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BEHAVIORAL INHIBITION SYSTEM (BIS) STRENGTH AND TRAIT DOMINANCE ARE ASSOCIATED WITH AFFECTIVE RESPONSE AND PERSPECTIVE TAKING WHEN VIEWING DYADIC INTERACTIONS

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The neurophysiology underlying the Behavioral Activation and Behavioral Inhibition Systems (BAS and BIS) and the impact of the strength of these systems on affective processing have received increased attention over the last 25 years. Specifically, left-frontal brain regions have been implicated in BAS strength as well as the experience of positive-approach affect (such as happiness). Conversely, BIS strength and negative-avoidance affect (such as fear) appear to be modulated by right-frontal brain regions. Taken together, it is not surprising that BAS and BIS strength have been associated with positive and negative affective biases, respectively, to emotional stimuli that do not involve extensive human interaction. The present investigation was designed to extend these findings by assessing the relationship between BAS and BIS strength on the perception of emotional interactions. Participants ($n = 67$) were shown four 2-min film clips that depict an individual exerting dominance over one or more other individuals. Each participant rated the clips with regard to valence, arousal, and dominance parameters, and then indicated the person(s) in the movie with whom they identified (i.e., the dominant individual or submissive individual[s]). Consistent with a priori hypotheses, persons identifying with the submissive character scored significantly higher on BIS sensitivity. BAS strength and BIS/BAS ratio, conversely, were not associated with character identification. Also as predicted, identification with the dominant movie character was associated with increased positive affect and feelings of dominance. Interestingly, although not hypothesized, trait dominance was also associated with character identification by virtue of being positively associated with BAS and PA and negatively associated with BIS and NA.

Keywords   arousal, Behavioral Activation System, Behavioral Inhibition System, bias, dominance, emotion, identification, negative affect, positive affect, valence

INTRODUCTION

The Behavioral Activation (BAS) and Behavioral Inhibition Systems (BIS) were first discussed by Jeffrey Gray and have been extensively expounded on by Don Fowles and Richard Depue. The BAS, sometimes called the Behavioral Facilitation System, is the appetitive motivation system that typically induces "approach" behavior in response to positively conditioned stimuli. Given its role in directing an animal toward reward, BAS activation is generally

associated with positive affect such as "hope" and "happiness" (Corr, 2001; Depue & Iacono, 1989; Fowles, 1988, 1994; Gray, 1990, 1994; Matthews & Gilliland, 1999, 2001). The BAS appears to involve the mesolimbic dopaminergic pathway that ascends from the ventral tegmental area to the nucleus accumbens and ventral striatum (Depue & Iacono, 1989; Fowles, 1994; Gray, 1987; Nothen et al., 1992). The BIS, conversely, inhibits behavior in response to threatening conditioned stimuli and is most closely associated with negative affect such as fear and anxiety (Corr, 2001; Depue & Iacono, 1989; Fowles, 1988, 1994; Gray, 1990, 1994; Matthews & Gilliland, 1999, 2001; Meyer et al., 2001). BIS arousal is modulated by adrenergic pathways from the locus ceruleus and serotonergic pathways from the raphe nucleus that innervate the septo-hippocampal system (Fowles, 1994; Gray, 1982; Gray et al., 1997; Winters et al., 2000).

Activation of the left- and right-frontal lobes has been associated with increased BAS and BIS strength, respectively. Using the BIS/BAS questionnaire (Carver & White, 1994), for instance, Sutton and Davidson (1997) found that the BAS/BIS ratio was positively associated with increased left-relative to right-frontal arousal among a group of 46 undergraduate students. These findings have been replicated and extended to include persons experiencing clinically significant anxiety and/or depression (Diego et al., 2001; Harmon-Jones & Allen, 1997). The relationship between motivational system strength and frontal asymmetry is notable because it also holds important implications for affective experience. Specifically, the experience of positive affect (PA) has been positively associated with left-frontal arousal and BAS strength whereas the experience of negative affect (NA) has been significantly associated with right-frontal arousal and BIS strength.

