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Emotion Regulation Profiles, Temperament, and Adjustment Problems in Preadolescents

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Abstract

The longitudinal relations of emotion regulation profiles to temperament and adjustment in a community sample of preadolescents (N = 196, 8–11 years at Time 1) were investigated using person-oriented latent profile analysis (LPA). Temperament, emotion regulation, and adjustment were measured at 3 different time points, with each time point occurring 1 year apart. LPA identified 5 frustration and 4 anxiety regulation profiles based on children's physiological, behavioral, and self-reported reactions to emotion-eliciting tasks. The relation of effortful control to conduct problems was mediated by frustration regulation profiles, as was the relation of effortful control to depression. Anxiety regulation profiles did not mediate relations between temperament and adjustment.

Emotion regulation is a critical ability representing the capacity to modulate or maintain an emotion in service of a goal (Cole, Martin, & Dennis, 2004), with implications for typical and atypical psychological development (Cicchetti, Ackerman, & Izard, 1995). This ability develops rapidly in infants and young children (Kopp, 1989) and continues to develop throughout adolescence (Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Important tasks for researchers are to carefully operationalize emotion regulation and to examine factors that contribute to it. This study addresses both of these issues, examining profiles of children's physiological, behavioral, and subjective emotional responses and testing temperament as a predictor of emotion regulation.

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Emotion regulation is linked to a range of indicators of child adjustment, including social competence (Denhman et al., 2003), internalizing problems (Silk, Steinberg, & Morris, 2003), and externalizing problems (Hill, Degnan, Calkins, & Keane, 2006). It has been suggested that internalizing problems are related to emotion regulation patterns of inexpressive or overcontrolled styles, in which children are inhibited or rigid (Eisenberg et al., 2001). Externalizing behavior problems relate to patterns of reactive, expressive, or undercontrolled emotion regulation styles (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). Positive adjustment is linked to emotion regulation patterns, in which children are adaptively regulated and able to flexibly modulate the expression of emotion to fit the situation (Cole, Michel, & Teti, 1994; Eisenberg et al., 2001).

Through the course of development, children are expected to require less external support for emotion regulation and to demonstrate increases in independent regulation of emotions (Yap, Allen, & Sheeber, 2007). The preadolescent period is marked by changes in children's family and social lives (Holmbeck & Kendall, 2002) such that parents and children spend less time together (Larson, Richards, Moneta, & Holmbeck, 1996), affording parents less opportunity to support children's emotion regulation. Understanding how preadolescent children regulate their emotions and what factors contribute to this may provide insight into how behavioral and emotional problems emerge in this developmental period (Angold & Rutter, 1992). Although children's emotion regulation has been described as overcontrolled, undercontrolled, and adaptively regulated, how such styles manifest in preadolescence is unclear.

Emotion regulation is an important and widely studied construct, but there is controversy surrounding its definition and measurement, as articulated in a special issue of *Child Development* (March/April 2004). Cole et al. (2004) defined emotion regulation as systematic changes in activated emotions or in related processes (e.g., memory, social interaction) regardless of the emotion that is activated. These researchers offered suggestions for assessing emotion regulation, several of which were incorporated in this study. A core concern is that there must be evidence of regulation, and not just emotion responses occurring. The use of multiple indicators allows inferences of emotions being regulated when discrepancies across modalities arise (e.g., a person reports feeling frustrated but does not display frustrated behaviors; a person demonstrates a physiological response but does not report feeling frustrated). Therefore, in this study, we assessed multiple emotion response systems (physiological, subjective, behavioral) to be able to detect emotion responses and regulation. In addition, it is important to consider the social demands or goals of the task to determine if regulation is adaptive or maladaptive (Thompson, 1994). Cole et al. suggest implementing procedures intended to elicit a particular emotion. Accordingly, our study utilized anxiety- and frustration-eliciting tasks that each had a specific goal, so individual differences in regulation could be assessed.

Most emotion regulation studies assess either one or two components of emotion (behavioral, subjective, or physiological), with few addressing multiple components. This may be because the various indicators are often uncorrelated (Quas, Hong, Alkon, & Boyce, 2000), and it is difficult to interpret the complex findings that can emerge from multiple response systems when variable-centered analyses are used (Gross, 2002; Mauss, Levenson,

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McCarter, Wilhelm, & Gross, 2005). As a result, interest in studying individuals as opposed to comparing groups or examining correlations among variables has increased (Magnusson, 1999). Few studies have used person-oriented approaches to study emotion regulation. One exception is a study that identified emotion regulation patterns that, using behavioral observation, classified children as regulated, undercontrolled, and overcontrolled (Maughan, Cicchetti, Toth, & Rogosch, 2007). Our study aimed to extend the use of the person-oriented approach to include physiological and subjective indicators of emotional responses.

