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Carver and White's (1994) BIS/BAS scales and their relationship to risky health behaviours

Danielle C. Voigt [a], James P. Dillard [a,*], Kurt H. Braddock [a], Jason W. Anderson [b], Pradeep Sopory [c], Michael T. Stephenson [d]

[a] Department of Communication Arts and Sciences, The Pennsylvania State University, 234 Sparks Building, University Park, PA 16802, United States
[b] Minnesota State University-Moorhead, 116F CA Moorhead, MN 56563, United States
[c] Wayne State University, 523 Manoogian Hall Detroit, MI 48202, United States
[d] Texas A&M University, 102 Bolton Hall TX 77843, United States

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ABSTRACT

The BIS (behavioural inhibition) and BAS (behavioural approach) motivational systems are thought to influence an individual's proclivity to engage in risky health behaviours. Using a sample of college undergraduates from four universities ($N = 1014$), Carver and White's (1994) BIS and BAS subscales (Reward Responsiveness, Drive, and Fun Seeking) were tested against seven health composites including sex, alcohol, drug, and tobacco use, safety, inactivity, and poor diet. Contrary to expectations, Reward Responsiveness (rather than BIS) served as a protective force against engagement in the risky health behaviours. In comparison, the Fun Seeking subscale performed as anticipated, generating strong, positive associations with all but two of the behaviours. The results are discussed in the context of recent theorizing as well as the factor structure of BIS and BAS, given concerns about the latter's dimensionality.

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1. Introduction

Nearly 50% of all deaths in the United States are caused by a "limited number of largely preventable behaviours," including smoking, poor diet and physical inactivity, alcohol use, motor vehicle crashes, risky sexual behaviour, and drug abuse (Mokdad, Marks, Stroup, & Gerberding, 2004, p. 1242). One explanation for why some individuals engage in risky health behaviours while others forgo them lies with individual differences in sensitivity to cues of reward and punishment (e.g., Franken & Muris, 2006a). That is the focus of this paper.

1.1. Appetitive and aversive motivational systems

Over the past several decades, researchers in diverse areas of social science have proposed the existence of two separate systems that provide the basis for human action (Carver, 2006; Davidson, 1992; Fowles, 1994; Gray, 1990; Higgins, 1998; Schneirla, 1959). Although, these approaches inevitably demonstrate variation in terminology, the core ideas are remarkably similar. The *appetitive system* is sensitive to cues of reward and motivates action toward those rewards when they are present. In contrast, the *aversive system* is responsive to punishing stimuli and serves to inhibit behaviour that may result in that end. One incarnation of the dual motivation perspective is (e.g., Gray's, 1993) reinforcement sensitivity theory (RST). Central to the current discussion, this theory posits the existence of the *behavioural approach system* (BAS) and the *behavioural inhibition system* (BIS). (Recent changes to the theory are examined later in this article.)

1.2. Operationalizing BIS/BAS

Several attempts have been made to devise a self-report index of BIS and BAS activation (e.g., Wilson, Barrett, & Gray, 1989). Arguably the most successful of these is Carver and White (1994), who developed items based on their "overall conceptualization of BIS and BAS functioning – particularly the postulated role of the systems in generating emotional reactions..." (p. 322). Accordingly, BIS items were written to reflect the experience of anxiety in circumstances that include signs of possible punishment. However, due to a lack of specificity in the theory regarding how chronic levels of BAS might manifest, items were penned so as to tap strong and quick goal pursuit (Drive), receptivity to reward (Reward

* Corresponding author. Fax: +1 814 863 7986.
E-mail address: jpd16@psu.edu (J.P. Dillard).

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Responsiveness), and the desire for new and potentially rewarding experiences (Fun Seeking).

1.3. BIS/BAS and risky health behaviours

As predicted by the BIS/BAS literature (e.g., Gray, 1993), positive associations have been found between BAS and addictive behaviours such as alcohol and drug use. Nearly all of these associations, however, have been among BAS-Drive and BAS-Fun Seeking, with less support generated for BAS-Reward Responsiveness (when it has been tested). For example, Loxton and Dawe (2001) reported a strong association between Drive, Fun Seeking and alcohol use among teenage girls, while Johnson, Turner, and Iwata (2003) demonstrated a significant link between Fun Seeking and long-time alcohol abuse (see also Franken, 2002; Kambouropoulos & Staiger, 2001; Zisserson & Palfai, 2007). Similar trends appear for drug use. Franken and Muris (2006a) reported an association between Fun Seeking and drug use (in addition to alcohol use). Franken, Muris, and Georgieva (2006) documented a relationship between Fun Seeking and Drive with drug use and dependence among addicts. Johnson et al. (2003) focused on a similar audience, but only found a significant relationship for Fun Seeking.

