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# Personality and Behavior in Parents of Temperamentally Inhibited and Uninhibited Children

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Parents of children categorized as behaviorally inhibited or uninhibited at age 30 months were assessed on measures of affectivity, personality, and behavior. Parents of inhibited children showed lower extraversion, higher avoidance and shyness, and faster drawing times on a task involving uncertainty than did parents of uninhibited children. Faster speed on the uncertainty task was interpreted as evidence of increased anxious responding. The Extroversion, Avoidance, Shyness, and Sociability scales loaded heavily on a singe factor, the scores of which differed significantly by group. Child behavioral inhibition (BI) negatively correlated with maternal scores on the Extroversion scale and the extracted factor and positively correlated with maternal scores on the Avoidance scale. BI correlated with both maternal and paternal scores on the uncertainty task in the predicted direction. Low parental extraversion, high paternal avoidance and shyness, and parental tendency toward anxious responding were associated with BI in children.

The purpose of this study was to explore personality characteristics, affectivity, and motivational behavior in parents of behaviorally inhibited and behaviorally uninhibited children. This investigation is part of a larger program of research aimed at assessing proximal causes of, distal contributors to, and moderating influences on behavioral inhibition (BI) in children. Research efforts to address the proximal causes of this temperamental characteristic suggest that a biological diathesis gives rise to a coherent pattern of psychological organization that includes behavior, affect, and personality (Davidson, Finman, Rickman, Straus, & Kagan, 1994; Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984; Kagan, Reznick, & Snidman, 1987; Kagan, Reznick, & Snidman, 1988). Evidence for the distal contributors to BI, such as genetic and environmental factors, comes directly from studies of families with behaviorally inhibited children (Rosenbaum et al., 1988, 1991) and indirectly from studies of the genetic and environmental factors associated with personality characteristics related to BI (Plomin, 1986; Plomin, Chipuer, & Loehlin, 1990).

Parental personality, behavior, and affective style could influence child BI in several ways. Parent genetic loading for psychological measures related to BI (a distal contributor) could be transmitted directly to the child, with the child's genetic loading for these characteristics (a proximal contributor) mediating the correlation between parent variables and child temperament. Parent characteristics related to BI could be transmitted to the child by modeling or by creation of an environment that is conducive to development of particular characteristics (distal contributors), with the child's psychological organization being the proximal cause of child temperament. It is also possible for parent variables to differentially influence the development and persistence of BI, thus moderating the relation between a child's propensity toward and expression of BI. The design of this study precludes separation of parental moderating influences from parental distal contributors but helps identify parental factors that are associated with BI in children, thus providing directions for subsequent research efforts. In the interest of using simple prose, we use the terms *contribute* and *influence* interchangeably throughout this article to include both moderators and distal contributors.

## BI as a Temperamental Characteristic

The tendency of a child to exhibit BI in response to novelty is a well-characterized temperamental characteristic (Asendorpf, 1990, 1991; Kagan, Reznick, & Gibbons, 1989; Kochanska, 1991) that has developmental consequences for the lifetime of the individual (Caspi, Bem, & Elder, 1989; Caspi, Elder, & Bem, 1988; Kagan & Moss, 1962) that include an increased risk for psychiatric disorders (Biederman et al., 1990). Behaviorally inhibited children are characteristically shy and withdrawn in novel social interactions and show signs of increased anxiety in the face of novel challenges; they often retreat to within arm's reach of their mothers and refuse to engage in play behavior with strangers (Kagan et al., 1984; Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988). In experimental task situations in which behaviorally inhibited children are compared with behaviorally uninhibited children, the inhibited children make

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more discrimination errors on affect-laden pictures than on neutral pictures (Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988), are less likely to guess at difficult problems, and preferentially fixate on passive figures in stories (Kagan et al., 1984).

## Biological Profile

The physiology of behaviorally inhibited children has been found to differ from that of uninhibited children on measures of heart rate acceleration and pupil dilation, thus suggesting increased reactivity in the sympathetic nervous system (Kagan et al., 1984; Kagan, Reznick, & Snidman, 1987, 1988). Although BI itself is typically assessed after 1 year of age, infants classified at 4 months of age as displaying high levels of crying and motor activity when presented with visual and auditory stimuli are more likely to become inhibited children. These infants later show larger heart rate acceleration in response to aversive stimuli than do infants classified at 4 months as low crying and low motor activity (Kagan & Snidman, 1991). This pattern of heart rate acceleration is similar to that seen in inhibited children in response to stress, suggesting that the physiological profile associated with BI precedes the full behavioral profile itself.

In recent electrophysiological studies researchers have found increased relative right cortical activation in frontal regions in behaviorally inhibited children when compared with uninhibited children (Davidson et al., 1994), a pattern of cortical asymmetry similar to that seen in adult depressives (Henriques & Davidson, 1990, 1991) and in infants who cry during maternal separation (Davidson & Fox, 1989). This pattern has been interpreted as reflecting increased vulnerability to negative emotions (Davidson, 1992; Davidson & Tomarken, 1989).