Person-oriented methods describe the patterning of variables within individuals to capture essential features of responding that may be lost when simple linear associations are analyzed. We used a person-oriented analysis—latent profile analysis (LPA; Muthén, 2001)—to capture profiles of emotion responses and regulation. LPA classifies individuals who are similar on several observed variables, with the assumption that the patterns of values are determined by latent person profiles or groupings. LPA differs from other traditional person-oriented methods, such as cluster analysis, in that it is model based and has more rigorous criteria for identifying the number of profiles or clusters (Pastor, Barron, Miller, & Davis, 2007). With LPA, each individual receives a probability of being a member of each profile. These probabilities can be linked to other variables that might predict or result from the particular styles of regulation.

Zeman et al. (2006) outlined potential avenues for future emotion regulation research, including efforts to further understand the etiology and mechanisms through which emotion regulation contributes to the development of adaptive and maladaptive adjustment. In this study, we examined temperament as a predictor of emotion regulation profiles and whether the emotion regulation profiles mediated the relation between temperament and adjustment.

Temperament is defined as individual differences in reactivity and self-regulation, including motivation, affect, inhibitory control, and attention characteristics (Rothbart & Bates, 2006). Reactivity refers to responsiveness to change in the external and internal environments. Indicators of fear, frustration, approach, and pleasure are commonly studied. Self-regulation refers to orienting and executive control of attention and behavior that operates to modulate reactivity, facilitating or inhibiting the physiological, affective or behavioral response. Self-regulation is commonly assessed with measures of attention focusing, attention shifting, and inhibitory control, which compose effortful control (Rothbart, Ahadi, Hershey, & Fisher, 2001). Underlying these dimensions of reactivity and self-regulation are motivational systems reflecting susceptibility to reward and punishment (Rothbart & Bates, 2006). Activation of the behavioral inhibition system (BIS), which is responsive to cues of punishment or threat, produces fear or anxiety, which serves to inhibit approach. Activation of the behavioral activation system (BAS), which is responsive to cues of reward, motivates approach behaviors or active avoidance of punishment (Gray, 1991) and produces frustration when reward attainment is blocked.

It has been suggested that temperament and emotion regulation can be difficult to distinguish and that they are not necessarily distinct constructs (Rothbart & Sheese, 2007). We view emotion regulation as the product of temperamental predisposition and socialization processes (i.e., family or peer interactions) in the service of goal attainment in a

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specific situation or type of situation (Yap et al., 2007). Specifically, child characteristics of reactivity and effortful control contribute to a child's emotional and behavioral response in a specific goal-directed or emotionally evocative situation. A temperamentally reactive child with poor effortful control would be more likely to react with unmitigated negative affect and inadequate attempts at goal achievement. Conversely, a reactive child with better effortful control would be more likely to employ strategies aimed at modulating their emotional responses.

Temperament predicts children's adjustment problems and competencies (Rothbart & Bates, 2006), and several theoretical models accounting for this association have been proposed such as the vulnerability (Shiner & Caspi, 2003), spectrum, and genetic (Nigg, 2006) models. Fear, shyness, or BIS activity are risk factors for anxiety problems (Leve, Kim, & Pears, 2005; Muris, 2006). Frustration, impulsivity, sensation seeking, BAS activity, and low effortful control are risk factors for conduct problems and lower social competence (Eisenberg, Smith, Sadovsky, & Spinrad, 2004). Reduced reward responsiveness or positive affect (low BAS), irritability, and low effortful control are associated with depression (Dennis, 2007; Eisenberg et al., 2001; Muris, 2006). Finally, lower reactivity and greater effortful control are related to social competence and conscience development (Kochanska, Murray, & Harlan, 2000). We propose that the relation between temperament and adjustment can be understood, in part, through the role temperament plays in emotion regulation and, in turn, the role of emotion regulation in adjustment. In particular, high fear and shyness, reflecting greater BIS activity, along with low effortful control were expected to predict anxious arousal in situations that are novel or threatening, and this in turn would predict the emergence of anxiety problems. High approach to intense and pleasurable stimuli, reflecting high BAS activity, high frustration, and low effortful control were expected to engender greater anger arousal in situations that block an individual to a goal or reward, and this poor anger regulation was expected to increase the likelihood of conduct problems. Lower pleasure, greater irritability, and low effortful control were expected to predict the emergence of depression. Finally, lower reactivity and greater effortful control were predicted to facilitate optimal emotion regulation that, in turn, is related to greater social competence.

