Differentiation Between Low Positive Affectivity and Behavioral Inhibition in Preschool-Age Children: A Comparison of Behavioral Approach in Novel and Non-Novel Contexts

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Abstract

The temperament constructs of low positive affectivity (PA) and high behavioral inhibition (BI) overlap and are often not differentiated in the research literature. In particular, both constructs are characterized by low approach and engagement. However, current theoretical conceptualizations of these constructs suggest that low PA should be associated with low approach across most contexts, whereas BI should be associated with low approach only in novel situations. The present study used laboratory measures of child temperament and behavior to test these hypotheses in a sample of 100 preschool-age children. Results indicated that in novel situations, both lower positive affect and higher BI predicted low behavioral approach. However, in non-novel situations, only lower levels of positive affect predicted lower levels of approach; BI was not related to approach behavior in more familiar contexts. In conclusion, this study indicates that the overlap between the temperament traits of low PA and high BI is limited to novel contexts and that these constructs are distinguished by behavior in non-novel situations.

Keywords

positive affect; behavioral inhibition; temperament

Temperament has been defined as largely biologically-based individual differences in behavioral and emotional reactivity and regulation. These differences are considered to be relatively stable over time and are thought to shape the way individuals adapt to environmental circumstances (Rothbart, Ahadi, & Evans, 2000, Clark & Watson, 1999). Research has explored the role of temperament in the development of personality as well as the emergence of psychopathology. However, further progress in the field requires sharpening the distinctions between several key, but overlapping, temperament constructs.

Two of the main dimensions on which major models of temperament have focused include positive affectivity (PA) and negative affectivity (NA) (Watson & Tellegen, 1985; Rothbart & Bates, 2006). In addition, Kagan (1997) and others (e.g., Fox et al., 2005) have developed an influential line of research examining the origins and developmental course of the construct of behavioral inhibition (BI). Although these constructs have distinct features, they also share some common behavioral traits that can create difficulties in distinguishing among them.

Specifically, low PA and high BI share the common feature of low behavioral approach/ engagement (Durbin, Klein, Hayden, Buckley, & Moerk, 2005; Pfeifer, Goldsmith, Davidson, & Rickman, 2002).

The construct of PA includes positive mood states, sociability, and engagement with the environment (Clark & Watson, 1991). For the purposes of this paper, we use PA to refer to the temperament construct of positive affectivity, and we use the term "positive affect" to refer specifically to the affective component of the broader PA construct. Thus, children with low PA tend to exhibit low levels of positive affect, social interactions, and appetitive behavior when interacting with stimuli and people in their environment. The construct of BI includes high negative affect (especially fear), low approach, and high constraint (Kagan, 1997). Children with high BI tend to be wary, hesitant, and fearful in unfamiliar contexts and with unfamiliar adults and peers. Although both constructs share low approach as a core feature, the underlying motivation and eliciting contexts are presumed to differ. In low PA, approach deficits should be exhibited across contexts in that the low approach reflects chronically low levels of motivation to engage the environment. In contrast, the low approach that characterizes BI should be limited to unfamiliar situations as BI is hypothesized to emerge from a system responsible for generating responses to novelty and threat.

Other researchers have distinguished between similar sets of constructs. Putnam and Stifter (2005) recently drew on Gray's (1982) motivational systems theory to hypothesize that low approach in infants and toddlers could be due to either an underactive behavioral approach system (BAS), which is linked to low PA, or an overactive behavioral inhibition system (BIS), which is associated with NA, especially fear/anxiety. It should be noted, however, that the role of the BIS has been revised in more recent formulations of Gray's theory (Gray & McNaughton, 2000; McNaughton & Corr, 2004). Thus, McNaughton and Corr (2004) view the BIS as a conflict detection system associated with anxiety that modulates both the BAS in regulating approach behavior in reward-related contexts and the flight/fight system in regulating avoidance behavior in fear-eliciting contexts

A number of investigators have distinguished between two groups of socially withdrawn children: a shy-conflicted, reticent group that wishes to engage in peer interactions but withdraws due to fear and anxiety; and a passive-solitary, disinterested group that withdraws due to a lack of desire for social interactions (Asendorpf, 1990; Coplan, Prakash, O'Neil, & Armer, 2004; Coplan, Rubin, Fox, Calkins, & Stewart, 1994; Harrist, Zaia, Bates, Dodge, & Pettit, 1997). Importantly, these subgroups have been shown to differ on a number of variables, including maternal reports of social fear, NA, and attention span; teacher ratings of anxiety; child ratings of perceived competence; EEG alpha power; and respiratory sinus arrhythmia (Coplan et al., 2004; Henderson, Marshall, Fox, & Rubin, 2004).