## Genetic Heritability

The physiological differences between behaviorally inhibited and behaviorally uninhibited children point to a biological diathesis as the most salient proximal cause of the behaviorally inhibited temperamental profile. Results of studies conducted with twins indicate that this biological diathesis is likely to be partially under genetic control. Monozygotic twins show greater similarities in social responding to unfamiliar persons but not to familiar persons than do dizygotic twins (Plomin & Rowe, 1979). In addition, monozygotic twins show greater similarity in changes in inhibited behavior over time than do dizygotic twins (Matheny, 1989). Additional evidence for the genetic heritability of personality characteristics related to behavioral inhibition comes from adoption studies that show that biological parent–adopted child correlations on measures of extraversion are consistently higher than adoptive parent–adopted child correlations (Plomin, 1986; Scarr, Webber, Weinberg, & Wittig, 1981). Similarly, correlations among measures of infant shyness and parental sociability and parental extraversion are strongest between parents and children in intact biological families, moderate among biological parent–adopted child pairs, and weakest between adoptive parent–adopted child pairs (Daniels & Plomin, 1985). In adoption-twin studies, which provide the most reliable estimate of the heritable genetic contribution to personality dimensions related to BI, researchers have estimated that genetic factors account for as much as 30% of the variance in measures of extraversion (a factor combining shyness, low sociability, and low impulsivity), as much as 25% of the variance in measures of neuroticism, as much as 20% of the variance in measures of sociability (the tendency to be with others), and from 30% to 37% of the variance in measures of emotionality as reflected in fear, anger, and distress (Plomin et al., 1990).

## Family Environment

Family environment, although confounded with genetic background, is also likely to contribute to the behaviorally inhibited profile seen in children. Personality characteristics theoretically related to BI, such as extraversion, neuroticism, and sociability, show statistically significant parent–child correlations in intact biologically related families (see Plomin, 1986, for a review). In family studies of BI, researchers have found that parents of children categorized as behaviorally inhibited have increased risk for phobias, social phobia in particular, and for recurrent anxiety disorders in childhood and adulthood when they are compared with controls and with parents of uninhibited children (Rosenbaum et al., 1991). In addition, BI in children is found more frequently among children of mothers with depression then among controls (Kochanska, 1991), and BI is found more frequently among children of parents with panic disorder or agoraphobia with and without comorbid major depression than among psychiatric controls (Rosenbaum et al., 1988). Taken together, these studies target both genetic and environmental factors as likely influences on BI in children.

## Hypotheses

If genetic and environmental factors together contribute to BI in children, then one would expect parents of inhibited children to show a psychological profile significantly different from that of parents of uninhibited children. In an attempt to identify factors associated with BI, we recruited parents of inhibited and uninhibited children participating in a longitudinal study of child temperament for an experimental session wherein electrophysiological and psychological variables were assessed. Analysis of the electrophysiological assessment is currently in progress and the results will be reported elsewhere (Rickman & Davidson, 1994).

For the psychological assessment, parents completed a measure of current state affect, a measure of general dispositional affect, an experimental task designed to assess motivational behavior, and six personality scales that assessed characteristics related to BI. We expected parents of inhibited children to report more negative affect during the laboratory session and in general than the parents of uninhibited children, whom we expected to report more positive affect during the laboratory session and in general. In a task assessing motivational behavior, we expected parents of inhibited children to behave similarly to anxious individuals. We also predicted that parents of inhibited children would have personality profile scores characterized by less extraversion, sociability, and impulsivity and more neuroticism, shyness, and avoidance than parents of uninhibited children. These hypotheses derive from research literature that

suggests a high degree of interrelatedness among measures of personality, emotional vulnerability, and motivation (Larsen & Diener, 1987; Larsen & Ketelaar, 1991; Patterson, Kosson, & Newman, 1987). Thus, there are likely to be significant correlations among these measures. A factor analysis was conducted on these data to assess the relation among these measures. Parents of inhibited and uninhibited children were compared on the resulting factor scores.

## Method

### *Subjects*

Subjects were recruited from a population of families participating in a longitudinal study of BI. Participants in the longitudinal study include 24 behaviorally inhibited children and 29 behaviorally uninhibited children identified on the basis of their behavior at age 30 months from an initial sample of 368 children. Same-sex pairs of children who were not known to each other were tested in a 25-min laboratory play session. Selection of BI measures was based on the work of Kagan et al. (1987). The children chosen for the behaviorally inhibited group exhibited extreme BI on multiple measures, including spending at least 9 min within arm's reach of their mothers and not playing, speaking for the first time late in the session, and showing wariness when confronted with novelty. The children chosen for the behaviorally uninhibited group showed extremely uninhibited behavior on multiple measures, including spending less than 30 s proximal to their mothers, speaking early in the session, and readily engaging in novel play activities (see Davidson et al., 1994, for details on child selection criteria).

Parents of inhibited and uninhibited children were recruited from the original longitudinal sample when their children were approximately 4 years old if they met the following criteria: the child is a continuing participant in the longitudinal study, the parents are legally married and living together, and neither parent has a known neurological disorder. One inhibited child and 1 uninhibited child discontinued participation in the study; 1 inhibited child and 3 uninhibited children could no longer participate because of geographical relocation; 2 sets of parents of inhibited children and 3 sets of parents of uninhibited children were divorced or separated; and 1 parent of an inhibited child was neurologically impaired due to a stroke. In addition, one family had fraternal twins participating in the study; both were uninhibited children. One twin was randomly selected to be included in this analysis. Thus, 19 families with inhibited children and 22 families with uninhibited children were eligible for this portion of the study and were contacted by letter and phone. Both the mother and the father were recruited. Of these, all parents of inhibited children (19 of 19 families) and all but 3 sets of parents of uninhibited children (19 of 22 families) agreed to participate. There were 8 girls and 11 boys among the inhibited children, and there were 7 girls and 12 boys among the uninhibited children. Two participants (1 father of an inhibited child, 1 father of an uninhibited child) were excluded from the analysis because they were diagnosed on the basis of Research Diagnostic Criteria (RDC; Spitzer, Endicott, & Robins, 1978) with a current episode of major depression. Two participants (1 mother of an uninhibited child, 1 father of an inhibited child) were excluded from the analysis because they were currently taking antidepressant medication. Analysis was completed on a final sample of 72 subjects: 19 mothers and 17 fathers of inhibited children, 18 mothers and 18 fathers of uninhibited children.