Evidence supporting the lateralization of affect has continued to mount since it was first found that depression is commonly associated with left-frontal hypoarousal (Robinson & Downhill, 1995; Robinson et al., 1984; Tucker et al., 1981). Many experiments have found that the experience of positive-approach and negative-withdrawal emotions correspond with left- and right-frontal arousal, respectively (e.g., Ekman & Davidson, 1993; Ekman et al., 1990; Fox & Davidson, 1987, 1988; Reuter-Lorenz & Davidson, 1981; Wheeler et al., 1993). Moreover, stable patterns of left- versus right-frontal arousal have been associated with increased trait PA and NA, respectively (Tomarken, Davidson, Wheeler, & Doss, 1992). Given the aforementioned research, data suggesting that BIS and BAS strength are significantly associated with the experience of trait NA and PA, respectively (e.g., Carver & White, 1994; Harmon-Jones & Allen, 1997), are hardly surprising.

A fascinating recent study on "everyday life" found that persons with high BAS experienced increased levels of PA throughout the day whereas persons with high BIS experienced greater NA (Gable et al., 2000). It was found, moreover, that persons with high BIS strength magnified negative events relative to those with lower BIS scores. How exactly does this happen? One possibility is that persons with high BIS experience a perceptual bias for affective stimuli. For example, Tomarken et al. (1990) showed 32 right-handed women several affective videos of approximately 60 s in length. Film clips depicted positive and negative affective scenes, and generally did not involve human interaction. For instance, a positive film clip showed a puppy playing with flowers, whereas a negative film clip included footage of a burn victim. Interestingly, Tomarken and colleagues (1990) found that relative right-frontal activation (associated with BIS activation) predicted increased self-reported NA in response to the negative films. Similarly, relative left-frontal activation (associated with BAS strength) was associated with a greater disparity between PA and NA in response to positive and negative films, respectively (Tomarken et al., 1990). These results were supported by research performed by Gomez and Gomez (2002), who found that BAS and BIS strength were associated with the processing of positive and negative stimuli, respectively. These findings correspond well with clinical data suggesting that clinically depressed affect (i.e., depression) is associated with decreased BAS strength (Depue & Iacono, 1989; Depue et al., 1987; Depue & Zald, 1993; Meyer et al., 1999) and left-frontal hypoactivation (Garcia-Toro et al., 2001; Heller et al., 1995; Heller & Nitschke, 1997; Henriques & Davidson, 1991; Robinson & Downhill, 1995; Robinson et al., 1984; Tucker et al., 1981). The reverse pattern of frontal asymmetry and motivational system strength has been found in clinical populations evidencing extreme PA, such as mania (Depue & Zald, 1993; Fowles, 1994; Garcia-Toro et al., 2001; Meyer et al., 1999).

Motivated by the finding that frontal asymmetry predicts one's emotional response to affective stimuli (Tomarken et al., 1990), the present research was designed to determine whether BIS and BAS strength was associated with affective response to perceived human interaction. Given the many interpersonal interactions typically seen during the course of a day, this research was designed to be very relevant in terms of understanding one's emotional perception of common events and aid in the understanding of how BIS and BAS strength predict NA and PA during "everyday life" (Gable et al., 2000). Participants were shown four 2-min video clips involving an individual exerting dominance over one or more other persons and asked to rate

their valence, arousal, and dominance feelings (Mehrabian, 1996; Mehrabian & Russell, 1974) in response to the movie. Participants then identified the person in the movie with whom they identified (the dominant or submissive character[s]). The following predictions were made: Identification with the submissive rather than dominant character would be associated with (1) increased BIS/BAS ratio (decreased BAS and increased BIS), (2) decreased trait PA and increased trait NA, and (3) decreased state positive affect and increased feelings of submission as a result of movie viewing.

METHOD

Participants

Male (33) and female (34) participants ($n = 67$) between the ages of 18 and 24 years (M = 18.66, SEM = .14) were recruited from the departmental undergraduate subject pool at Case Western Reserve University (CWRU). All participants obtained extra credit toward their psychology course for participation. The research was approved by the CWRU Institutional Review Board.

Films

Participants were shown four 2-min films that depicted an individual exerting dominance over at least one other person. Films 1–3 were excerpts from the movie *Lean On Me* (*Lean On Me*, 1989), which is about a principal who attempts to make an urban high school academically more successful. Film 1 depicted the principal yelling at the faculty/staff of the school for their poor performance. Film 2 showed the principal as he gave a speech to his high school students, imploring them to follow his leadership and work their hardest to achieve academic success. Film 3 depicted the principal yelling at an individual high school student for not fulfilling his obligations as a student. Film 4, excerpted from the movie *Schindler's List* (*Schindler's List*, 1993), showed a Nazi factory supervisor attempt to kill one of his detained workers because of their poor productivity.