Unfortunately, studies often fail to distinguish between high BI and low PA. Laboratory observational measures of BI frequently include markers of PA, such as smiling and laughter (e.g., Gest, 1997; Kagan, Snidman, & Arcus, 1998). In addition, many studies have conceptualized BI and PA as the opposite ends of a single dimension, defined by high BI at one end and high PA/exuberance at the other (Polak-Toste & Gunnar, 2006). However, laboratory observations of temperament in young children indicate that BI and PA are empirically distinct and almost orthogonal dimensions (Durbin et al., 2005; Pfeifer et al., 2002). Failure to distinguish these traits both conceptually and methodologically may result in difficulties integrating findings from studies as well as understanding the possible differential trajectories of these temperament constructs. For example, temperament traits of BI and PA may have important roles in the development of later psychopathology. Research has suggested that low PA may be specific to depression (Clark & Watson, 1991), whereas BI has been

proposed to be an early temperamental precursor of later anxiety disorders (Fox et al., 2005; Kagan, 1997).

The present study seeks to extend the literature on the relationship between BI and PA by testing the core proposition that these constructs reflect distinct patterns of motivation as indicated by differences in their eliciting contexts. Specifically, we hypothesized that higher levels of BI and lower levels of PA would both predict low approach behavior in novel situations, but only lower levels of PA would predict low approach in non-novel contexts. We tested these hypotheses in a sample of 100 preschool-age children using a comprehensive battery of laboratory measures of temperament and behavior.

Method

Participants

Participants included 100 children (53 males and 47 females) from a suburban community. The mean age of the children was 3.57 years ($SD = .3$). The mean age of parents was 33.6 years ($SD = 4.3$) for mothers and 36.4 years ($SD = 5.2$) for fathers. Participants were recruited via a commercial mailing list (52.1%) and preschool bulletin board/newspaper advertisements (47.9%). Participants were 85% Caucasian and came from mainly working and lower-middle class families, as measured by the Hollingshead's Four Factor Index of Social Status (Hollingshead, 1975; M=34.9; SD=9.9). The vast majority (97.0%) of the children came from two-parent homes, and 58.2% of the mothers worked outside the home part- or full-time. Children were administered the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997) to screen for gross cognitive impairment ($M = 103.5, SD = 13.9$). Participant families were given a complete description of the study, after which written informed consent was obtained. The families were compensated monetarily for their participation.

Assessment Procedures

Laboratory Assessment—The laboratory visit consisted of the children's participation in a standardized set of twelve episodes from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995), lasting approximately two hours. The twelve episodes were designed to elicit different behaviors and emotions. The episodes in the Lab-TAB were drawn from previous studies that examine a number of research questions related to child development and emotionality (e.g., Kochanska & Knaack, 2003; Pfeifer et al., 2002). The children returned to a neutral state in between each episode by taking a short play break. Each episode was videotaped through a one-way mirror and later coded. Parents remained in the room for all episodes except for Stranger Approach and Box Empty. Below is a description of each episode and what each was designed to elicit:

Risk Room (BI, activity)—The child explored a set of novel and ambiguous stimuli (e.g. cloth tunnel, balance beam, Halloween mask, etc.).

Tower of Patience (inhibitory control, interest)—The child and experimenter alternated turns building a tower together with large blocks. During each of her turns, the experimenter increased delays in placing her block on the tower, thus making the child wait.

Arc of Toys (positive affect, interest, negative affect)—The child was allowed to play with toys for a few minutes, after which the experimenter asked the child to clean up the toys.

Stranger Approach (BI)—While the experimenter went to get more toys, a male research assistant entered the room where the child waited alone and spoke to the child in a neutral tone while gradually walking closer (Afterwards, the experimenter re-entered and asked the child

if there was a man in the room and what he was like. The experimenter told the child it was her friend who was looking for some papers and then proceeded to open the door and greet the stranger).

Car Go (positive affect, interest)—The child and experimenter raced remote controlled cars.

Transparent Box (persistence, interest, negative affect)—The child selected a toy, which was then locked in a transparent box. The child was then left alone in the room with a set of incorrect keys to use to open the box. After a few minutes, the experimenter returned, gave the child the correct key, and encouraged the child to use the new key to open the box and play with the toy.