The ages of the parents ranged from 29 years to 47 years, with a mean age of 36.7 years. Groups did not differ in mean age, but fathers were older ($M$ = 38.0 years) than mothers ($M$ = 35.6 years), $t(70) = 1.99$, $p < .05$. A mean aggregate BI index was calculated as the mean of the standardized scores of six variables assessed during the laboratory play session: time proximal to mother, latency to speak first word, latency to touch first toy, latency to approach a robot, latency to approach a stranger, and latency to enter a toy tunnel. The sample of children whose parents were included in this study showed mean BI index scores that were comparable to the mean BI index scores of the entire longitudinal sample. The mean BI index score of the inhibited group ($n$ = 24; $M$ = 1.25, $SD$ = 0.60) differed significantly from the mean of the uninhibited group ($n$ = 30; $M$ = −0.98, $SD$ = 0.10) for the longitudinal cohort, $t(24) = 18.0$, $p < .001$ (adjusted for unequal variance). Mean BI index scores also differed between the inhibited group ($n$ = 19; $M$ = 1.27, $SD$ = 0.64) and the uninhibited group ($n$ = 19; $M$ = −0.99, $SD$ = 0.05) for the sample used in this study, $t(18.3) = 15.5$, $p < .001$ (adjusted for unequal variance). The BI index was used to examine relations between parent measures and child temperament.

### *Procedure*

Informed consent was obtained at the beginning of each laboratory session. The subject was seated in a comfortable chair while the experimenter and assistant applied a Lycra electroencephalographic (EEG) recording cap and electrooculogram (EOG) electrodes. Placement of the cap and application of electrodes took approximately 1 hr. After placement, the subject completed a pencil-and-paper measure of current affect. Then, EEG recordings were collected for approximately 15 min while the subject sat alone in the recording room. At completion of the EEG recordings, the experimenter and the assistant returned to remove the recording cap and electrodes. The subject then completed a pencil-and-paper measure of general affect. When the subject finished, the experimenter left the room and the assistant administered a circle-drawing task, which is described below. Completion of this task took 2 min to 15 min. When finished, the assistant demonstrated for the subject how to complete a computerized personality inventory. The subject was then left alone to complete the inventory. The entire laboratory session typically lasted 1 hr and 30 min.

The experimenter was a female graduate student and the assistant was one of two undergraduates. The assistants, one male and one female, were trained to administer all aspects of the study and were randomly assigned to both male and female subjects. The experimenter and assistant were unaware of the group status of the subjects, but they were aware of the hypotheses being tested. Standardized procedures for presentation and implementation of experimental procedures prevented the experimenter or assistants from unduly influencing the subjects.

### *Affect Measures*

Each participant completed the Positive and Negative Affect Scale (PANAS) in both its current form and its general form (Watson & Clark, 1988). Participants rated the extent to which they currently and in general felt each of 10 positive emotions (e.g., interested, excited, proud) and 10 negative emotions (e.g., distressed, upset, guilty) on a scale ranging from *very little or not at all* (1) to *extremely* (5). Scores were calculated as the sum of the ratings of positive words and the sum of the ratings of negative words. A univariate analysis of variance (ANOVA) was done separately for the current and general forms of the measure. The main effects of group and parent gender and the Group × Parent Gender interaction were tested.

### *Circle-Drawing Task*

This task was modeled after one developed by Wallace, Bachorowski, and Newman (Bachorowski & Newman, 1990; Wallace & Newman, 1990). The subject was seated upright in a comfortable recliner, and the experimenter was seated to the right of and slightly behind the subject. The subject was given an erasable pen and a 1 ft (305 mm) × 1 ft (305 mm) Plexiglas square that was backed with white cardboard upon which were drawn two concentric circles, 8 in. (200 mm) and 9 in. (230

mm) in diameter respectively. A hatch mark was drawn outward from the 9-in. (230-mm) circle at the 12:00 position. The word GO was written in green letters to the right of the hatch mark and the word STOP was written in red letters to the left of the hatch mark. The experimenter then recited the following memorized directions:

> This task evaluates motor skills. We want you to draw a circle as slowly as possible, without stopping, while staying within the double lines. We will have you do this three times. Start at the word "GO" when I tell you to begin and draw clockwise to the word "STOP." Do you have any questions?

The experimenter answered any questions, told the subject to begin, and started a noiseless digital stop watch. If the subject lifted the pen or stopped drawing, the experimenter repeated the following statement: "You must draw continually, without stopping or lifting your pen." Any questions from the subject were politely deferred. When the subject finished drawing, the experimenter recorded the time and then had the subject repeat the task twice more. Subjects who had not completed a circle in 4 min were stopped at that point. In these cases, the experimenter recorded the arc of the circle completed. Projected completion time was extrapolated from the arc completed and recorded.

