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A person-oriented analysis of behavioral inhibition and behavioral activation in children

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Abstract

The goal of this study was to examine the socio-emotional functioning of groups of children who differed in their levels of behavioral inhibition system (BIS) and behavioral activation system (BAS) sensitivities. Participants were 95 (49 boys, 46 girls) children between the ages of 6 and 14 years ($M = 9.6$ years, $SD = 1.90$ years). Children completed a self-report of BIS/BAS, as well as assessments of social anxiety, depressive symptoms, positive and negative affect, and subjective well-being. Results indicated that BIS scores were significantly and positively associated with socio-emotional difficulties, whereas BAS scores were either unrelated or significantly and negatively associated with indices of maladjustment. Furthermore, results from person-oriented analyses indicated that children high in BIS and low in BAS sensitivity (i.e., avoidant) appeared to be at the greatest risk for psychosocial maladjustment. Results are discussed in terms of the importance of considering the joint contributions of BIS and BAS towards social functioning in childhood.

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1. Introduction

Gray (1972) proposed that there are two neurologically-based motivational systems that regulate approach and avoidance behavior, the behavioral inhibition system (BIS) and the behavioral activation system (BAS). Drawing upon this theory, Asendorpf (1990) proposed a conceptual model characterizing children's affiliative behaviors with peers in terms of the combination of social approach and social avoidance motivations. For example, he speculated that *avoidant* children (low in approach- and high in avoidance-motivations) would be particularly "at risk" for socio-emotional maladaptation. However, to date there have been virtually no empirical studies of avoidant children. In the present study, we used a person-oriented analysis to examine the socio-emotional functioning of groups of children who differed in their levels of BIS and BAS sensitivities.

1.1. *BIS and BAS: research with adults*

According to Gray (1987) the behavioral activation system (BAS) regulates approach behaviors, whereas the behavioral inhibition system (BIS) controls avoidant tendencies. BAS is responsive to appetitive stimuli (e.g., reward-like cues), contributes towards impulsiveness, and triggers approach behaviors and goal-directed activity. In contrast, BIS is sensitive to aversive stimuli (e.g., cues of punishment, novelty), causes avoidance behaviors, and can lead to feelings of fear and anxiety.¹ In studies with adults, BAS has been associated with trait measures of extraversion and positive affect, whereas BIS has been related to neuroticism, anxiety, depression and negative affect (Gable, Reis, & Elliot, 2000; Johnson, Turner, & Iwata, 2003; Jorm et al., 1999; Zelenski & Larsen, 1999).

Gray (1990) asserted that BIS and BAS function independently of one another. This is the *separable subsystems hypothesis* (SSH, Corr, 2001). More recently, it has been suggested that under certain conditions, BIS and BAS may act as interdependent systems and therefore jointly influence behavior (Kambouropoulos & Staiger, 2004; Smillie & Jackson, 2005). This notion has been labeled the *joint subsystems hypothesis* (JSH, Corr, 2002). In fact, Corr (2002) argued that the JSH is valid under typical human experimental conditions, and that the SSH would only be expected to apply to extreme personality groups or conditions of extreme appetitive or aversive stimuli. Particularly relevant for the present study, Corr (2002) postulated that individuals high in BIS and low in BAS would be most sensitive to punishment and experience the most negative affect.

1.2. *BIS and BAS: research with children*

There has been much less attention paid to the functioning of BIS and BAS in children. Much of the research has involved related constructs, including temperamental traits such as behavioral inhibition to the unfamiliar (Kagan, 1998) and self-regulation (Posner & Rothbart, 2000). For example, Putnam and Stifter (2005) recently found that the combination of negative emotionality and avoidance behavior in high intensity situations was significantly related to internalizing prob-

¹ It should be noted that the conceptualization of BIS/BAS in the current study does not take into account recent theoretical revisions proposed by Gray and McNaughton (2000).

lems in a sample of toddlers. There have only been a handful of studies where researchers have directly explored the correlates and outcomes of BIS and BAS sensitivity in children. These studies have typically employed laboratory tasks to assess BIS and BAS (e.g., Colder & O'Connor, 2004).