In this study, we examined the relation between temperament and emotion regulation responses, hypothesizing that temperament would predict emotion regulation profiles in preadolescent children and that particular emotion regulation responses may serve as pathways linking temperament with adjustment outcomes. Self-report measures of irritability and high-intensity pleasure were used as indicators of BAS whereas fear and shyness were assessed as indicators of BIS. Self-report measures of effortful control were also obtained. In addition, adjustment self-report measures assessed children's depression, anxiety, externalizing problems and social competence. To measure children's physiological responses, heart rate (HR) reactivity, a nonspecific indictor of arousal (Berntson, Cacioppo, & Fieldstone, 1996) that has been studied in conjunction with hostility (Vogele, 1998) and frustration (Panee & Ballard, 2002), was obtained. On the other hand, electrodermal response (EDR) reactivity has been consistently used to measure anxiety (Brenner, Beauchaine, & Sylvers, 2005). Although in other studies, both HR and EDR have been measured in frustration and anxiety paradigms, findings report that EDR was nonsignificant

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during frustration tasks (Holden & Barlow, 1986; Wallien, van Goozen, & Cohen-Kettenis, 2007). Our four aims were to:

1. Use LPA—a person-oriented approach—to identify profiles of emotion regulation based on children's behavioral, physiological, and subjective emotional responses in frustration-and anxiety-eliciting tasks. We expected distinct patterns of the three modalities to indicate emotion regulation styles that could not be captured examining linear relations. We expected that a profile of elevated responses across all three emotion systems would indicate an *unregulated responsive* profile. An unregulated response to the frustration-eliciting task would include elevated HR reactivity, greater observed frustration, and higher self-reported frustration. An unregulated response profile to the anxiety-eliciting task would include elevated EDR, greater observed anxiety, and higher self-reported anxious emotion. Discrepancies in responses across systems, where one or two emotion indicators were elevated and others not, would be taken as indication of a *regulated emotional response*. Low responses on all three modalities would indicate that there was little responsiveness or the child was *well regulated*. We allowed the identification of profiles on an empirical basis so that a range of regulated or unregulated profiles could emerge.

2. Test the relations of temperament, assessed in the 1st year of the study, to emotion regulation profiles, assessed as a specific response to an emotion-eliciting task in the 2nd year of the study. We expected that children higher in negative emotionality would be more likely to show unregulated profiles in response to emotion-eliciting tasks, whereas children higher in effortful control would show regulated or low-responsive profiles.

3. Test the relations of emotion regulation profiles, assessed in the 2nd year of the study to adjustment, assessed in the 3rd year of the study. We expected that profiles with elevations across all emotion indicators, indicating little or no regulation of emotional responses, would be related to adjustment problems. More specifically, unregulated responses to the frustration task were expected to predict externalizing problems, and unregulated responses to the anxiety-eliciting task would predict internalizing problems. Profiles with elevations on at least one indicator but not all of them were thought to indicate a regulated emotional response. These were expected to be related to lower levels of problems and higher social competence than the unregulated profiles. Finally, profiles with no elevations were expected to predict lower problems and higher social competence.

4. Test emotion regulation profiles as intervening variables in the relation between temperament and adjustment by examining their mediating effects. We hypothesized that an unregulated response to the frustration-eliciting task would mediate the relations of lower effortful control, higher irritability, and high-intensity pleasure to later externalizing problems and that a regulated response would mediate the relations of higher effortful control and lower irritability with later social competence. For the anxiety regulation profiles, we hypothesized that an unregulated response to the anxiety-eliciting task would mediate the relations of

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lower effortful control, higher fear, and higher shyness to later anxiety. Although we had less clear expectations for the prediction of depression, we hypothesized that an unregulated profile consisting of observed emotion, heightened physiological arousal, and child report of frustration or anxiety in either of the emotion-eliciting tasks would mediate the relation between lower effortful control and negative affect (irritability or fear) with depression.

Method

Participants

At Time 1, the sample included 214 children in 3rd–5th grade (Time 1) and their mothers. Families were tested two more times, each assessment occurring 1 year later. In total, families had three assessments over 3 years. Participants were recruited through children's public school classrooms. Schools were selected to represent the range of sociodemographic characteristics of the urban area surrounding our Northwest University. Children with developmental disabilities and families not fluent in English were excluded from the study to ensure that questionnaires were understood fully. At Time 2, 196 families participated. At Time 3, 201 families participated. Given that LPAs were conducted using Time 2 data, profiles were available for 196 cases, and all remaining analyses were based on $N = 196$.

For the sample of 196 cases, children's mean age at Time 1 was 9.5 years ($SD = 1.0$, range = 8–12). The sample included 14% African American children, 2% Asian American children, 3% Latino or Hispanic children, 3% Native American, 72% European American or White children, and 6% children identified with multiple ethnic backgrounds. Fiftysix percent of children were female. Ninety-four percent of the female primary caregivers were biological, 4% were adoptive, and 2% were grandmothers. Seventy percent of children lived in households with two caregivers. Annual family income was distributed roughly evenly across sextiles of income: 11% < $20,000; 11.4% $21,000–$40,000; 17.1% $41,000–$60,000; 16.7% $61,000–$80,000; 19% $81,000–$100,000, and 15.7% > $100,000. Mothers' average level of educational attainment was some college or technical or professional school.