Because projected circle-drawing times were included in the analysis, results were analyzed with an aligned ranks procedure that is equivalent to a nonparametric ANOVA. Raw and projected circle-drawing times were aligned by group and then ranked. The rank scores were subjected to an ANOVA with two between-subjects variables, group and parent gender, and the repeated measure factor of trial repetition. The main effect of group was then tested. Subsequent alignments and ANOVAs were performed to test for the main effect of parent gender and all two-way and three-way interactions. On the basis of previous studies in which this task was used, scores were also aligned to allow for planned contrasts to test the within-subject effect of trial repetition.[1]

### *Personality Measures*

Each participant completed a 93-item forced-choice questionnaire using a computer. The questionnaire comprised six scales. Items were included from the Extroversion and Neuroticism scales of the Eysenck Personality Inventory (Eysenck & Eysenck, 1968) and from the Impulsivity subscale of the Eysenck Personality Inventory (Revelle, Humphreys, Simon, & Gillilan, 1980). The Extroversion scale measures the personality dimension of introversion–extraversion by comparing quietness, passivity, and cautiousness with outgoingness, sociability, and optimism. The Neuroticism scale measures emotional lability with items such as, "Are your feelings easily hurt?" The Impulsivity scale is derived from an early version of the Extroversion scale and measures impulse control with items such as "Do you generally do and say things quickly without stopping to think?" The Cheek and Buss Shyness and Sociability Scales (Cheek & Buss, 1981) were included to measure shyness, the discomfort one feels in social situations, separately from sociability, one's desire for social interaction. The Avoidance scale was extracted from a larger scale of sensitivity to threat, novelty, and punishment—the Susceptibility to Punishment Scale (Torrubia & Tobena, 1984)—and was included as an exploratory scale designed to measure avoidance of novelty and uncertainty in nonsocial situations. Only questions the content of which did not include reference to novel social interaction were selected from the original scale; several items were then eliminated to avoid redundancy with the other scales. The items on the Avoidance scale are largely behavioral assessments, such as "Do you readily engage in dangerous sports?" and as such provide a good estimate of the likelihood of engaging in novel or uncertain activities. The Avoidance scale is included as an Appendix.

Questions were presented centrally on a computer screen, one question at a time. The subject used a keyboard to toggle between yes and no until a decision was reached; then the subject pressed a key marked "next" and proceeded to the next question. Subjects were required to answer all questions and did not have the opportunity to review previously answered questions.

Coefficient alpha was calculated for each scale, across all subjects, to assess the internal consistency of each scale. Univariate ANOVAs were separately calculated for each scale to test for the main effects of group and parent gender, and the Group × Parent Gender interaction.

### *Factor Analysis*

Scores on the personality scales, scores on the PANAS scales, and rank mean circle-drawing times were entered together into a principal-components analysis, and three factors were extracted. A promax rotation showed that the factors were not naturally oblique, so a varimax rotation was applied to reveal orthogonal factors. This procedure was implemented on a VAX, using Statistical Analysis System software, version 6.06.

## Results

### *Affect Measures*

The current and general forms of the PANAS were evaluated separately. A mixed-design ANOVA, with group and parent gender as between-subjects factors and with affect type (positive or negative) as a repeated-measures factor, did not detect significant main effects for group or parent gender, nor a significant interaction.[2] As expected, subjects reported more positive than negative affect during the laboratory session, $F(1, 68) = 326.6$, $p < .001$, and in general, $F(1, 68) = 550.8$, $p < .001$.

### *Circle Drawing*

The results of the circle-drawing analysis were derived with an aligned-ranks ANOVA as described in the *Circle-Drawing Task* subsection of the Method section. The main effect of group revealed that parents of inhibited children drew more quickly on average ($M = 154$ s) than did parents of uninhibited children ($M = 294$ s), $F(1, 68) = 6.31$, $p < .01$. Parents of uninhibited children, on average, completed only 188° of the circle in the mean time it took parents of inhibited children to complete the entire circle.

Alignment for and testing of the main effect of trial repetition revealed a significant slowing of drawing speed with time, $F(2,$

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[1] Wallace and Newman (1990) found that trends in speed of circle drawing across trials vary as a function of personality variables. Although these researchers were unable to identify robust variables that consistently predicted individual differences in slowing trends, data from these studies suggest that there might be individual differences in tendencies toward habituation that may reflect important underlying processes. We used planned contrasts to test the a priori hypothesis that parents of inhibited children differ from parents of uninhibited children in their tendency to habituate to the circle-drawing task over time.

[2] PANAS-Now scores were as follows: Positive, $M = 27.7$, $SD = 6.7$, and Negative, $M = 11.9$, $SD = 2.2$, for parents of inhibited children; Positive, $M = 28.2$, $SD = 7.0$, and Negative, $M = 12.1$, $SD = 2.2$, for parents of uninhibited children. PANAS-General scores were as follows: Positive, $M = 34.3$, $SD = 5.7$, and Negative, $M = 15.6$, $SD = 4.6$, for parents of inhibited children; Positive, $M = 36.3$, $SD = 5.3$, and Negative, $M = 15.7$, $SD = 4.2$, for parents of uninhibited children.