Blair (2003) used a newly developed parental rating scale of BIS/BAS to explore the associates of BIS and BAS in a sample of 42 preschool-aged children. Results were somewhat mixed: BIS sensitivity was positively related to teacher-reported social competence but negatively related to on-task behavior in the classroom; whereas BAS was unrelated to preschool outcomes. In a subsequent study, Blair, Peters, and Granger (2004) employed the same parental assessment preschoolers to explore the physiological and neuropsychological correlates of BIS and BAS in a sample of 170 preschoolers. Results indicated that BIS was positively related to cortisol increase (in response to a cognitive assessment session) and cognitive self-regulation (e.g., executive function). In contrast, BAS was related to cortisol decrease and negatively associated with cognitive self-regulation.

Most recently, Muris, Meesters, de Kanter, and Timmerman (2005) used a modified “age-downward” version (i.e., the wording of some items was simplified) of the Carver and White (1994) BIS/BAS scales as a self-report measure in a sample of 284 school-aged children (aged 8–12 years). Among their results, BIS was positively related to neuroticism, emotional problems, anxiety, and negatively related to extraversion; and BAS was positively associated with extraversion, hyperactivity and aggression.

Social approach and avoidance motivations. Drawing upon the early work of Gray (1972), Asendorpf (1990, 1993) proposed a theoretical model suggesting different psychosocial outcomes for children as a function of the combination of social approach and social avoidance motivations. According to this model, *sociable* children have low social avoidance and high social approach motivations, and are thought to be extraverted, gregarious, and frequent engagers in social activity. *Unsociable* children are low on both social approach and avoidance motivations, and are considered to have a preference for object-oriented solitary activities. *Shy* children have both high social approach and high social avoidance motivations. Such children are thought to suffer from an approach-avoidance conflict, whereby their desire to interact with peers is simultaneously inhibited by social fear and anxiety. Finally, *avoidant* children are thought to be low on social approach and high on social avoidance motivations. Asendorpf (1990) speculated that for these children, high levels of social anxiety might overpower what little approach tendencies they may have, and that avoidant children would be particularly at risk for social and emotional maladjustment.

To date this model remains largely untested empirically because of a lack of specific measures of social approach and social avoidance motivations in childhood. Recently, Coplan, Prakash, O'Neil, and Armer (2004) developed a parental rating scale based on Asendorpf's (1990) theory to distinguish between shyness and unsociability in preschool-aged children. Among their findings, shyness was associated with negative emotionality, teacher-rated anxiety and behavioral withdrawal, and observations of onlooking behaviors (i.e., watching others play without joining in) during free play at school. Onlooking behaviors are considered a behavioral marker of an approach-avoidance conflict (Coplan, Rubin, Fox, Calkins, & Stewart, 1994). In contrast, unsociability was related to higher attention-span, less negative emotionality, and a greater expressed preference for playing alone. Moreover, in preschool, unsociable children were also observed to make comparatively fewer social initiations to peers, and were rated by teachers as behaviorally withdrawn (but not anxious).

The conceptual parallels between Asendorpf's (1990) social motivations theory and Corr's (2002) joint subsystems hypothesis are apparent. However, to date, our review of the literature uncovered only one study that included a group of children that could be conceptually labeled as socially avoidant. In their previously described study of the physiological and neuropsychological correlates of BIS/BAS with preschoolers, Blair et al. (2004) also used parental ratings of BIS and BAS to create various groups of children. Children high in BAS (whether high or low in BIS) demonstrated lower baseline cortisol levels as compared to other groups of children. However, whereas children with high BAS and low BIS (i.e., sociable) displayed a decrease in cortisol levels throughout the duration of a cognitive testing session, children high in BAS and high in BIS (i.e., avoidant) displayed an increase in cortisol during testing. Higher levels of cortisol have been associated with indices of social wariness and anxiety in children (e.g., Schmidt et al., 1997).

