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Review

A comparison of revised reinforcement sensitivity theory with other contemporary personality models

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ABSTRACT

Gray and McNaughton's revised Reinforcement Sensitivity Theory (r-RST) is unique among personality models because it is based on contemporary neuroscience and animal learning. We advocate r-RST provides a basis through which to compare strengths and weaknesses of other biologically-based personality models. We compare r-RST to Zuckerman's Sensation Seeking and Jackson's Hybrid Model of Learning in Personality (HMLP), Elliot and Thrash's Approach and Avoidance Temperament Model (AATM), and Cloninger's Psychobiological Model of Temperament and Character (PMTC). We highlight that most modern models conflate or under-represent systems of r-RST despite possessing other admirable qualities. We think r-RST could be more widely used as a strong basic model of temperament with applications across work, clinical, educational, and other domains.

1. Introduction

Gray's (1970, 1982) *original Reinforcement Sensitivity Theory* (o-RST) was comprehensive and based on the best available animal learning and neuroscience of the time. The model was revised by the original author based on developments in animal learning and neuroscience and the updated version is referred to as *revised Reinforcement Sensitivity Theory* (r-RST; Gray & McNaughton, 2000). In this article, we compare and contrast r-RST with other biologically-based personality models. This investigation is important because to the best of our knowledge, this exercise has not been previously conducted despite evidence that r-RST occupies a unique space in the literature as a strong basic model of temperament although much research still needs to be conducted. The purpose of this article is to provide readers with an overview of how r-RST relates to other personality models and to provide evidence that it has better utility than other models. We advocate that it should be more widely used in personality and related research. We expect this article to be useful to many researchers, because personality research is conducted across organizational, clinical, and educational contexts.

While many personality models are potentially available for review, we constrain our review to a representative group of the most contemporary and important personality models in the academic literature that claim a full or partial biological basis. The systems we compare to r-RST are *Sensation Seeking* and the *Hybrid Model of Learning in Personality* (HMLP; Jackson, 2008), the *Approach and Avoidance Temperament Model* (AATM; Elliot & Thrash, 2002, 2010), and the *Psychobiological Model of Temperament and Character* (PMTC; Cloninger, Svrakic, & Przybeck, 1993). Because we constrain our review to models that began with at least a partial biological basis, we have not included the Five Factor Model (Costa & McCrae, 1992) in this review. See DeYoung (2015) for an overview of developments regarding the Five Factor model, including biological underpinning and its relationship with r-RST. We also do not include Eysenck's psychobiological theory of personality (e.g., Eysenck, 1967) in our review as it is a forerunner of Gray's (1987) model of o-RST with declining influence in the contemporary literature. We believe that this review will assist researchers in better understanding the strengths and weaknesses of r-RST as the most comprehensive available personality model of temperament, while also recognizing its limitations given the contrasting strengths of the other models. See Table 1 for an outline of the strengths and weaknesses of each of the personality models.

Gray's (1987) o-RST highlighted two motivational systems. The Behavioral Approach System (BAS), also called the Behavioral Activation System, is reward sensitive and mediates approach motivations. The Behavioral Inhibition System (BIS) is punishment sensitive and mediates avoidance of aversive stimuli. A vast literature on neuroscience and animal learning has supported an approach and avoidance understanding of personality. The self-report measures developed to test o-RST include the Behavioral Inhibition System and Behavioral Activation System scales (BIS/BAS scales; Carver & White, 1994) and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Moltó, & Caseras, 2001). Researchers conducted substantial research using these measures. The claimed biological basis of these scales

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Table 1
Comparison of r-RST with other personality models.

Model	Strengths	Weaknesses
r-RST	A strong basic personality model that is grounded in neuroscience and animal learning	It has been under-utilized in the literature, which means it does not have the breadth of research compared to other models
HMLP	Includes clear differentiation between the biological basis of Sensation Seeking and socio-cognitive mediators. Sensation Seeking is consistent with BAS in r-RST	Under-utilized in the literature and no measure of punishment sensitivity
AATM	Clear differentiation between biological basis and socio-cognitive goals	Limited support because under-utilized in the literature. Outdated because based on o-RST rather than r-RST
PMTC	Biological and includes a vast amount of literature in the clinical and medical fields.	Outdated because based on o-RST rather than r-RST

Note. r-RST = revised Reinforcement Sensitivity Theory (Gray & McNaughton, 2000); o-RST = original Reinforcement Sensitivity Theory (Gray, 1982); HMLP = Hybrid Model of Learning in Personality (Jackson, 2008); AATM = Approach and Avoidance Temperament Model (Elliot & Thrash, 2002, 2010); PMTC = Psychobiological Model of Temperament and Character (Cloninger et al., 1993).

made them attractive to many fields including medical and clinical domains. Potentially because three systems did not coalesce with the general and widely accepted concept of approach and avoidance, or because the most widely used measurement models did not include them, the third system, called the Fight/Flight System (FFS), gained little traction in the literature.