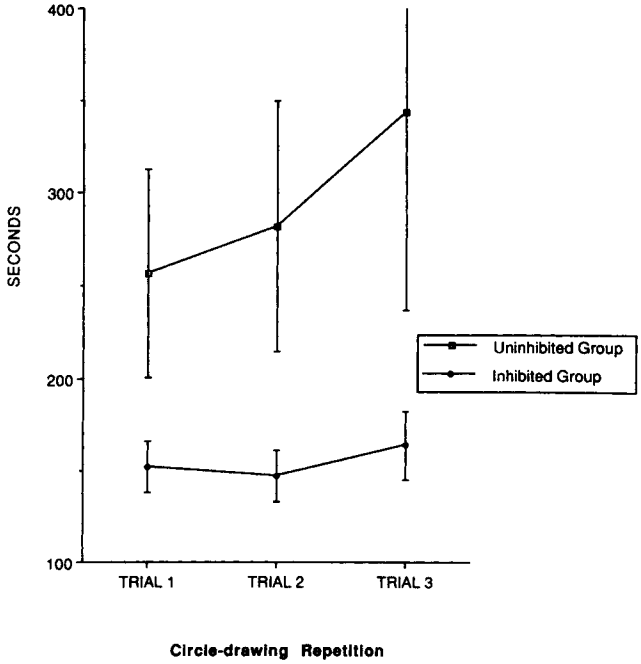


*Figure 1.* Mean circle-drawing time for each of three trials presented separately by group. Error bars represent the standard error of the mean.

68) = 17.97, $p < .001$, with mean times of 204 s, 215 s, and 254 s for Trials 1, 2, and 3, respectively. Scores were then aligned for the Group × Trial Repetition interaction. Figure 1 shows that parents of uninhibited children slowed their drawing speed across trial repetitions, whereas parents of inhibited children maintained their initial drawing speed throughout.

Planned comparisons ($p < .05$) showed that parents of inhibited children were significantly faster than parents of uninhibited children on Trials 2 and 3, but that the groups did not differ on Trial 1. Alignment for and testing of the main effect of parent gender, the Group × Parent Gender interaction, the Parent Gender × Trial Repetition interaction, the Group × Trial Repetition interaction, and the three-way interaction revealed no other statistically significant results.

A Spearman rank-order correlation ($r_s$) between mean circle-drawing time and the BI index was calculated separately for mothers and fathers. A midparent score was calculated as the mean of mother and father scores, to provide a midparent–child correlation. The correlation between mean circle-drawing time and the BI index was significant for the midparent–child correlation, $r_s = -.44$ ($p < .01$); was nearly significant for mothers, $r_s = -.31$ ($p < .06$); and was in the predicted direction for fathers, $r_s = -.24$ ($p < .17$). Table 1 summarizes mother–child, father–child, and midparent–child rank-order correlations for all measures that differed significantly between the groups.

## *Personality Scales*

Reliability of each scale was derived separately. Coefficient alpha for each scale was as follows: Extroversion, $\alpha = .86$; Avoidance, $\alpha = .78$; Shyness, $\alpha = .83$; Sociability, $\alpha = .80$; Impulsivity, $\alpha = .51$; and Neuroticism, $\alpha = .80$. Even though these scales were administered in a format that was different from that for which they were designed, all scales showed internal consistency that was comparable to that of the standardized forms of these scales, and all but the Impulsivity scale showed acceptable internal consistency. Because of the low reliability of the Impulsivity scale, it was excluded from further analyses.

Table 1
*Spearman Rank-Order Correlations of Parent Measures With Child Behavioral Inhibition*

| Measure | Mother–child | Father–child | Midparent–child |
|---|---|---|---|
| Extroversion | −.40* | −.20 | −.45** |
| Avoidance | .36* | −.13 | .19 |
| Shyness | .28 | −.02 | .18 |
| Mean circle-drawing time | −.31 | −.24 | −.44** |
| Factor 1 | −.48** | −.12 | −.41* |

*Note.* Factor 1 is a factor score that primarily reflects personality measures of Extroversion, Avoidance, Shyness, and Sociability.
* $p < .05$. ** $p < .01$.

Figure 2 shows the mean percentage of items endorsed on each personality scale by group. Univariate ANOVAs were performed on each scale. There was a significant main effect for group on the Extroversion scale, $F(1, 68) = 5.73$, $p < .05$, with parents of uninhibited children scoring higher than parents of inhibited children. The main effect for parent gender and the

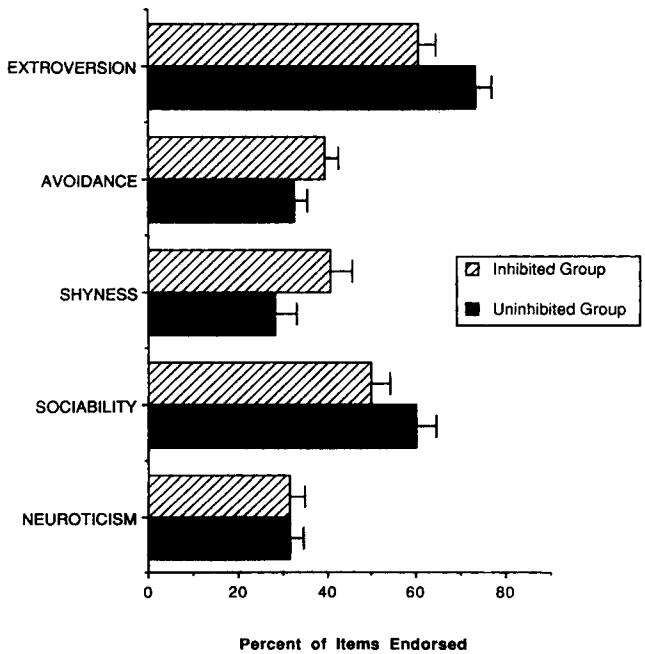


*Figure 2.* Mean percentage of items endorsed on five personality scales presented separately by group. Error bars represent the standard error of the mean.