1.3. *The current study*

The goal of the present study was to further explore the correlates of BIS and BAS in a sample of school-aged children. Given past research results related to BIS and BAS in adults and children, we expected that, overall, BIS would be associated with greater socio-emotional problems whereas BAS would be associated with more positive outcomes. Moreover, drawing upon the work of Asendorpf (1990) and Corr (2002), we hypothesized that children characterized by the combination of high BIS and low BAS sensitivities (i.e., avoidant) would demonstrate the greatest psychological maladjustment, particularly along the internalizing dimension.

2. Method

2.1. *Participants*

The participants in this study were 95 children (49 boys, 46 girls) attending local day camps in and around Ottawa, Ontario, Canada. Children were recruited through a package of information/consent letters sent home to the parents. The exact consent rate for participation was difficult to calculate because of children starting and ending camp at different points throughout the study. However, we estimated the consent rate to be about 60% (both parental and child consent were required for participation). Children ranged in age from 6 to 14 years ($M = 9.6$ years, $SD = 1.90$ years). Most participants (about 90%) were between the ages of 7–12 years.² The majority of children were Caucasian (71%), although Asians (8%) and Hispanics (7%) were also represented in the sample.

2.2. *Measures*

During small group testing sessions, children completed the *BIS/BAS Scales* (Carver & White, 1994). Two female experimenters were on hand to assist children as necessary. The 20 items are

² There were three 6-year-olds, six 13-year-olds, and one 14-year-old in the sample. Analyses were also conducted without the inclusion of these 10 children. Since results were virtually identical, the analyses utilizing the entire sample are presented.

scored from 1 (“very false for me”) to 4 (“very true of me”). It should be noted that one item on BIS subscale is reversed scored (i.e., “Even if something is bad is about to happen to me, I rarely experience fear or nervousness”). The BIS/BAS Scales have been shown to have good validity and reliability in adult samples, and typically demonstrate a four-factor solution: BIS, BAS Reward responsiveness, BAS Drive, and BAS Fun seeking (e.g., Carver & White, 1994). Muris et al. (2005) recently reported a two-factor solution (i.e., BIS and BAS) and good psychometric properties for the BIS/BAS Scales in a sample of 284 children aged 8–12 years. In the current sample, internal consistency scores were $\alpha = 0.66$ for BIS, and $\alpha = 0.75$ for BAS.³

Children also completed the *Child Depression Inventory* (CDI, Kovacs, 1980/1981), a 27-item self-report questionnaire commonly used to assess depressive symptoms. In the present study, the item regarding suicidal ideation was omitted because of ethical concerns. Items scores (rated on a 3-point scale) are summed to create a summary score of depression. In the current sample, the internal consistency of the CDI was $\alpha = 0.85$.

The *Positive Affect and Negative Affect Schedule for Children* (PANAS-C; Laurent et al., 1999) was used to assess self-reported trait affect. The PANAS-C consists of 15 items (rated on a 5-point scale) assessing positive (PA) and negative affect (NA). In the current sample, internal consistency scores for the PANAS-C subscales were: $\alpha = 0.88$ for NA and $\alpha = 0.69$ for PA.

The *Social Anxiety Scale for Children – Revised* (LaGreca, 1998) was used to assess child anxiety, and consists of 22 items (rated on a 5-point scale) divided into three subscales: fear of negative evaluation (FNE), social avoidance/distress in meeting new situations and unfamiliar people (SAD-New), and generalized social avoidance/distress (SAD-General). In the current sample, internal consistency scores for the subscales were: $\alpha = 0.87$ for FNE, $\alpha = 0.70$ for SAD-New, and $\alpha = 0.69$ for SAD-General.