Procedure

Data were collected using structured 2.5-hr interviews and tasks that were conducted in the families' homes at three time points 1 year apart. After confidentiality was explained, mothers signed informed consent forms and children signed assent forms. The children were informed that their responses would not be shared with their mothers unless there was concern about child safety. Mothers and children were interviewed individually to ensure confidentiality of responses. Child tasks were videotaped and coded at a later time. Families received $40 for participating at Time 1, and the compensation increased by $10 for each subsequent assessment.

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Measures

Socioeconomic status—At Time 1, maternal education level and family income were standardized and averaged to create an indicator of the families' socioeconomic status. Socioeconomic status was used as a covariate.

Temperament—At Time 1, dimensions of reactivity and self-regulation were assessed using mother and child reports on the fear, irritability, shyness, and attention regulation subscales of the Early Adolescent Temperament Questionnaire (EATQ; Capaldi & Rothbart, 1992), and the inhibitory control and high-intensity pleasure subscales of the Child Behavior Questionnaire (CBQ; Goldsmith & Rothbart, 1991). The CBQ was developed to assess temperament in children ages 3–6; a measure assessing Rothbart's model of temperament in children ages 8–12 did not exist at the time these data were collected. Previous research has successfully and reliably used the measure with children in middle childhood (ages 8–12; Lengua & Long, 2002). Based on this research (see Lengua & Long, 2002), we combined the EATQ scale of Attention Regulation and CBQ Inhibitory Control scales to assess effortful control. Participants responded to items on a 1 *(very false)* to 5 *(very true)* scale. Example mother report effortful control items include rating how true the following statements are about their child: "good at keeping track of several things" and "can wait before entering into new activities if asked to do so." These items are from the CBQ and EATQ, respectively. Subscale scores were calculated as the mean-weighted sum of the items on a subscale. Cross-reporter measures of temperament were sought to partially address the effects of shared method variance and reporter bias on the observed associations. Combining reporters have been suggested to capture differing perspectives of behavior, and combining measures across methods would also reduce the number of statistical tests conducted. Correlations between mother and child report were as follows: irritability, $r = .05$; high-intensity pleasure, $r = .41$, $p < .05$; fear, $r = .20$; shyness, $r = .27$, $p < .05$; effortful control, $r = .20$, $p < .05$. Despite modest to moderate correlations across reporter, prior confirmatory factor analyses with this sample suggested that combining mother and child report of temperament was feasible (Lengua, 2006). To combine reporters, mother and child reports were standardized and then combined by averaging the mother and child report scale scores. The composite alphas were calculated to take into account the alpha and variance for each contributing scale as well as the covariance between the scales. Composite alphas also supported combining mother and child reports. Means, standard deviations, and the composite alphas of the study measures are presented in Table 1.

Emotion regulation—Behavioral, physiological, and subjective indicators of emotion responses were measured during frustration- and anxiety-eliciting tasks to create two sets of emotion regulation profiles at Time 2. Children's frustration responses were assessed using a bead-sorting task in which children were asked to sort beads based on an experimenter's instructions. Children were told that if they correctly sorted the beads in 2 min they would receive $1. The children started sorting, but 30 s into the task, experimenters told the children they had been given the wrong directions. The children were told to re-sort the beads with the new directions, but the timer could not be restarted. The children were interrupted again after another 30 s in a similar fashion, and again the children were told they should re-sort the beads, but that the timer would not be restarted. Regardless of

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whether they finished sorting the beads, all children were given the money at the end of the task.

To elicit anxiety, children were asked to give a speech to an unfamiliar experimenter who had been working with the parent (e.g., Cobham, Dadds, & Spence, 1999; Inderbitzen-Nolan, Anderson, & Johnson, 2007). To intensify the experience, the children were told that the other experimenter was an expert speaker and that the children's speeches would be evaluated by that experimenter. Furthermore, children were instructed to speak into a microphone and told that they were being videotaped. Children were instructed to speak for 2 min about their favorite subject in school. If they did not speak for the 2-min period spontaneously, up to three prompts were given.

Physiology—Changes in HR and EDR were measured during the frustration- and anxiety-eliciting tasks. HR was measured by attaching a photo-electric plethysmograph (Biopac Systems Inc., Santa Barbara, CA) to the distal phalange of the child's ring finger. EDR was measured with two sensors placed on distal phalanges of the middle and pointer fingers. Gel 100 from Biopac was used on the EDR sensors to assure that skin contact was maintained. A Biopac MP 100 MSW data collection and amplifier system was used to record HR and EDR directly onto the hard drive of a laptop computer, and the data were scored using AcqKnowledge version 3.2.6. HR was sampled at a frequency of 500 Hz and EDR was sampled at 1,000 Hz. For both HR and EDR slopes, positive scores reflect increases, and negative scores reflect decreases in each indicator. Greater absolute values reflect greater changes across the task. HR during the bead task and EDR during the speech task were used in the LPA. One hundred sixty-six children had data for EDR and HR. Missing data on physiological measures resulted from equipment problems or child refusal.

