-BAS and o-BIS, the r-BAS and r-FFFS can also be viewed as automatic bottom-up reactive control responses. In contrast, the r-BIS is more a regulatory control process. While reactive control processes are autonomic and related to affective systems (Evans & Rothbart, 2007; Rothbart et al., 2000), self-regulation control processes

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are top-down control, cognitive driven processes that "increase, decrease, maintain, and restructure the patterning of reactivity in either an anticipating or correctional manner" (Rothbart & Derryberry, 1981, pp. 51–52).

Like r-RST, Rothbart's temperament model is also a neurobiological model that focuses on the relationships between emotion and emotion regulation, and involves both reactive and regulatory control processes and associated approach and avoidance responses. Like r-RST, Rothbart's model includes broad categories for an approach system (extraversion/surgency), an avoidance system (negative affectivity), and a regulatory system (effortful control; Rothbart & Bates, 2006). Rothbart's temperament model proposed for adults comprises reactive constructs for extraversion/surgency and negative affectivity, and regulatory constructs for effortful control and orienting sensitivity. Extraversion/surgency is the tendency towards sociability, displaying positive affect, and enjoying high intensity activities. Negative affectivity is the tendency to respond intensely, especially to negative emotional cues. Effortful control relates to aspects of behavior associated with the ability to focus attention and shift to desired channels. Orienting sensitivity is the degree to which an individual is sensitive to low intensity cues (neutral or emotional) in the individual's environment, or conscious of a spontaneous idea not directly related to an association with the surrounding environment.

According to Evans and Rothbart (2007), their reactive temperament constructs of negative affectivity and extraversion/surgency were operationalized to correspond with evidence for the existence of personality domains associated with potentially aversive stimuli/negative affect and potentially appetitive stimuli/positive affect, respectively. As will be evident by now, o-RST has appetitive stimuli/positive affect (the BAS) and aversive stimuli/negative affect (the BIS) as core personality dimensions. Thus temperament negative affectivity and extraversion/surgency constructs can be viewed as corresponding to o-RST BIS and BAS, respectively. As anxiety and fear are closely related (Carver & White, 1994), negative affectivity can also be expected to be associated with r-BIS and FFFS.

In relation to existing data, in a study involving adolescents, Muris and Meesters (2009) reported that effortful control sub-constructs correlated negatively with the BIS and BAS, and negative affectivity and extraversion/surgency sub-constructs correlated positively with o-BIS and BAS, respectively (Muris & Meesters, 2009). Another study involving adolescents found a negative association between attention control (a sub-construct of effortful control) and o-BIS (Sportel, Nauta, de Hullu, de Jong, & Hartman, 2011). For adult samples referred for compulsive bullying, Müller et al. (2014) found that effortful control correlated negatively with o-BIS. In contrast, Voth et al. (2014) found that effortful control had no significant correlation with o-BIS or a BAS construct related to reward responsiveness. For a student sample, Mueller et al. (2011) found that effortful control correlated negatively with BAS in males and females, and effortful control correlated negatively with o-BIS in males, but not females. In another study involving female students, Claes et al. (2010) found that effortful control correlated negatively with a BAS related construct of fun seeking, but not with o-BIS, and not with BAS constructs related to reward responsiveness and drive. Apart from these studies, we were unable to locate any other relevant study. Thus currently no study has examined the relationships of the full set of Rothbart's temperament constructs with the full set of either o-RST or r-RST constructs, especially among adults. Such data would be valuable as they can facilitate integration of these models, and also integration of research findings derived from these models. For example, there is now ample data indicating that RST constructs are associated with a range of psychological disorders (see Bijttebier, Beck, Claes, & Vandereycken, 2009, for a comprehensive review), and there is fairly comprehensive data on the emergence, course and development of temperament across the lifespan (Rothbart & Bates, 2006). Thus an understanding how RST and Rothbart's constructs are related to each other would enable us to integrate the findings from these areas, which in turn would lead to a better understanding of the emergence, development, and course of the relevant clinical disorders.

The aim of the current study was to examine the relationships of the temperament constructs with r-RST constructs. Based on the conceptual overlap proposed here between the constructs in Rothbart's model and r-RST model, it was expected that negative affectivity would be associated positively with r-BIS and FFFS, and extraversion/surgency would be associated positively with BAS. As effortful control and orienting sensitivity are both self-regulatory control processes, they are relevant to r-BIS in r-RST. Thus, theoretically, we could expect a positive association for r-BIS with effortful control and orienting sensitivity. As past studies have shown a negative association between effortful control and BAS related to fun seeking, we expected a similar association.

2. Method

2.1. Participants

A total of 329 adults (female = 228) were recruited in Australia through several sources from the State of Tasmania. The age range of participants was 18 years to 50 years. The mean age (*SD*) of all participants together was 26.97 years (10.88). Mean age was 26.71 years (10.36) and 27.67 years (11.41) for females and males, respectively. The mean age of females and males did not differ significantly, $t(265) = 0.68$, *ns*. Participants were recruited from the general community (mainly shopping centers, and sporting and recreational clubs). Research assistants approached potential participants directly in these centers.

2.2. Measures

2.2.1. Adult Temperament Questionnaire (ATQ; Evans & Rothbart, 2007)

The short form of the Adult Temperament Questionnaire (ATQ; Evans & Rothbart, 2007) was used to measure the temperament constructs. The ATQ is a self-report measure with 77 items, with scales for the constructs of negative affectivity, effortful control, extraversion/surgency, and orienting sensitivity. Each item in the ATQ is scored on a seven-point scale, ranging from *extremely untrue* (scored 1) to *extremely true* (scored 7). All items also have a *not applicable* option, and such items are omitted when scored. Scores for each scale for an individual are scored in terms of item mean scores (total score for the scale/number of items rated), resulting in a score from 1 to 7. The ATQ has good internal and external validity (Evans & Rothbart, 2007). In the current study the Cronbach's alpha values for the constructs of negative affectivity, effortful control, extraversion/surgency, and orienting sensitivity, were .79, .74, .71, and 72, respectively.

2.2.2. Behavioural Inhibition System/Behavioural Activation System Scales (BIS/BAS Scales; Carver & White, 1994)

The BIS/BAS Scales were used to measure r-RST constructs. This is also a self-report questionnaire. In this measure, the BIS scale (7 items) and the BAS scale (13 items) measure their namesakes as conceptualized in o-RST. The BAS scale has subscales for Reward Responsiveness (BAS-RR; 5 items), Drive (BAS-D; 4 items) and Fun Seeking (BAS-FS; 4 items). BAS-RR measures approach motivation in anticipation of a future reward; BAS-D measures persistent goal-directed behavior; and BAS-FS measures the tendency to impulsively pursue pleasure. In relation to the BIS scale, studies have suggested that its seven items can be split into BIS-anxiety and BIS-fear subscales, with researchers proposing either three (Heym, Ferguson, & Lawrence, 2008) or two items (Johnson, Turner, & Iwata, 2003). The BIS-anxiety and BIS-fear (either the two or three items) have been used as proxies for measuring the BIS and FFFS, respectively, as conceptualized in r-RST. As evidence indicates more support for the three-item than the two-item BIS-fear scale (Dissabandara, Loxton, Dias, Daglish, & Stadlin, 2012; Heym et al., 2008), we used the three-item version as a measure