Finally, children completed a measure of general well-being developed by Allison and Furstenberg (1989), 10 items (rated on a 5-point scale) assessing satisfaction and distress in children. In the current sample, the total scale score of subjective well-being had an internal consistency coefficient of $\alpha = 0.74$.

3. Results

3.1. Preliminary analyses

There were no significant sex differences in BIS and BAS scores, or for any of the outcome variables assessed in this study. The correlation between BIS and BAS approached significance ($r = 0.17$, $p = 0.09$).

Correlations between BIS and BAS scores and socio-emotional outcome variables are displayed in Table 1. Following Muris et al. (2005), we controlled for the (albeit modest) association

³ The internal consistency scores in our sample were notably lower than those reported by Muris et al. (2005): $\alpha = 0.78$ for BIS, $\alpha = 0.81$ for BAS. In their study, Muris et al. used an “age-downward” version of the BIS/BAS Scale, with simplified wording on several items. In our study, the original wording was employed. It is possible that some children had difficulty understanding some of the items, which may have contributed towards the lower internal consistency scores.

between BIS and BAS scores by computing partial correlations (i.e., correlations between BIS and outcome variables were computed while controlling for BAS scores, correlations between BAS and outcome variables were computed while controlling for BIS scores).

Results were for the most part in predicted directions. For example, BIS was significantly and positively associated with depressive symptoms, negative affect, and all three social anxiety subscales, as well as significantly and negatively related to subjective well-being. In contrast, BAS was significantly and negatively related to depression, negative affect, fear of negative evaluation, and generalized social avoidance and distress.

3.2. Person-oriented analysis

Drawing upon the theoretical work of Asendorpf (1990), and following the procedures outlined by Blair et al. (2004), children were divided into four groups based on median splits of both BIS and BAS. *Shy* children ($n = 33$) were above the median on both BIS and BAS ($M_{\text{BIS}} = 3.11$, $SD = 0.36$; $M_{\text{BAS}} = 3.32$, $SD = 0.25$); *unsociable* children ($n = 26$) were below the median on both BIS and BAS ($M_{\text{BIS}} = 2.21$, $SD = 0.31$; $M_{\text{BAS}} = 2.61$, $SD = 0.33$); *sociable* children ($n = 17$) were below the median on BIS and above the median on BAS ($M_{\text{BIS}} = 2.30$, $SD = 0.38$; $M_{\text{BAS}} = 3.34$, $SD = 0.20$); and finally *avoidant* children ($n = 20$) were above the median on BIS and below the median on BAS ($M_{\text{BIS}} = 3.09$, $SD = 0.35$; $M_{\text{BAS}} = 2.60$, $SD = 0.36$).

The first analyses concerned group differences in internalizing problems. A MANOVA was performed with Group serving as the independent variable, and depressive symptoms, negative affect, and the three social anxiety subscales (fear of negative evaluation, social avoidance/distress in meeting new situations and unfamiliar people, generalized social avoidance/distress) serving as dependent variables. Results indicated a significant multivariate effect for Group (Wilks' $\Lambda = 0.737$, $F(15, 240.57) = 1.875$, $p < 0.05$). Results from follow-up univariate analyses indicated

Table 1
Partial correlations between BIS/BAS and outcome variables

	BIS	BAS
Depressive symptoms	0.42***	-0.26**
Affect		
Positive	-0.05	0.11
Negative	0.41***	-0.27**
Social anxiety		
FNE	0.48***	-0.25*
SAD-New	0.42***	-0.19†
Sad-General	0.27**	-0.21*
Well-being	-0.29**	0.07

FNE: fear of negative evaluation; SAD-General: general social avoidance and distress; SAD-New: social avoidance and distress to new situations and unfamiliar people.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

† $p < 0.07$.