Observed frustration and anxiety—Trained coders rated the videotaped emotion regulation tasks. For the frustration-eliciting task, codes were assigned to each 30-s epoch based on physical/bodily signs of frustration/anger (putting beads down hard, body/arm/hand tensing and/or stiffening, shrugging shoulders), facial expressions (furrowed brow, widened eyes, squinting eyes), frustrated vocalizations to the self (sighs and mumbling), and frustrated vocalizations to the experimenter (words, phrases, or questions the child posed to the experimenter indicating frustration, anger, annoyance). Coders assessed the intensity and frequency of these behaviors and made a global rating of the overall frustration/anger observed as being 0 (*none at all*), 1 (*mild/typical*), 2 (*moderate/some*), or 3 (*high/a lot*). For anxiety measures, anxious physical/bodily signs (shifting in seat, twitching/nervous movements), facial signs (gaze aversion, widening eyes), and vocal signs of anxiety (cracking voice, shaking or trembling voice) were each rated. Again, using these behaviors, coders made a global rating of the overall anxiety as being 0 (*none at all*), 1 (*mild/typical*), 2 (*moderate/some*), or 3 (*high/a lot*). To assess reliability, 15% of the bead task and 10% of the anxiety task cases were coded twice by independent coders. Because scores were continuous, reliability was assessed using intraclass correlations, which were .89 and .83 for the frustration and anxiety tasks, respectively. Behavioral ratings were available for 184 children.

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Subjective reports of emotion—After each emotion-eliciting task, children were asked to report on a scale of 1 (*none), 2* (*a little*), 3 (*some*), and 4 (*a lot*), how much they experienced four emotions: frustration/anger, nervous/anxious, happy, and shy/embarrassed. In creating the emotion regulation profiles, we used the subjective report of frustration/anger for the bead task and the nervous/anxious item for the speech task. Ratings were available for 194 children.

Adjustment—Both mother and child reports of adjustment problems and social competence were obtained at Time 3. Mothers reported on children's anxiety, depression, and externalizing problems using the Child Behavior Checklist (Achenbach, 1991a), rating items on a 3-point scale (0 = *not true*, 1 = *somewhat/sometimes true, 2 = very/often true*). Scores for anxiety and depression were obtained using an alternate scoring approach that allows for separate anxiety and depression scores to be derived (Lengua, Sadowski, Friedrick, & Fisher, 2001). Child reports of their own conduct problems were assessed using raw scores from the Delinquent and Aggressive subscales (28 items) of the Youth Self-Report (YSR; Achenbach, 1991b). Although the YSR was developed for children slightly older than many of the children in this study, the Delinquent and Aggressive Behavior subscales have demonstrated acceptable reliability and validity with this age group (Sandler, Tein, & West, 1994). Because many of the children fell outside the recommended age for the YSR at the start of the study, the full measure was not administered. Depression was assessed with the 27-item Child Depression Inventory (CDI; Kovacs, 1981). For each item, children select one of three statements of increasing severity to reflect their level of depressive symptoms. Children reported on their anxiety on the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978). The RCMAS consists of 28 items (9 Lie scale items) to which the child responds "yes" or "no" and assesses both the degree and quality of anxiety experienced by children and adolescents from ages 6 to 19. Social competence was assessed using mother and child reports on the 34-item Social Skills Rating Scale (Gresham & Elliot, 1990), which assesses cooperation, assertion, responsibility, empathy, and self-control. Correlations between mother and child reports were: depression, $r = .21$, $p < .05$; anxiety, $r = .13$; externalizing, $r = .42$, $p < .05$; social competence, $r = .29$, $p < .05$. Reports were combined in the same manner as the temperament scales.

Analytic Plan

First, correlations among the temperament, adjustment, and emotion indicators for the frustration and anxiety task were examined. Next, LPA was used to identify emotion regulation profiles (Muthén & Muthén, 1998–2006). Probability of profile membership was correlated with temperament and adjustment measures because particular relations would otherwise be lost in regression analyses. Next, the resulting profile probabilities were used in regression analyses to identify which temperament variables predicted profile membership and, in turn, how profile membership predicted adjustment. Whether the emotion regulation profiles mediated the relation between temperament and adjustment was tested using a product of coefficients test outlined in MacKinnon, Lockwood, Hoffman, West, and Sheets (2002). Based on theoretical relevance, irritability, high-intensity pleasure, and effortful control were examined in relation to the frustration regulation profiles, whereas shyness, fear, and effortful control were examined in relation to the anxiety regulation profiles.