Group × Parent Gender interaction were not significant for the Extroversion scale. Analysis of the Avoidance scale revealed a marginally significant main effect for group, $F(1, 68) = 3.38$, $p < .07$, whereby parents of inhibited children reported higher scores than did parents of uninhibited children, and a significant main effect for parent gender, $F(1, 68) = 16.65$, $p < .001$, whereby mothers reported higher Avoidance scores ($M = 43.4$) than did fathers ($M = 28.2$). The Group × Parent Gender interaction was not significant for Avoidance. The main effect of group was marginally significant for the Shyness scale, $F(1, 68) = 3.50$, $p < .07$, with parents of inhibited children reporting higher scores than parents of uninhibited children. There was no significant main effect for parent gender, nor was there a significant Group × Parent Gender interaction for Shyness. There were no significant main effects for group or parent gender, and there was no significant Group × Parent Gender interaction on the Sociability scale. The Neuroticism scale showed a significant main effect for parent gender, $F(1, 68) = 7.48$, $p < .01$, with mothers reporting higher scores ($M = 37.2$) than fathers ($M = 25.8$), but there was no significant effect of group. There was also no significant Group × Parent Gender interaction.

Spearman rank-order correlations were calculated between the BI index and the personality scale scores that differed by group. Child BI correlated significantly with midparent Extroversion, $r_s = -.45$ ($p < .01$) and with maternal Extroversion, $r_s = -.40$ ($p < .02$), but child BI was not correlated with paternal Extroversion, $r_s = -.20$ ($p < .25$). Maternal Avoidance was significantly correlated with child BI, $r_s = .36$ ($p < .03$), but paternal Avoidance and midparent Avoidance were not. Child BI was correlated in the predicted direction with maternal Shyness, $r_s = .28$ ($p < .11$), whereas BI was not correlated with either paternal Shyness or midparent Shyness.

### *Factor Analysis*

As described in the *Factor Analysis* subsection of the Method section, orthogonal factors were derived from the personality scales, scores on the PANAS scales, and rank mean circle-drawing times. Table 2 shows the resulting factor structure. Factor 1 is most heavily loaded by scores from the personality measures of Extroversion, Avoidance, Shyness, and Sociability. Rank mean circle-drawing time, Neuroticism scores, and PANAS measures of current and general negative affect loaded most heavily on Factor 2. Current and general positive affectivity as measured by the PANAS loaded most heavily on Factor 3.

Univariate ANOVAs were calculated separately for each factor. A significant effect of group was found for Factor 1, $F(1, 68) = 6.6$, $p < .01$, but there were no significant effects of parent gender or of Group × Parent Gender interaction for Factor 1. There were no significant effects found for either Factor 2 or Factor 3. Factor 1 factor scores correlated significantly with child BI among mothers, $r_s = -.48$ ($p < .01$), and for midparent factor scores, $r_s = -.41$ ($p < .05$), but not among fathers, $r_s = -.12$.

Table 2
*Factor Structure of Personality, Affectivity, and Circle-Drawing Scores*

| Measure | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|
| Extroversion | **0.86** | 0.05 | 0.12 |
| Avoidance | **−0.73** | 0.26 | 0.04 |
| Shyness | **−0.82** | 0.22 | −0.08 |
| Sociability | **0.79** | 0.02 | 0.17 |
| Neuroticism | −0.35 | **0.70** | 0.11 |
| Rank circle-drawing time | 0.26 | **0.47** | −0.18 |
| Positive affect | | | |
| Current | −0.03 | −0.16 | **0.83** |
| General | 0.31 | 0.03 | **0.80** |
| Negative affect | | | |
| Current | −0.12 | **0.70** | −0.17 |
| General | −0.12 | **0.81** | 0.03 |
| Cumulative variance | .33 | .50 | .63 |

*Note.* Personality scale scores, Positive and Negative Affect Scale (Watson & Clark, 1988) scores, and rank mean circle-drawing time were entered into a principal-components analysis, then varimax rotated to derive orthogonal factors. Measures that loaded most heavily on each factor are highlighted in boldface. Parents of inhibited children differed from those of uninhibited children on Factor 1 ($p < .01$).

## Discussion

Earlier, we presented an argument suggesting that BI is a temperamental characteristic the most proximal cause of which is a particular biological diathesis. By the term *diathesis* we suggest that environmental and genetic influences create an underlying predisposition toward particular behaviors that are engaged when stimulated by appropriate environmental events. The influences on BI as a temperamental characteristic are likely to be those factors that influence the developmental trajectory of the biological diathesis that is believed to underlie BI.

This study is unique in that it assessed in parents a broad range of psychological measures that were hypothesized to be associated with BI in children. The results of this study suggest that parent behavioral response in a task involving uncertainty and parent personality characteristics of extraversion, shyness, and avoidance are likely influences on child BI. Parent affectivity and personality characteristics of neuroticism and sociability, however, were not found to differ by child status, and they are thus less likely to be important influences on child BI.