Questionnaires

Questionnaires were administered to participants in order to determine (a) their affective response to each movie, (b) their demographic background,

and (c) specific aspects of their trait personalities. The following question-naires were administered:

The Self-Assessment Manikin (SAM). The SAM (Bradley & Lang, 1994) was used to measure the three aspects of emotional experience—valence, arousal, and dominance—that may have been affected by movie viewing. The SAM is a Likert-type scale that depicts five figures ranging from happy to sad (1 to 5), aroused to relaxed (1 to 5), and submissive to dominant (1 to 5). After each movie, the participants were asked to select one figure for each emotional aspect (valence, arousal, and dominance) that most closely approximated their affective response to the just-completed film. The SAM has been frequently administered to assess people's reactions to affective stimuli (e.g., Bradley et al., 1996; Lang et al., 1990; Lang et al., 1998).

The Semantic Differential (SD). The Semantic Differential (Bradley & Lang, 1994), too, is designed to assess a person's affective responses to emotional stimuli using valence, arousal, and dominance parameters. The SD comprised 18 Likert-type scales (rated –3 to +3) that can be broken down into valance (unhappy-happy, annoyed-pleased, unsatisfied-satisfied, melancholic-contented, despairing-hopeful, bored-relaxed), arousal (relaxed-stimulated, calm-excited, sluggish-frenzied, dull-jittery, sleepy-wide awake, unaroused-aroused), and dominance (controlled-controlling, influenced-influential, cared for-in control, awed-important, submissive-dominant, guided-autonomous) parameters. The paper-and-pencil SD and SAM valence, arousal, and dominance measures have been found to correlate .97, .94, and .23 with one another, respectively (Bradley & Lang, 1994). At the end of the SD, participants were asked to circle the movie character with whom they identified ("The Principal" or "The Teachers/Staff" [movie 1], "The Principal" or "The Students in the Auditorium" [movie 2], "The Principal" or "The Student" [movie 3], and "The Factory Supervisor" or "The Factory Worker" [movie 4]).

Demographic Questionnaire. In accordance with guidelines from the National Institute of Mental Health, participants were asked to report information regarding their age, sex (male or female), and racial background (American Indian/Alaskan Native, Asian, Native Hawaiian/Other Pacific Islander, Black/African American, White, or Other).

The BIS/BAS Scales. The BIS/BAS Scales (Carver & White, 1994) consist of 20 questions that assess BIS and BAS sensitivity. The BIS Scale (7 items) measures the degree to which people feel anxiety when confronted

with cues for punishment. The BAS Scale (13 items) may be subdivided into Reward Responsiveness (5 items), Drive (4 items), and Fun Seeking (4 items). The internal consistency of the BIS, BAS Reward Responsiveness, BAS Drive, and BAS Fun Seeking Scales have been reported as .74, .73, .76, and .66, respectively (Carver & White, 1994).

The Positive and Negative Affect Schedule (PANAS). The PANAS (Watson et al., 1988) was used to assess trait positive and negative affect (PA and NA, respectively). Participants were asked to rate 10 positive- (e.g., excited, strong, proud) and negative-affect descriptors (e.g., distressed, guilty, hostile) using a 5-point Likert-type scale (1 = "very slightly or not at all" and 5 = "extremely"). The test-retest reliability of PA and NA scores taken "at least one week apart" have been reported as .68 and .71, respectively (Watson et al., 1988).

The Revised Trait Dominance-Submissiveness Scale (TDS). The TDS (Mehrabian, 1994) was administered to assess trait dominance. The TDS comprised 26 Likert-type sentences that are scored from –4 ("very strong disagreement") to +4 ("very strong agreement"). This measure has been re-ported to have an internal consistency of .91 (Mehrabian, 1995) and be posi-tively associated with measures of extraversion, impulsivity, arousal seeking, achieving tendency, and aggression (Mehrabian & O'Reilly, 1980).

The Marlowe-Crowne Social Desirability Scale (SDS). The SDS (Crowne & Marlowe, 1960) is a 33-item True-False questionnaire designed to deduce the degree to which persons want to represent themselves in a culturally sanctioned light. The internal consistency of this measure has been reported as .88 (Crowne & Marlowe, 1960).