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Results

Correlations Among Study Variables

First, the correlations of temperament and adjustment variables with the emotion indicators were computed. Shyness was negatively related to the observed frustration, $r = -.19$, $p < .05$, and positively related to the observed anxiety, $r = .24$, $p < .05$. None of the remaining temperament variables were related to the emotion indicators. Higher HR was associated with greater conduct problems, r = .16, $p < .05$. Child report of frustration/anger during the frustration task was positively related to depression, $r = .23$, $p < .05$; anxiety, $r = .19$, $p < .05$; and conduct problems, $r = .25$, $p < .05$, and negatively related to social competence, $r = -.21$, $p < .05$. Child report of being nervous/anxious during the anxiety task was related to greater anxiety, r = .20, $p < .05$ at Time 3.

Latent Profile Analyses

Latent profile analyses identified five latent emotion regulation profiles for the frustration (bead) task and four latent profiles in the anxiety (speech) task. Starting with a one-class model, classes were added iteratively until the addition of a class did not improve the model. Information criterion statistics were used to determine class number including Bayesian information criterion (BIC; Schwarz, 1978), adjusted Bayesian information criterion (adjusted BIC; Sclove, 1987), and Akaike information criterion (AIC; Akaike, 1973). Both BIC (Magidson & Vermunt, 2004) and adjusted BIC (Yang, 2006) have been found to be accurate statistics in different simulation studies. Entropy is reported as further evidence for our profile selection, with values approaching 1 suggesting superior class identification (Celeux & Soromenho, 1996). Table 2 shows decreasing adjusted BIC and AIC values for the frustration-eliciting task. A six-class model did not converge; therefore, the five-class model was selected. In the anxiety task, adding a fifth class increased all information criterion statistics, suggesting a four-class emotion regulation model provided the best fit. Full information maximum-likelihood estimation was used to account for missing data when there were data available on at least one emotion indicator. Therefore, all profile analyses were conducted with 196 cases.

The results of the LPA are presented in Figure 1, which displays the deviation of the class mean from the overall sample for the frustration and anxiety regulation profiles. The profile and grand means for the observed emotion, the physiological indicator, and child report of emotion for the frustration and anxiety regulation are reported in Table 3.

After the profiles were identified, they were correlated with the identified potential covariates— gender, age, and socioeconomic status—to determine if it was necessary to covary these variables in all regression analyses. These covariates were chosen due to their associations with effortful control and emotion regulation (Cole, Teti, & Zahn-Waxier, 2003; Martini, Root, & Jenkins, 2004; Rothbart & Bates, 2006; Sanson, Smart, Prior, Toumbourou, & Oberklaid, 2009) and because they were correlated with the profiles discussed below.

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Frustration Regulation Profile

For the frustration-eliciting task, Profile 1 (n = 82) was characterized by being lower than the sample mean on observed frustration, and having a slight increase in HR and lower levels of child-reported frustration compared to other children. This profile might be considered a *low-response* or *well-regulated group*. Profile *2 (n* = 22) was characterized by lower observed frustration, a moderate increase in HR, and higher levels of child-reported frustration. This profile might reflect children who were *responsive but regulated*. Profile 3 (n = 14) was characterized by children observed as being more frustrated, and having a moderately increased HR and higher child-reported frustration. This profile might be considered a *moderately responsive* group. Profile 4 (n = 10) was characterized as having the highest levels compared to the sample mean on all three variables and was considered an *unregulated-response* group. Profile 5 (n = 68) was characterized by more observed frustration, average increased HR, and less self-reported frustration. This profile might reflect a *moderately responsive-expressive* group.

Frustration regulation profiles, temperament, and adjustment—LPA probabilities of profile membership were correlated with temperament to identify temperament characteristics that may contribute to particular emotion regulation profiles. Children more likely to be response regulated (Profile 2) were more shy, r = .16, p < .05. Children more likely to be moderately responsive (Profile 3) had lower levels of effortful control, r = −.16, p < .05. Children more likely to be unregulated responders (Profile 4) had lower levels of effortful control, r = −.18, p < .05; lower shyness, r = −.14, p < .10; and greater high-intensity pleasure, r = .17, p < .05. There was a trend for children more likely to be expressive (Profile 5) and to be less irritable, r = −.12, p < .10, and less shy, r = −.14, p < .05. There were no significant temperament correlations with the well-regulated children (Profile 1).