Table 2
Means (SD's) of child outcome variables for each group

Variable	Group			
	<i>Avoidant</i> (n = 20)	<i>Shy</i> (n = 32)	<i>Unsociable</i> (n = 26)	<i>Sociable</i> (n = 17)
Depressive symptoms	0.48 _a (0.29)	0.29 _b (0.23)	0.21 _b (0.18)	0.22 _b (0.19)
Negative affect	2.15 _a (0.82)	1.80 _b (0.66)	1.63 _b (0.53)	1.66 _b (0.48)
Fear negative evaluation	3.16 _a (1.09)	2.62 _b (0.92)	2.35 _{bc} (0.97)	2.00 _c (0.87)
Positive affect	3.51 _a (0.56)	3.83 _b (0.49)	3.85 _b (0.39)	3.79 _b (0.43)
Well-being	3.67 _a (0.94)	4.18 _b (0.54)	4.36 _b (0.36)	4.29 _b (0.45)

FNE: fear of negative evaluation; SAD-General: general social avoidance and distress; SAD-New: social avoidance and distress to new situations and unfamiliar people means with different subscripts differ significantly at the 0.05 level.

a significant main effect of Group for depressive symptoms ($F(3, 91) = 5.855, p < 0.001$), negative affect ($F(3, 91) = 2.960, p < 0.05$), and fear of negative evaluation ($F(3, 91) = 4.912, p < 0.01$).

Relevant means are displayed in Table 2. Results from follow-up post hoc analyses (LSD) indicated that the *avoidant* group scored significantly higher than all other groups in terms of depressive symptoms, negative affect, and fear of negative evaluation.

The final analyses concerned group differences in positive outcomes. A MANOVA was performed with Group serving as the independent variable, and positive affect and subjective well-being serving as dependent variables. Results again indicated a significant multivariate effect for Group (Wilks' $\Lambda = 0.803, F(6, 176) = 3.409, p < 0.01$). Results from follow-up univariate analyses indicated a significant main effect of Group for both positive affect ($F(3, 89) = 2.815, p < 0.05$) and well-being ($F(3, 89) = 5.583, p < 0.001$).

Relevant means are displayed in Table 2. Results from follow-up post hoc analyses (LSD) indicated that the *avoidant* group scored significantly lower than all other groups in terms of both positive affect and well-being.

4. Discussion

The results from the present study provide some additional evidence of the functioning of the behavioral inhibition and behavioral activation systems in children. Overall, our findings indicated a conceptually similar pattern of associations between BIS and socio-emotional functioning in childhood as has been evidenced by previous research with adults. The findings for BAS were somewhat less consistent, perhaps supporting the argument that BAS may be less well developed in children. Moreover, strong evidence was found in support of Corr's (2002) joint subsystems hypothesis and Asendorpf's (1990) social motivations model. Avoidant children, who were characterized by both high BIS and low BAS evidenced the most profound psychosocial maladjustment.

4.1. Childhood correlates of BIS and BAS

As discussed earlier, in only a handful of studies have researchers attempted to directly assess BIS and BAS in children, with most researchers using laboratory assessments (e.g., Colder &

O'Connor, 2004) or parental ratings (e.g., Blair, 2003). Consistent with the previous study by Muris et al. (2005), our results support the notion that children can also provide valid *self-reports* of BIS and BAS functioning, even when the original item wording is employed from the BIS/BAS items (Carver & White, 1994).

In the present study, child self-reports of BIS sensitivity were significantly associated with increased depressive symptoms, greater negative affect and social anxiety, and less positive reports of subjective well-being. These findings are certainly consistent with previous results with adults (e.g., Johnson et al., 2003) and the few recent studies with children (e.g., Muris et al., 2005). Thus, there is converging evidence that BIS sensitivity may influence socio-emotional functioning in a similar manner for children as it does in adults.