Pop-up Snakes (positive affect)—The child and experimenter surprised the child's mother with a can of potato chips that actually contained coiled toy snakes.

Snack Delay (inhibitory control)—The child was instructed to wait for the experimenter to ring a bell before eating a snack. The experimenter systematically delayed ringing the bell.

Impossibly Perfect Green Circles (negative affect, persistence)—The child was instructed to repeatedly draw a circle on a large piece of paper. After each drawing, the circle was mildly criticized.

Popping Bubbles (positive affect, interest)—The child and experimenter played with a bubble-shooting toy.

Painting a Picture (positive affect)—The child played with watercolor pencils and crayons.

Box Empty (negative affect)—The child was given a present to unwrap, in which nothing was inside. After the child discovered the box was empty, the experimenter returned with several small toys for the child to keep.

Although all episodes were somewhat novel to children in that they took place in an unfamiliar laboratory setting, only two (i.e., Risk Room and Stranger Approach) were explicitly designed to elicit wariness, hesitancy, and fear. These episodes, which are similar to the episodes used in most laboratory studies of BI (Kagan, 1997; Pfeifer et al., 2002), were included as novel situations for this study. The remaining 10 episodes, which were similar to play situations that young children frequently participate in, were characterized as non-novel.

Tape Coding Procedures—Coding procedures followed those in previous studies (Durbin et al., 2005, Olino, Klein, Durbin, Hayden, & Buckley, 2005). Both a micro-level and global-level coding method were employed, each using different coders. The micro-level coding, based on Goldsmith et al. (1995), consisted of coding highly specific behaviors and emotions at 20–30 second intervals for each episode. A summary variable was computed for each variable coded in each episode by computing average ratings over the entire episode. Aggregate variables were then computed as averages across all episodes that coded that variable.

The global-level coding was similar to that of the micro-level coding; however, only a single rating was made per episode. This single global rating was based on all behaviors thought to be relevant to each dimension during that episode. The scoring developed for these assessments have been related to independent home observations and have shown moderate stability over time (Durbin, Hayden, Klein, & Olino, 2007).

For the present analyses, global ratings of positive affect were used. These ratings considered qualitative and quantitative aspects of displays of joy and enthusiasm. Positive affect was coded during all 12 episodes, regardless of whether that episode was specifically designed to elicit it. This decision was based on the rationale that children may display positive affect in many contexts and not just those intended to elicit high positive affect. Thus, ratings of bodily, facial, and vocal positive affect were each averaged across the 12 episodes. Next, averaged ratings of bodily, facial, and vocal positive affect were combined to yield a composite score of positive affect (α = .90). Interrater ICC for global coded positive affect was .84 (*N*=14).

Most previous studies of BI have employed a micro-coding approach, using a small number of episodes specifically designed to elicit BI (Kagan, 1997; Pfeifer et al., 2002). Thus, in order to compare the present findings to those in the BI literature, the present analyses used micro-coding of BI that incorporated variables from the two novel situations. Additionally, because, by definition, BI should only be evident in novel contexts, variables used to measure BI were only assessed and coded during the two novel episodes. From Risk Room, these variables included tentative play, latency to verbalize, total number of objects played with, and latency to touch objects. From Stranger Approach, variables included gaze aversion and avoidance of stranger. Variables included from both novel episodes were fearful facial, vocal, and bodily affect. The micro BI scale was an average of z-scored codes (α = .86; ICC = .85) from Risk Room and Stranger Approach.

Variables on which the constructs of PA and BI were hypothesized to overlap included activity, interest/engagement, and sociability. Global activity ratings were based on the quantity and quality of movement during each episode as well as the amount of vigor exhibited in the manipulation of stimuli. Global interest ratings were based on how engaged the child appeared in play. Global sociability ratings were based on the quality and quantity of the child's attempts to engage and interact with the experimenter and the parent. Interrater ICCs for activity, interest, and sociability were .75, .72, and .93 (*N*=14), respectively. Ratings of each variable were summed to form a composite behavioral approach scale (α = .69).