Procedure

Participants were tested in a group testing facility located within the Depart-ment of Psychology at CWRU. Group sizes ranged from 2 to 13. Upon arrival, participants were asked to read and sign an informed consent form. Participants were then shown four 2-min movie clips (previously described). These videos were shown using a Dell Latitude CPi A300 ST computer using Windows Media Player. The image was displayed over a LCD projec-tor (Proxima Ultralight LX1) onto a white projector screen. The resulting image was 65" (diagonal) in size, and participants sat between 70" and 190" away from the screen. The sound of the movie was approximately 50 dB,

and centrally located approximately 120" from the screen. Movie order was counterbalanced such that movies were shown in the following 4 sequences—1, 2, 3, 4 (17 participants); 2, 1, 4, 3 (19 participants); 3, 4, 1, 2 (17 participants); and 4, 3, 2, 1 (14 participants). After each movie, participants were asked to complete both the SAM and SD scales. Following the presentation of all of the movies, participants were asked to complete each of the remaining questionnaires—the Demographic Questionnaire, BIS/BAS, PANAS, TDS, and SDS. After the questionnaires were completed, participants were debriefed and thanked for their time.

RESULTS

Participant Characteristics and General Description of Movie Character Identification

The 33 men and 34 women participants were aged between 18 and 24 years (M = 18.66, SD = 1.16). Participants reported being White (n = 38), Asian (n = 23), Other (n = 3), or Black/African American (n = 2) (1 participant did not answer this question). Of the 268 observations, only 6 times were participants unable to decide with which movie character(s) they identified (Movie 1, n = 1; Movie 2, n = 4, Movie 3, n = 1). These data were excluded from future analyses.

Of the remaining 262 data points, 53% (35 of 66), 60% (38 of 63), 67% (44 of 66), and 7% (5 of 67) individuals identified with the dominant person in Movies 1–4, respectively. 4.5% and 13.4% of participants always identified with the dominant or submissive characters, respectively, whereas the remaining participants (82.1%) switched identification across movies.

To assess any effects of movie order, an ANOVA with between factors of Order (4) and Movie (4) and a within factor of Participant was performed on character Identification (2: dominant or submissive). Results revealed a nonsignificant main effect of Order [$F(3,259)$ = .24, p > .05] and a nonsignificant interaction effect of Order x Movie [$F(9,253)$ = 1.60, p > .05]. Hence, results are not believed to be influenced by the order of movie presentation.

Participant Description by Character Identification (Dominant or Submissive)

To assess the relationship between character identification and personality traits, a correlation matrix was created assessing the relationship between the

number of times a participant identified with the dominant figure in the four movies (Identify: 0 [submissive person in all 4 videos] to 4 [dominant person in all 4 videos]) and the following data—Sex (1 = male; 2 = female), BIS, BAS Reward Responsiveness, BAS Drive, BAS Fun Seeking, BAS Total, BIS/BAS ratio, PA, NA, TDS, and SDS (please see Table 1).

As predicted, participants who identified with the submissive character reported greater BIS strength ($p < .05$). Identification (0–4) was not associated with BAS strength, BIS/BAS, PA, or NA, however. Although not predicted, identification with the dominant character was associated with higher scores on the TDS ($p < .01$) and also more common among males ($p < .01$). As one would expect, BIS and BAS were associated with NA and PA, respectively. Interestingly, however, TDS score was positively associated with BAS and PA and negatively associated with BIS and NA.

Affective Response by Movie and Character Identification (Dominant or Submissive)

To determine the relationship between character identification and affective response, an ANOVA with between factors of Identify (2: Dominant or Submissive) and Participant (67) was performed on the following questionnaire data—the SAM and SD Valence, Arousal, and Dominance parameters. A main effect of Identify was found for SAM Valence [$F(1,194) = 62.89$, $p < .001$, $R^2 = .182$], SD Valence [$F(1,194) = 53.04$, $p < .001$, $R^2 = .164$], SAM

Table 1. Correlation matrix involving Identify (0–4), BIS, BAS, PANAS, TDS, and Sex data ($n = 67$)

	Identify	BIS	BAS RR	BAS D	BAS FS	BAS total	BIS/ BAS	PA	NA	TDS
BIS	−.27*									
BAS RR	−.12	.30*								
BAS D	.08	.05	.56**							
BAS FS	−.01	−.11	.28*	.34**						
BAS total	.01	.09	.78**	.82**	.71**					
BIS/BAS	−.11	.65**	−.39**	−.55**	−.62**	−.68**				
PA	.15	−.13	.14	.31*	.16	.27*	−.29*			
NA	.00	.43**	−.06	−.17	.00	−.10	.37**	−.23		
TDS	.27*	−.25*	.22	.31*	.30*	.36**	−.45**	.53**	−.25*	
Sex	−.36**	.51**	.20	.10	−.21	.03	.34**	−.03	.20	−.12

*$p < .05$, **$p < .01$. RR = reward responsiveness, D - drive, FS = fun seeking.