The LPA probabilities of profile membership were correlated with adjustment. Children who were more likely to be well regulated reported lower conduct problems, r = −.15, p < .05, and there was a trend for them to report lower anxiety, r = −.14, p < .05. Being response regulated was not associated with adjustment. Children more likely to be moderately responsive reported higher depression, r = .24, p < .05; conduct problems, r = .20, p < .05; and a trend toward greater anxiety, r = .14, p < .10, and lower social competence, r = −.14, p < .10. Children more likely to be unregulated res-ponders reported higher depression, r = .20, p < .05, and conduct problems, r = .31, p < .05, and lower social competence, r = −.27, p < .05. Children more likely to be expressive reported higher social competence, r = .15, p < .05.

Test of frustration emotion regulation profiles as mediators of temperament-adjustment relations—Multiple regression analyses were used to test whether emotion regulation profiles mediated the relation between temperament and adjustment. The mediating variables in these regression analyses were the five probability variables of being in each frustration profile. These probabilities are not independent as they sum to 1.0 for each case. Thus, probabilities of group classification are fully captured by g-1 (where g is the number of groups) variables, similar to when using dummy coding to indicate category

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inclusion. Thus, one profile was excluded as it would be completely redundant with the others. For the frustration profiles, the response-regulated group was excluded as it was unrelated to any of the adjustment measures.

First, irritability, high-intensity pleasure, and effortful control were examined as predictors of the frustration emotion regulation profiles using multiple regression analyses. Child age, gender, and socioeconomic status were entered as covariates in the first step of the regression. The set of temperament variables was entered in the second step. Above the effects of the covariates, lower effortful control predicted a higher likelihood of being a moderate responder, $\beta = -.17$, $p < .05$, and an unregulated responder, $\beta = -.16$, $p < .05$.

Next, temperament and emotion regulation profiles were examined as predictors of adjustment. Again, the regression models included child age, gender, and socioeconomic status in the first step. Next, irritability, high-intensity pleasure, and effortful control were entered in the second step of the regression, and the frustration regulation profiles were entered in the third step (Table 4). In the step that they were entered, lower effortful control, $\beta = -.35$, $p < .05$, and greater high-intensity pleasure, $\beta = .22$, $p < .05$, were significantly related to conduct problems. Effortful control was significantly negatively related to depression, $\beta = -.34$, $p < .05$, and anxiety, $\beta = -.22$, $p < .05$. Effortful control was significantly related to social competence, $\beta = .40$, $p < .05$. When the emotion regulation profiles were entered next, the well-regulated profile predicted lower anxiety, $\beta = -.19$, $p < .10$. There were trends toward associations of the moderately responsive children to have higher depression, $\beta = .17$, $p < .10$, and the unregulated responders to have more conduct problems, $\beta = .11$, $p < .10$.

Plausible mediated relations between temperament and adjustment were identified. This was determined if there was a trend or significant relation of temperament to an emotion regulation profile and if there was a trend or significant relation of an emotion regulation profile to an adjustment indicator. In those cases, the significance of the intervening effects of emotion regulation profiles were tested using a products of coefficients test outlined in MacKinnon et al. (2002) and this method was used because prior research has demonstrated that it is more powerful than the product of coefficients method outlined by Baron and Kenny (1986). The product of coefficients test divides the estimate of the intervening variable effect, $\alpha\beta$, by its standard error and compares this value to a standard normal distribution (Meeker, Cornwell, & Aroian, 1981). The regression coefficients for the effects of temperament on each emotion regulation profile (α path) and emotion regulation profile on adjustment (β path) were converted to *z* statistics, which were then multiplied ($P = Z_\alpha Z_\beta$) to provide an estimate of the indirect effect of temperament on adjustment through emotion regulation. Two plausible mediating paths were tested for the frustration regulation profiles, and both tests were significant. The critical value for *P* is 2.18 rather than 1.96 to test for the .05 significance level. The indirect effect of effortful control on depression through the moderate responders was significant, $P = -4.39$, $p < .05$, as was the indirect effect of effortful control on conduct problems through the unregulated responders, $P = -3.97$, $p < .05$.

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Anxiety Regulation Profile

For the anxiety-eliciting task, Profile 1 (n = 3) was characterized by lower observed anxiety, large decreases in electrodermal responding, and moderate levels of child report of anxiety compared to other children. This profile might reflect children who were *reactive but regulated*. Profile 2 (n = 70) was characterized by lower anxiety, minimal change in EDR, and lower reported anxiety, and may reflect children who were *unresponsive* or *well regulated*. Profile 3 (n = 102) was characterized by greater observed anxiety, a small decrease in EDR, and slightly higher than average levels of subjective anxiety, possibly reflecting children who were *responsive but regulated*. Profile 4 (n = 21) was characterized by higher levels of observed anxiety, increases in EDR, and slightly higher levels of subjective anxiety. This profile might reflect children who had an *unregulated response*.