Jorm et al. (1999) have argued that the BIS subscale (from the BIS/BAS Scales, Carver & White, 1994) is primarily a measure of neuroticism and negative-affectivity. Thus, children with highly activated BIS would be more likely to avoid aversive stimuli because of feelings of fear and anxiety and subsequently already seem at risk for internalizing problems. Moreover, the negative outcomes associated with elevated avoidance tendencies may become exacerbated by the potentially stressful context of elementary school. For example, if children frequently avoid stressful social situations at school, they become more susceptible to social isolation. In and of itself, social isolation in childhood is associated with a host of psychological and school-related difficulties (Rubin, Coplan, Chen, Buskirk, & Wojslawowicz, 2005). Thus, there appears to be some cause for concern for children who have extremely activated behavioral inhibition systems, especially considering its relations with depressive symptoms, social anxiety, negative feelings, and lower perceived well-being.

The linear associations found for BAS in the present study were somewhat less consistent with previous research results. As expected, BAS was significantly *negatively* associated with indices of internalizing problems. However, we did not find significant positive relations between BAS and subjective well-being or positive affect. Previous research with adults has suggested that BAS functioning is related to positive affect (e.g., Gable et al., 2000). However, the relationship between negatively valenced traits (e.g., neuroticism and BIS) and well-being may simply be stronger than the relationship between positively valenced traits (e.g., extraversion and BAS) and well-being (DeNeve & Cooper, 1998; Vitterso, 2001).

Aside from positive affect, BAS has also been associated with extraversion in both adults (Zelenski & Larsen, 1999) and children (Muris et al., 2005). However, there is also a growing body of research indicating associations between BAS and more negative outcomes in adults, including eating disorders, alcohol abuse, anger, and aggression (Harmon-Jones, 2003; Kane, Loxton, Staiger, & Dawe, 2004). Similarly, Muris et al. (2005) reported positive associations between BAS and both hyperactivity and aggression in their sample of school-aged children. It should be noted that conceptually relevant “negative” outcome variables more specifically related to BAS (i.e., aggression) were not assessed in the present study.

BAS has been less consistently associated with predicted outcomes in the few studies with children. This has led some researchers to suggest that BAS is less clearly manifested in children and youth (Blair, 2003; Muris et al., 2005). Thus, children may not show the same emotional associations simply because the behavioral activation system is still developing. Alternatively, behavioural activation needs to be viewed within the context of a child's social world. For example, as noted in Blair (2003), behaviors associated with high BAS may not be acceptable

in the school environment. Children with high BAS may show more motor activity and behavioral expression which sometimes can be viewed by teachers as disruptive. This may result in a child receiving negative feedback from their environment instead of feelings of reward. This negative feedback may interrupt the pathway to positive affect that has been demonstrated in adults.

Alternatively, BAS functioning may be associated with other more positive outcomes in children that have yet to be assessed. For example, given their potentially gregarious nature, children with more highly active BAS may engage in more positive social activities, tend to be more popular and well-liked among peers, and demonstrate leadership skills. Clearly, future research is required to further explore these speculations.

Avoidant children. Asendorpf (1990) speculated that avoidant children, who were high in social avoidance motivations and low in social approach motivations would be particularly at risk for psycho-social maladaptation. To our knowledge, the present study represented the first attempt to directly assess this hypothesis. Our results provided strong empirical support for this assertion. As compared to other groups, avoidant children (who were high in BIS and low in BAS) reported significantly more depressive symptoms, negative affect, and social anxiety, and significantly less positive affect and subjective well-being. These findings suggest that the *interaction* between BIS and BAS may be particularly important to explore with children. This is consistent with the BIS/BAS joint subsystems hypothesis (Corr, 2002) in research with adults.

Although these results are clearly preliminary in nature, they have the potentially important implications for identifying children who may benefit from ameliorative intervention programs. Previous explorations of Asendorpf's (1990) theoretical model have focused on differences between shy (high social approach, high social avoidance motivations) and unsociable (low approach, low avoidance) children (e.g., Coplan et al., 2004). Results from such studies have suggested that shy children are at risk for psychosocial maladaptation, particularly along the internalizing dimension. However, our findings suggest that avoidant children may in fact be at an even *greater* risk. This notion clearly warrants further empirical investigation.