Data analysis

In order to eliminate overlap between variables, the PA variable used in this study was defined solely by positive affect; the BI variable was defined using specific behaviors derived from previous research; and the behavioral approach variable was defined using variables on which the constructs of PA and BI are hypothesized to overlap, with the exception of the affective component. While PA has generally been conceptualized as a dimensional variable in the literature (Clark & Watson, 1999), BI is often conceptualized as a categorical variable (Kagan, 1997). Hence, PA and BI were examined using both dimensional and categorical approaches. Multiple linear regressions were used for the dimensional analysis. Positive affect and BI were entered simultaneously into models predicting behavioral approach in novel and non-novel contexts. For the categorical analyses, a one-way analysis of variance (ANOVA) was used to compare three groups (low PA, high BI, comparison) on levels of behavioral approach, and subsequent planned comparisons were conducted.

Results

Differentiation of PA and BI using dimensional definitions

The zero-order correlation between positive affect and BI was small-moderate ($r = -.27$, $p = .008$). Data from the regression analyses are presented in Table 1. In the novel situations, the overall *F* value was significant, as were both the coefficients for positive affect and BI. In the non-novel situations, the overall *F* was significant; however, only the coefficient for positive affect was significant.

Differentiation of PA and BI using categorical definitions

We also conducted secondary analyses using categorical definitions of PA and BI. As described earlier, to eliminate overlap between the independent and dependent variables, the PA group was defined solely by positive affect, and the BI group was defined using specific behaviors derived from previous research. Using the global positive affect ratings, children who scored in the lowest 25% of the sample (N=11) were included in the low PA group. Children who scored in the highest 25% on BI (N=13) were included in the high BI group. A comparison group (N=27) was created consisting of those children who fell within both the highest 50% of positive affect scores and lowest 50% of BI scores. In order to create distinct groups of children with high BI and those with low positive affect, children who met criteria for both groups (N=12) were not included in the analyses. The three groups were compared on the composite behavioral approach variable (activity, interest, and sociability).

A one-way ANOVA was conducted to compare the three groups on levels of behavioral approach. Analyses yielded significant results for the overall ANOVA in both the novel (F [2,48] = 6.55, $p < .01$) and non-novel situations (F [2,48]= 14.97, $p < .001$). Group differences as well as means and standard deviations are presented in Table 2. Planned comparisons between each pair of groups were then conducted. For novel situations, there was a significant difference between the comparison and high BI groups (t [48] = −3.49, $p ≤.001$), reflecting a medium effect size (ES = .50), and a marginally significant difference between the comparison and low PA groups (t [48] = −1.98, $p = .05$), reflecting a small-medium effect size (ES = .33). There was no significant difference between the low PA and high BI groups (t [48] = −1.14, $p > .05$). Results for the non-novel situations revealed no significant difference between the comparison and high BI groups (t [48] = −1.32, $p > .05$). However, there was a significant difference between the comparison and low PA group (t [48] = −4.03, $p < .01$), reflecting a medium-large effect size (ES = .62), and a significant difference between the low PA and high BI groups (t [48] = 3.15, $p < .01$), reflecting a medium effect size (ES = .55).

Discussion

The temperament traits of low PA and high BI share the common characteristic of low behavioral approach/engagement with the environment (Durbin et al., 2005; Pfeifer et al., 2002); however, research has indicated that there may be different motivational tendencies underlying this phenotypic similarity (Putnam & Stifter, 2005; Henderson, Marshall, Fox, & Rubin, 2004). Specifically, in the BI literature, the lack of approach is hypothesized to reflect the presence of fearful inhibition (Kagan, 1997; Kagan et al., 1998). Children who are high in BI are thought to possess the motivation to approach other people and novel stimuli but have anxiety/fear about doing so. Research on child shyness and social withdrawal has shown that lack of approach may also emerge from social disinterest or the lack of desire to engage (Asendorpf, 1990). This latter motivation is consistent with the pattern we observed in children who exhibit low positive affect. However, past research on BI has generally not distinguished BI from low PA or has assumed that high PA and BI were the two poles of a single dimension, making it difficult to discern whether these two traits are associated with different patterns of approach behavior.

The present study sought to demonstrate that although low approach is common to both BI and low PA, specific contextual factors determine whether children low in PA or high in BI engage in approach behaviors with their surroundings. BI appears to dampen approach behaviors only in novel situations. In non-novel situations, children with low PA will continue to exhibit low approach, whereas children with high BI will exhibit approach behavior that is similar to comparison children who are neither low on PA nor high on BI.