Other research has focused on obesity and the factors that can lead to this condition. Davis et al. (2007) found a positive relationship between the collapsed BAS subscales and overeating. They also found a positive relationship with food preferences; people who prefer foods that are sweet and high in fat content tend towards higher BAS scores. In a similar vein, sensitivity to reward has been found to induce noticeable physiological responses in the brain when respondents are exposed to images of such appealing foods as chocolate cake and ice cream (Beaver et al., 2006). Using fMRI technology, the Drive subscale produced the most dramatic results, being the clearest predictor of "blood oxygen level-dependent response to appetizing foods" (p. 5162).

Although, work has been done to explore the link between the BIS and BAS motivational systems and risky health behaviours, the scope has been primarily limited to alcohol and drug use, with some attention paid to food-related issues such as obesity. The current study broadens this view by examining an array of risky health behaviours including sexual activity, alcohol, drug, and tobacco use, lack of safety precautions, physical inactivity, and poor diet. In doing so, the research not only tests the motivational systems in new domains, but allows us to simultaneously compare the effects these systems have on different risk behaviours.

In light of the existing literature, we expected that individual differences in sensitivity to reward (i.e., BAS) would show positive correspondence with risky health behaviours. However, based on the research reviewed, we anticipated some degree of variation among the BAS subscales. Conversely, we thought that BIS sensitivity would produce negative associations with these outcomes given heightened receptivity to cues of punishment.

2. Method

2.1. Participants and procedures

Participants were 1014 undergraduate students who received extra credit toward communication courses at one of four universities: Pennsylvania State University ($N = 288$), Minnesota State University at Moorhead ($N = 338$), University of Memphis ($N = 203$), Texas A&M ($N = 161$) (24 students did not indicate their affiliation). Their ages ranged from 17 to 69 ($M = 20.85$; $SD = 4.71$), and a little more than half (58.4%) were female. Due to missing data, this overall N was reduced to 976. All participants responded to a survey administered via the Internet.

2.2. Missing data

The amount of missing data on any given variable ranged from 0% to 3.4%. We performed a missing value analysis (MVA) using the expectation maximization (EM) algorithm in SPSS Version 16.0. Little's (1988) MCAR chi-square test was nonsignificant ($\chi^2 = 6899.95$, $df = 7141$, $p < 0.979$) indicating that the data were missing completely at random. Consequently, we allowed the program to impute values for missing data on the BIS/BAS and health behaviour measures, but not the categorical demographic variables.

2.3. Measures

Participants completed Carver and White's (1994) BIS/BAS questionnaire using a 5-point Likert-type response scale, with 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. One BIS item reads "Criticism or scolding hurts me quite a bit" ($\alpha = .77$ for the scale). The BAS scale consists of three subscales: Reward Responsiveness ($\alpha = .73$; e.g., "It would excite me to win a contest"), Drive ($\alpha = .76$; e.g., "I go out of my way to get things I want"), and Fun Seeking ($\alpha = .71$; e.g., "I crave excitement and new sensations") (Carver & White, 1994).

Confirmatory factor analysis was conducted to assess the structure of the BIS/BAS scales. Following several iterations, the best fitting model treated BIS and BAS as four separate but correlated latent variables. The fit statistics for the model, which allowed for correlated errors between the negatively worded BIS items, were as follows: $\chi^2 = 219.2$, $df = 163$, $p < .01$, RMR = .054, TLI = .96, RMSEA = .030. Although, the χ^2 result was significant, which was not surprising given our sample size, the remaining indices caused us to conclude that the model exhibited satisfactory fit.

To determine which risky health behaviours posed the greatest risk to the general population, we investigated the leading causes of death. Items were taken from the 2007 State and Local Youth Risk Behaviour Survey, an instrument developed by the Centers for Disease Control and Prevention (see Brener et al., 2002 for a discussion about the reliability of the measures). These items spanned seven general categories, including: safety (four items; e.g., "How often do you wear a seat belt when driving or riding in a car driven by someone else?), tobacco use (three items; e.g., "During the past 30 days, on how many days did you smoke cigarettes?"), drug use (seven items; e.g., "During your life, how many times have you used marijuana?"), alcohol consumption (one item; e.g., "During the past 30 days, on how many days did you have five or more drinks of alcohol in a row, that is, within a couple hours?"), sexual practices (two items; e.g., "Of the sexual experiences that you have had in the past 3 months, in what percentage of them was a condom used?"), eating habits (eight items; e.g., "During the past 7 days, how many times did you eat French fries, fried potatoes, or potato chips?"), and physical activity (three items; e.g., "During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?"). Many of the response categories revolved around frequency per week (e.g., "1–3 times during the past 7 days") though some variation did exist from one health behaviour to the next.

3. Results

3.1. Constructing the risky health behaviour variables

The risk behaviour items were such that the assumption of a latent variable for each set of items was implausible. Consider, for example, the tobacco items which asked about the frequency with