Table 2. SAM and SD valence, arousal, and dominance ratings by character identification (dominant and submissive)

| | Character identification | | | |
| | Submissive ($n = 140$) | | Dominant ($n = 122$) | |
Measure	Mean	SD	Mean	SD
SAM				
Valence**	2.52	1.00	3.67	1.15
Arousal*	2.88	0.98	2.56	1.09
Dominance**	3.30	0.93	2.34	1.04
SD				
Valence**	3.17	6.22	−3.39	6.75
Arousal	3.19	5.81	4.56	6.76
Dominance	2.25	5.92	−4.29	4.96

*$p < .05$, **$p < .001$, two-tailed.

Arousal [$F(1,194) = 6.34$, $p < .05$, $R^2 = .016$], SAM Dominance [$F(1,194) = 44.21$, $p < .001$, $R^2 = .349$], and SD Dominance [$F(1,194) = 58.39$, $p < .001$, $R^2 = .129$]. As expected, persons who identified with the dominant character self-reported increased positive valence and feelings of dominance (please see Table 2).

A main effect of Participant was also revealed for the SAM Arousal [$F = (66,194) = 3.03$, $p < .001$, $R^2 = .496$], SEM Arousal [$F = (66,194) = 4.11$, $p < .001$, $R^2 = .576$], SAM Dominance [$F = (66,194) = 2.23$, $p < .001$, $R^2 = .105$], and SEM Dominance measures [$F = (66,194) = 2.08$, $p < .001$, $R^2 = .304$].

DISCUSSION

Extending previous research that suggested a relationship between BIS/BAS strength and an affective processing bias in "everyday life" (Gable et al., 2000), the present study was designed to help understand the mechanism underlying this relationship. Specifically, it was hypothesized that BAS and BIS strength, BIS/BAS ratio, and trait PA and NA would be related to person identification when viewing an interpersonal interaction. As expected, identification with the submissive character was associated with increased BIS. However, hypotheses involving BAS strength, PA, and NA were not supported.

Notably, identification with the submissive character was associated with decreased state PA and feelings of dominance (measured by both SAM and SD

questionnaires). Taken together, the findings suggest that persons with strong BIS sensitivity are particularly likely to empathize with persons in submissive, or compromised, positions. Please note that the effect of character identification on valence and dominance feelings are large, perhaps indicating that person identification in "real life" has robust effects on state affect.

One surprising finding of this study was the additional relationship between trait dominance (as measured by the TDS) and character identification. Post-hoc analyses of the TDS revealed that it was positively correlated with BAS and PA and inversely associated with BIS and NA. As part of his Pleasure-Arousal-Dominance (PAD) framework Mehrabian (1996) describes the Trait Pleasure-displeasure, Trait Arousability, and Trait Dominance-submissiveness scales as "nearly orthogonal" (p. 265). Indeed, among a group of 138 undergraduate students, a modest correlation of .15 was found between the Trait Pleasure-displeasure and Trait Dominance-submissiveness scales (Mehrabian, 1995); thus, the TDS was not expected to correlate significantly with the PANAS.

The present research suggests that BIS strength is associated with biased perception of interpersonal interactions, and that these biases may lead to decreased state PA and feelings of submissiveness. Future research may benefit from the incorporation of similar, "ambiguous" movies (i.e., that involve two distinct roles in a social interaction) and monitoring individual differences with regard to affective and physiological (e.g., cardiovascular, electroencephalographic) reactivity. Such investigation may produce considerable insight into how persons with high BIS (e.g., persons with anxiety) differentially experience identical stimuli and, perhaps, why such individuals experience an increased likelihood for cardiovascular disease (e.g., Denollet et al., 1996; Murray & Lopez, 1997). The videos selected for this research predominantly showed men (in both dominant and submissive postures), thus, the replication of this research using female characters appears warranted.

Last, participants were allowed to pick the person with whom to identify. This is a powerful measure of individual differences, however, one cannot say that the choice of identification *caused* differences in emotion ratings (particularly valence and dominance). The present findings are certainly consistent with such a possibility, especially given that identification explained a significant amount of variance even after controlling for individual differences in emotion ratings. A true experiment in which participants are randomly assigned to different identification roles would be the definitive method for demonstrating a causal role for person identification (albeit at the cost of losing information about individual differences).

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