Using a dimensional approach, results indicated that in novel situations, both lower positive affect and higher BI predicted low behavioral approach. However, in non-novel situations, only lower levels of positive affect predicted lower levels of approach; BI was not related to approach behavior in more familiar contexts.

Similar results were obtained using a categorical approach. In novel situations, the high BI group exhibited a significantly lower level of behavioral approach than the comparison group. The low PA group also displayed a marginally significantly lower level of approach than the comparison group. Importantly, the high BI and low PA groups did not differ on approach behavior in novel situations. This confirms the predicted overlap between these two temperament constructs in novel contexts and highlights the difficulty of distinguishing them when examined in an unfamiliar environment.

In contrast, in non-novel situations, the high BI and comparison groups did not differ, whereas the low PA group exhibited significantly lower levels of approach behavior than both of these groups. Thus, children with high BI and children with low PA can be distinguished with respect to approach behavior when examined using tasks that employ more familiar stimuli and situations.

These results parallel the findings of studies that have examined similar constructs related to social withdrawal (Putnam & Stifter, 2005). Furthermore, consistent with Pfeifer et al. (2002), the negative correlation between the constructs of PA and BI was quite modest in magnitude. This provides further evidence that they are not opposite ends of a single continuum as assumed in much past research (Polak-Toste & Gunnar, 2006).

This study adds to the small literature examining the relationship between PA/exuberance and BI, and it extends that literature by demonstrating that the overlap between the two constructs depends on the context in which they are observed. The study, however, had several limitations. First, the size of the sample was modest, limiting the power of the statistical comparisons, particularly using a categorical approach. Second, the sample was not diverse, thus limiting the population to whom findings may be generalized. Third, as this paper involved cross-sectional data, we were not able to examine the stability of the differences in PA and BI. Fourth, this study relied on laboratory measures of temperament traits. By including other measures, such as parent/teacher reports of temperament, or other observational contexts, such as the home or school, findings may be more generalizable to settings outside of the laboratory. Finally, this was a study of the internal construct validity of the distinction between PA and BI. Hence, we did not compare the associations between these constructs and theoretically relevant external variables. However, other studies have suggested that these constructs have differential associations with behavioral and psychophysiological variables and familial risk for psychopathology (Coplan et al., 2004; Durbin et al., 2005; Henderson et al., 2004). Additionally, research has shown a relationship between these temperament constructs and later psychopathology, specifically depression and anxiety (Clark & Watson, 1991; Fox et al., 2005; Kagan, 1997).

Taken together with the results in the present study, these data suggest that low PA and high BI can and should be differentiated. Conceptualizing PA and BI as opposite ends of a single dimension or including indices of PA in the measurement of BI may confound efforts to explore the individual differences associated with each construct. Moreover, by not considering the different motivations underlying a child's low approach, it may prove difficult to effectively address this behavior. By understanding the reasons behind a child's lack of approach, parents and teachers may be able to tailor their interaction styles appropriately to the individual needs of each child.

In conclusion, this study indicates that the overlap between the temperament traits of low PA and high BI is limited to novel contexts and that these constructs can be distinguished by measurement in non-novel situations. Low approach/engagement in BI is context-dependent and limited to novel situations, whereas it appears to be more generalized in low PA in that it is evident regardless of the familiarity of the context. These results suggest that low PA and high BI reflect different motivational systems and that future research should treat them as independent dimensions that likely have different developmental trajectories and are associated with different patterns of adjustment and functioning.

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Table 1

Simultaneous multiple regressions with behavioral approach as the criterion variable and positive affect and BI as the predictor variables

Novel Situations	β	sr	t	R^2	$F_{(2, 97)}$
Positive Affect	.33	.31	3.79[***]	.34	24.43[***]
BI	−.40	−.39	−4.66[***]		
Non-Novel Situations					
Positive Affect	.75	.73	11.17[***]	.59	70.12[***]
BI	−.06	−.05	−.84		

Note.

[*] = $p < .05$;

[**] = $p < .01$;

[***] = $p < .001$.

Table 2

Planned comparisons of the high BI, low PA, and comparison groups on behavioral approach in Novel and Non-Novel situations

Behavioral Approach	BI	Low PA	Control
Novel Situations M(SD)	4.54(1.71)[a]	5.20(1.74)[a]	6.21(1.10)[b]
Non-Novel Situations M(SD)	6.14(.55)[a]	5.03(1.06)[b]	6.39(.58)[a]

Note. Superscripts indicate differences at p≤ .05.