Parental anxiety in novel or uncertain situations may indicate the presence of a genetically heritable biological diathesis, or it may provide a child with a behavioral model of anxiety that influences the development and persistence of BI. The circle-drawing task was developed to test hypotheses about a model of behavioral regulation and anxiety proposed by Gray (1982) and expanded by other investigators (Fowles, 1987; Wallace, Bachorowski, & Newman, 1991). Gray's model of behavioral regulation includes two mutually inhibitory systems—the behavioral inhibition system (BIS) and the behavioral activation system (BAS). In Gray's model, the BIS is activated in response to novelty and cues for threat, punishment, and frustrative nonreward, and when activated, the BIS interrupts ongoing activity and is associated with the subjective experience of anxiety. The BAS is activated in response to cues for rewards and appetitive stimuli, thus increasing goal-directed behaviors. A third component of the system, the nonspecific arousal system (NAS), integrates input from the BIS and the BAS, multiplies their

summed activity by its own activity level, and drives the intensity of the behavioral response.

In a series of experiments, Bachorowski and Newman (1990) and Wallace and Newman (1990) demonstrated that activation, either of the BIS by uncertainty or threatened punishment or of the BAS by cues for reward, increases the speed of motor output when there is a task demand to continue ongoing behavior. Anxious individuals (persons with high scores on measures of neuroticism and introversion), who are hypothesized to have increased sensitivity in the BIS, show a greater increase in speed of drawing in the presence of threat or uncertainty than do comparison groups. Behaviorally inhibited children could be characterized as having increased sensitivity in the BIS, thus resulting in an overanxious response to novel situations. Presence of this characteristic in parents of behaviorally inhibited children was hypothesized to be a possible factor affecting BI in children.

Although no direct measures of subjective anxiety experienced during the task were obtained, the observed slowing of drawing time across three trials supports the hypothesis that the level of uncertainty associated with the task, and therefore its anxiogenic properties, diminished as the task became more familiar. Further support of the notion that circle drawing is associated with BIS activity comes from the finding that mean circle-drawing time loads most highly on a factor that includes high loadings from the Neuroticism and PANAS negative affect scales. Overall, the parents of the inhibited children drew more quickly than did parents of uninhibited children, but this group difference was statistically significant only on the second and third trials. This result is attributed to the failure of the parents of inhibited children to reduce their drawing speed over three trials, which suggests that they maintained higher levels of BIS activation throughout the experiment than did parents of uninhibited children who, by slowing their speed across trials, demonstrated reduced BIS activity as the task became more familiar.

In addition to the finding that parents of inhibited children drew significantly faster than parents of uninhibited children, child BI was found to be modestly correlated with mean circle-drawing time among both mothers and fathers, and child BI correlated significantly with midparent circle-drawing time. These results provide corroborative evidence for the hypothesis that parental sensitivity to uncertainty, as measured by this task, is associated with BI in children.

The personality scales used in this study were chosen because each provides a testable hypothetical parental characteristic that may be related to BI. Extraversion is a personality trait that has been adopted by numerous researchers as one of the basic factors of personality. Eysenck describes extroverts as outgoing, sociable, active, and optimistic, whereas he describes introverts as quiet, unsociable, passive, and cautious (Eysenck & Eysenck, 1968). The Eysenck Extroversion scale used in this study places introversion–extraversion on a continuum. Given the genetic loading and familial similarities on this measure, we hypothesized that if this parental personality factor contributed to BI, parents of uninhibited children ought to score higher on the Extroversion scale than parents of inhibited children. This hypothesis was upheld. Furthermore, child BI was significantly negatively correlated with maternal and midparent Extroversion scores, and it was modestly negatively correlated with paternal Extroversion scores.

Although the children included in this study were categorized on the basis of their behavior in a novel social situation, behaviorally inhibited children have been shown to exhibit BI in novel environments even when there is no requirement for social interaction (Asendorpf, 1990). The Avoidance scale was designed to measure avoidance of novelty and uncertainty in nonsocial situations, and as such, it might provide a good estimate of the likelihood that parents of inhibited children differ from parents of uninhibited children in the opportunities to engage in novel or uncertain activities that they vicariously or directly provide for their children. Parents of inhibited children reported marginally higher Avoidance scores than did parents of uninhibited children. Child BI and Avoidance scores were significantly correlated among mothers and were uncorrelated among fathers. This suggests that parental engagement in novel or uncertain activities may be moderately related to BI in children. There are no genetic or family studies of Avoidance, so hypotheses as to the mechanism by which Avoidance influences BI cannot be adequately addressed.

Shyness and sociability, although theoretically captured in the primary personality characteristic of extraversion, have been shown to be separable personality characteristics. Cheek and Buss (1981) demonstrated that even though shyness and sociability are highly correlated, they are separable constructs, in that some individuals who experience high levels of discomfort in social situations also desire high levels of social interaction, whereas other individuals who report low levels of shyness also prefer little social interaction. The Shyness scale was administered to parents of inhibited and uninhibited children in this study to assess the subjective level of discomfort in novel social situations. Children who are behaviorally inhibited show increased BI in the presence of strangers, thus suggesting increased psychological discomfort in those situations. We hypothesized that parental shyness would be associated with child BI. Parental shyness could contribute to BI by means of a genetic pathway, a social learning mechanism, or an affective matching mechanism, wherein the young child learns to match parental affect and behavior in social situations. Parents of inhibited children reported marginally higher levels of shyness than did parents of uninhibited children. Child BI and shyness were modestly correlated among mothers, but they were uncorrelated among fathers. Given that the children in this study were chosen as the most behaviorally extreme from a population of more than 350 children, we expected a stronger effect when assessing group differences between the parents of these children on this measure.