5. Conclusions

Results from the present study suggest that the BIS/BAS scales (Carver & White, 1994) can provide a valid assessment of behavioral inhibition and behavioral activation in school-aged children. However, our results should be treated as preliminary in nature, particularly given our relatively small sample size. As well, the sole reliance on self-report measures could have inflated associations between variables because of shared method variance. Moreover, longitudinal studies are required to better elucidate the relations between BIS/BAS and child adjustment.

Nevertheless, our findings did indicate that BIS was associated with greater internalizing problems and lesser well-being, whereas BAS was negatively related to indices maladjustment. Perhaps most importantly, our results suggest that children with the combination of both high BIS and low BAS were particularly at risk for socio-emotional maladaptation. Future researchers should continue to explore the associates of BIS and BAS (and their various combinations) in childhood.

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References

- Allison, P. D., & Furstenberg, F. F. (1989). How marital dissolution affects children: variations by age and sex?. *Developmental Psychology*, *25*, 540–549.
- Asendorpf, J. (1990). Beyond social withdrawal: shyness, unsociability and peer avoidance. *Human Development*, *33*, 250–259.
- Asendorpf, J. (1993). Abnormal shyness in children. *Journal of Child Psychology and Psychiatry*, *34*, 1069–1081.
- Blair, C. (2003). Behavioural inhibition and behavioural activation in young children: relations with self-regulation and adaptation to preschool in children attending head start. *Developmental Psychobiology*, *42*, 301–311.
- Blair, C., Peters, R., & Granger, D. (2004). Physiological and neuropsychological correlates of approach/withdrawal tendencies in preschool: further examination of the behavioral inhibition system/behavioral activation system scales for young children. *Developmental Psychobiology*, *45*, 113–124.
- Carver, C. S., & White, T. L. (1994). Behavioural inhibition, behavioural activation, and affective responses to impending reward and punishment: the BIS/BIS Scales. *Journal of Personality and Social Psychology*, *67*, 319–333.
- Colder, C. R., & O'Connor, R. M. (2004). Gray's reinforcement sensitivity model and child psychopathology: laboratory and questionnaire assessment of the BAS and BIS. *Journal of Abnormal Child Psychology*, *32*, 435–451.
- Coplan, R. J., Prakash, K., O'Neil, K., & Armer, M. (2004). Do you 'want' to play? Distinguishing between conflicted-shyness and social disinterest in early childhood. *Developmental Psychology*, *40*, 244–258.
- Coplan, R. J., Rubin, K. H., Fox, N. A., Calkins, S. D., & Stewart, S. L. (1994). Being alone, playing alone, and acting alone: distinguishing among reticence, and passive- and active-solitude in young children. *Child Development*, *65*, 129–138.
- Corr, P. J. (2001). Testing problems in J.A. Gray's personality theory: a commentary on Matthews and Gilliland (1999). *Personality and Individual Differences*, *30*, 333–352.
- Corr, P. J. (2002). J.A. Gray's Reinforcement Sensitivity Theory: tests of the joint subsystems hypothesis of anxiety and impulsivity. *Personality and Individual Differences*, *33*, 511–532.
- DeNeve, K. M., & Cooper, H. (1998). The happy personality: a meta-analysis of 137 personality traits and subjective well-being. *Psychological Bulletin*, *124*, 197–229.
- Gable, S. L., Reis, H. T., & Elliot, A. J. (2000). Behavioural activation and inhibition in everyday life. *Journal of Personality and Social Psychology*, *78*, 1135–1149.
- Gray, J. A. (1972). The psychophysiological Nature of Introversion-Extraversion: a modification of Eysenck's Theory. In V. D. Nebylitsyn & J. A. Gray (Eds.), *Biological bases of individual behaviour*. New York and London: Academic Press.
- Gray, J. A. (1987). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. Oxford, England: Oxford University Press.
- Gray, J. A. (1990). Brain systems that mediate both emotion and cognition. *Cognition and Emotion*, *4*, 269–288.
- Gray, J. A., & McNaughton, N. (2000). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system* (2nd ed.). Oxford, England: Oxford University Press.
- Harmon-Jones, E. (2003). Anger and the behavioral approach system. *Personality and Individual Differences*, *35*, 995–1005.
- Johnson, S. L., Turner, R. J., & Iwata, N. (2003). BIS/BAS levels and psychiatric disorder: an epidemiological study. *Journal of Psychopathology and Behavioral Assessment*, *25*, 25–36.
- Jorm, A. F., Christensen, H., Henderson, A. S., Jacomb, P. A., Korten, A. E., & Rodgers, B. (1999). Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: factor structure, validity and norms in a large community sample. *Personality and Individual Differences*, *26*, 49–58.