While the simplicity of o-RST (Gray, 1987) was appealing, developments in animal learning and neuroscience provided further evidence that the motivational system divided into three primary systems (Gray & McNaughton, 2000). The BAS remains relatively unchanged, except that it now mediates motivation to approach any rewarding stimuli rather than just conditioned stimuli (Smillie, Pickering, & Jackson, 2006). The second motivational system retains the name BIS, but now the function of the BIS changes such that it becomes a comparator that evaluates whether to approach or avoid a stimuli (Corr, 2004). BIS is activated when a threat is intangible and requires investigation, which often leads to arousal, hypersensitivity to threat, and cautious approach to determine if the threat is real (Smillie et al., 2006). The conflict detector mechanism of the BIS usually evaluates between approach-avoidance conflicts, but can also evaluate between approach-approach conflicts and avoidance-avoidance conflicts (Smillie et al., 2006). The BIS is also described as anxiety. The third motivational system in r-RST is the Fight/Flight/Freezing System (FFFS). As opposed to the evaluative function of the BIS, the FFFS mediates a fear response to tangible, punishing stimuli. Fight, also known as defensive aggression, concerns a frenzied and vociferous response to threat or pain that is unescapable (Smillie et al., 2006). Researchers usually perceive fight as defensive aggression and as different from predatory aggression (Harmon-Jones & Sigelman, 2001), but fight may also have an approach element similar to the BAS (Smillie et al., 2006). Flight concerns rapid escape from threat or pain that is escapable. Freezing concerns escape from pain or threat through non-motion. Freezing is associated with the physiological state of panic (DeYoung, 2010). Flight and freezing are responses to distal threat, whereas fight is a response to proximal threat (Blanchard & Blanchard, 1990).

As described, r-RST differs considerably to o-RST. The original model mainly focused on motivational systems in which BAS was an approach system, BIS was an inadequately defined avoidance orientation and the FFS was poorly understood. The revised model is more comprehensive because it has better definitions of each of the proposed systems, greater focus on the importance of fear as a personality system, and divides into the behavioral responses of fight, flight, and freezing (Smillie et al., 2006). Measures are now available to assess r-RST including the Jackson 5 (Jackson, 2009) and Reinforcement Sensitivity Theory Personality Questionnaire (Corr & Cooper, 2016)

Corr suggests Gray took Darwinism seriously because he believed that personality arises from brain-behavior systems and that "data obtained from (non-human) animals could be extrapolated to human animals" (Corr, 2008, p. 2). This animal research basis makes r-RST unique and a strong basic model of temperament. Corr (2009, p. 371) comments: "Over a forty-year period, RST has developed into a sophisticated model of emotion, motivation, personality and psychopathology". Given that r-RST is grounded in biology and animal learning (Corr, 2008; Gray & McNaughton, 2000; Smillie et al., 2006), the purpose of the current article is to evaluate how well r-RST provides a standard by which we can assess the contribution of other biologically-based personality models that are representative of the modern personality literature. We think r-RST could potentially be applied to many domains including clinical, organizational, educational, and other domains that have traditionally been dominated by other personality models. Yet such application is dependent upon understanding the relative strengths of r-RST and its currently available measurement models in comparison to other contemporary models. Making this comparison would be an important step as, for example, temperament models in general have had negligible impact in some applied literatures, such as workplace contexts, despite their considerable possibilities (Furnham & Jackson, 2008)

2. Sensation seeking and the Hybrid Model of Learning in Personality (HMLP)

The original conception of Sensation Seeking is the tendency to be excited by novel experiences and the willingness to take risks (Zuckerman, 1978, 1994). As a result, the focus of most research on Sensation Seeking has concerned its dysfunctional basis, which indicates it is different to BAS. On the other hand, an alternative understanding of Sensation Seeking focuses on exploration and curiosity (Jackson, 2008), which is conceptually similar to the underlying reward seeking drive of the BAS. Operationally, the BAS scale in the Jackson 5 measurement model of r-RST (Jackson, 2009) and the Sensation Seeking scale in the Hybrid Model of Learning in Personality (HMLP; Jackson, 2008) share some items. In line with theory (Arnett, 1994), the HMLP suggests that Sensation Seeking is not necessarily dysfunctional and can be functional. The HMLP develops the concept of the BAS by arguing that Sensation Seeking is potentially dysfunctional if directly expressed, but likely to be functional if expressed through socio-cognitive mediators such as Conscientiousness, Rationality, Mastery, or Deep Learning (e.g., Jackson, 2011; O'Connor & Jackson, 2008). The HMLP is consistent with research suggesting Sensation Seeking concerns exploratory behavior that is not necessarily associated with reinforcement (Ball & Zuckerman, 1990; Pickering, 2004). Notably, the HMLP includes Conscientiousness and Deep Learning (similar to Openness to Experience) as socio-cognitive mechanisms rather than general personality variables in the Five Factor Model (Costa & McCrae, 1992).

The broad theoretical basis of the model is similar to the Approach and Avoidance Temperament Model (Elliot & Thrash, 2002, 2010) in that it assumes personality variables have "more of a biological basis" and some have "more of a socio-cognitive basis" (Jackson, 2011, p. 35). In the HMLP (Jackson, 2008), Sensation Seeking has more of a biological basis and the other scales are more socio-cognitive or experiential (Jackson, Hobman, Jimmieson, & Martin, 2009). Research has identified how the theory underlying Rational Emotive Behavior Therapy (Ellis, 2004) is similar to the theory underlying HMLP (Jackson, Izadikhah, & Oei, 2012), which adds additional credibility to the model. Several studies provide evidence of how cognitive mechanisms re-express high scores of Sensation Seeking through indirect paths to predict organizational, educational, and other outcomes (Gardiner & Jackson, 2015; Jackson, 2008, 2009, 2011; Jackson, Baguma, &