Sociability was measured as the desire to interact with others, independent of the level of shyness one feels in social situations (Cheek & Buss, 1981). The hypothesis that parental sociability is associated with BI stems from the assumption that individuals act on their desire for social interaction, thus leading those who report higher levels of sociability to engage in more social interactions. Parental sociability could influence the development of inhibited behavior in that less sociable parents might expose their children to fewer social interactions, thereby providing the child with fewer opportunities to become comfortable in social situations. This hypothesis was not upheld. Par-

ents of inhibited children did not differ from parents of uninhibited children on the Sociability measure.

Neuroticism has been proposed as a second primary factor in personality (Eysenck & Eysenck, 1968). The individual who has high Neuroticism scores is emotionally labile and overreactive, has difficulty returning to a normal state after an emotional experience, and has numerous somatic complaints. Behavioral inhibition could be construed as a prolonged, overreactive response to novelty. Parental neuroticism was hypothesized to be associated with BI because of its genetic loading (Plomin et al., 1990) and because of the idea that children learn behavior by modeling and affective matching. Parents of inhibited children did not differ from parents of uninhibited children on this measure, suggesting that neuroticism is not a likely contributor to BI.

The hypothesis that some of the parental personality characteristics measured in this study are associated with BI is corroborated by the outcome of the factor analysis. The Extroversion, Shyness, Sociability, and Avoidance measures all loaded heavily on the first factor extracted, and a comparison of factor scores revealed a significant group difference on this factor. Maternal factor scores derived from Factor 1 accounted for more than 20% of the variance in child BI; midparent factor scores accounted for more than 15%. Paternal factor scores were uncorrelated with child BI.

The notion that positive and negative affectivity are important psychological individual differences is based on a model of emotion derived from factor-analytic studies (Tellegen, 1985). This model defines positive and negative emotions as orthogonal factors and proposes that individuals who are vulnerable to high negative affect tend toward distress, nervousness, and fearfulness, whereas individuals with low positive affectivity tend toward sluggishness, dullness, and drowsiness. Individuals located at the 45° intersection of these two factors in the low-positive-affect, high-negative-affect quadrant are characterized as blue, grouchy, sad, sorry, and unhappy. The PANAS scales were chosen as a measure of positive and negative affectivity (Watson & Clark, 1988), because of the hypothesis that increased parental negative affectivity, decreased parental positive affectivity, or the combination is associated with BI in children. This study found no significant differences between parents of inhibited and uninhibited children on these measures. Factor analysis of the multiple measures used in this study confirmed that positive and negative affectivity load most heavily on separate factors and that there were no significant differences between groups on scores derived from these factors. Thus, the hypothesis that BI is associated with parental vulnerability to positive or negative emotions is not supported.

Overall, this study found corroborating evidence for associations between child BI and specific parental personality characteristics and between child BI and parental anxious responding to uncertainty. Interestingly, parent neuroticism and negative affectivity were not found to be associated with child BI.

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## Appendix

## Avoidance Scale

(From "A Scale for the Assessment of 'Susceptibility to Punishment' as a Measure of Anxiety: Preliminary Results," by R. Torrubia and A. Tobena, 1984, *Personality and Individual Differences, 5,* pp. 371–375. Copyright 1984 by Elsevier Science. Adapted by permission.)

1. Do you generally avoid giving your opinion about topics you know nothing about?
2. Do you often refrain from doing something because you are afraid of it being illegal?
3. Do you, on a regular basis, think that you could do more things if it were not for your insecurity or fear?
4. Do you generally stop at a traffic signal, going by car or walking, when it is yellow?
5. Do you prefer not to ask for something when you are not sure if you will attain it?
6. Do you worry a lot about little mistakes in your work or studies?
7. Do you prefer nondangerous sports to dangerous sports?
8. Would you prefer a routine job without worries to another more difficult job with possibility of promotion?
9. Do you often renounce your rights so as to avoid a quarrel with a person or an organization?
10. As a child, were you distressed when punished at home or in school?
11. Do you readily take part in interesting jobs or activities without being prepared?
12. Would you confront someone who had played a bad trick on you?
13. Are you easily discouraged by difficult situations?
14. Do you frequently avoid disturbing people around you?
15. Do you avoid demonstrating your skills, whenever possible, for fear of being embarrassed?
16. When you are with a group, do you have difficulty selecting a good topic to talk about?
17. Are you afraid of having problems with the law?
18. Do you engage in physical activities when there is some risk or danger?
19. Do you avoid going to unknown places whenever you can?
20. Do you generally avoid high places or cliffs that are not well protected?
21. Are you often worried by things you said or did?
22. Would it be difficult for you to ask your boss for a raise (salary increase)?
23. Do you generally try to avoid speaking in public?
24. Do you tend to keep in the background during fights?
25. Comparing yourself to other people you know, are you afraid of many things?

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