- Kagan, J. (1998). Biology and the child. In N. Eisenberg (Vol. Ed.) & W. Damon (Ed.), *Handbook of child psychology: Vol. 3. Social, emotional and personality development* (5th ed., pp. 177–235). New York: Wiley.
- Kambouropoulos, N., & Staiger, P. K. (2004). Personality and responses to appetitive and aversive stimuli: the joint influence of behavioural approach and behavioural inhibition systems. *Personality and Individual Differences*, *37*, 1153–1165.
- Kane, T. A., Loxton, N. J., Staiger, P. K., & Dawe, S. (2004). Does the tendency to act impulsively underlie and alcohol use problems? An empirical investigation. *Personality and Individual Differences*, *36*, 83–94.
- Kovacs, M. (1980/1981). Rating scales to assess depression in school-aged children. *Acta Paedopsychiatrica*, *46*, 305–315.
- LaGreca, A. M. (1998). *Manual for the social anxiety scale for children and adolescents*. Coral Gables, FL: Author.
- Laurent, J., Catanzaro, S., Joiner, T., Rudolph, K., Potter, K., Lambert, S., et al. (1999). A measure of positive and negative affect for children scale development and preliminary validation. *Psychological Assessment*, *11*, 326–338.
- Muris, P., Meesters, C., de Kanter, E., & Timmerman, P. E. (2005). Behavioural inhibition and behavioural activation system scales for children: relationships with Eysenck's personality traits and psychopathological symptoms. *Personality and Individual Differences*, *38*, 831–841.
- Posner, M., & Rothbart, M. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology*, *12*, 427–441.
- Putnam, S. P., & Stifter, C. A. (2005). Behavioral approach-inhibition in toddlers: prediction from infancy, positive and negative affective components, and relations with behavior problems. *Child Development*, *76*, 212–226.
- Rubin, K. H., Coplan, R. J., Chen, X., Buskirk, A., & Wojslawowicz, J. (2005). Peer relationships in childhood. In M. Bornstein & M. Lamb (Eds.), *Developmental science: An advanced textbook* (5th ed.). Hillsdale, NJ: Erlbaum.
- Schmidt, L. A., Fox, N. A., Rubin, K. H., Sternberg, E. M., Gold, P. W., Craig, C., et al. (1997). Behavioral and neuroendocrine responses in shy children. *Developmental Psychobiology*, *30*, 127–140.
- Smillie, L. D., & Jackson, C. J. (2005). The appetitive motivation scale and other BAS measures in the prediction of Approach and Active Avoidance. *Personality and Individual Differences*, *38*, 981–994.
- Vitterso, J. (2001). Personality traits and subjective well-being: emotional stability, not extraversion, is probably the important predictor. *Personality and Individual Differences*, *31*, 903–914.
- Zelenski, J. M., & Larsen, R. J. (1999). Susceptibility to affect: a comparison of three personality taxonomies. *Journal of Personality*, *67*, 761–791.