Anxiety regulation profiles, temperament, and adjustment—Correlations between the anxiety regulation profiles, temperament, and adjustment were computed. Both response regulated profiles were not significantly related to the temperament variables. The low responsive children were less shy, r = −.18, $p < .05$. The unregulated responsive children were more shy, $r = .20$, $p < .05$. None of the anxiety regulation profiles was related to adjustment.

Teste of anxiety regulation profiles as mediators of temperament-adjustment relations—First, temperament variables were examined as predictors of anxiety regulation profiles using multiple regression analyses. Child age, gender, and socioeconomic status were entered in the first step of the regression as covariates. The set of temperament variables, effortful control, fear, and shyness were entered in the second step. Lower effortful control, β = −.21, $p < .05$, and lower fear, β = −.18, $p < .05$, predicted a higher likelihood of being response regulated. Shyness was related to a lower probability of being a low responder, β = −.16, $p < .05$, and a higher probability of being unregulated responsive, β = .21, $p < .05$.

Next, temperament and anxiety regulation profiles were examined as predictors of adjustment. The regression models included child age, gender, and socioeconomic status in the first step to covary their effects. Fear, shyness, and effortful control were entered in the second step of the regression. The set of anxiety regulation profiles was entered in the third step (Table 5). In the step that they were entered, shyness, β = −.16, $p < .05$, and effortful control, β = −.41, $p < .05$, predicted lower conduct problems. Effortful control was significantly related to lower depression, β = −.34, $p < .05$. Fear, β = .22, $p < .05$, and lower effortful control, β = −.20, $p < .05$, predicted anxiety. Greater effortful control was significantly related to social competence, β = .40, $p < .05$. When the emotion regulation profiles were entered next, none of the anxiety regulation profiles was related to adjustment. Therefore, no mediation tests were conducted.

Discussion

In this study, we examined the relations of emotion regulation to preadolescents' temperament and adjustment using both variable- and person-centered analyses, allowing for examination of the possibility that emotion regulation responses might mediate the relation

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between temperament and adjustment. To do this, we identified emotion regulation profiles using behavioral, physiological, and subjective indicators of emotions, and using discrepancies across these measures to facilitate inference of regulation. These profiles might reflect variations of emotion regulation that are, in part, determined by children's characteristic levels of reactivity and self-regulation. Person-oriented quantitative methods were used in these analyses because we were interested in the possibility that patterns of relations among emotion systems, and not necessarily any one emotion indicator on its own, would provide valuable information about how children regulated their emotions in goal-oriented and emotionally evocative situations.

The frustration and anxiety regulation profiles that emerged depicted a range of children's emotion regulation responses, which may consist of regulating none, one, or more systems during an emotion-eliciting experience. Some children demonstrated unregulated responsiveness across all three emotion indicators. Others demonstrated regulated responsiveness, in which there were elevations in one or two emotion indicators but not all of them. There were also nonresponsive or well-regulated children who exhibited low responses on all three indicators. The LPAs also identified the number of children in each classification, thus providing information about which profiles represent more common emotion regulation approaches for this age group.

Temperament characteristics and adjustment were related to the emotion regulation profiles, particularly to children's responses to the frustration task. Hypotheses that the emotion regulation profiles would mediate the association between temperament and adjustment had mixed support. The moderately responsive and unregulated responsive frustration profiles were predicted by lower effortful control, yet they were differentially related to later depression and conduct problems, respectively. In most other instances, the emotion regulation profiles did not contribute additional information beyond the effects of temperament in predicting adjustment.

Frustration Regulation

There was evidence for intervening effects of the unregulated (Profile 4) and moderately responsive (Profile 3) children in the relations of lower effortful control to conduct problems and depression, respectively. In addition to being related to lower effortful control, being in the unregulated group was associated with high-intensity pleasure and lower shyness, characteristics reflecting higher BAS activity. Lower effortful control may have left these children with little ability to put the "brakes" on their emotion systems when provoked. During the frustration task, these children exhibited a strong response to a blocked goal that was evident through their unmitigated display of frustration, increased HR, and endorsement of feeling frustrated. A pattern of unregulated emotion responses during challenging situations may represent one mechanism by which children low in effortful control and high in BAS develop conduct problems. The unregulated responders may be similar to undercontrolled styles identified by others (Cole et al., 1996; Eisenberg et al., 2001).

Superficially, the moderately responsive profile appears similar to the unregulated profile because both exhibited elevated responses on all three emotion indices. Both profiles were predicted by low effortful control, as well. However, there are several differences between

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the unregulated and moderately responsive profiles that appear to have implications for children's adjustment, particularly depression. First, there were differences in responses across the emotion indicators. Children demonstrating the moderately responsive profile had high levels of subjective frustration during the task, but only a slight increase in HR and moderate observed frustration. It appears that these children modulated their frustration to some extent relative to children who were unregulated. However, their responses were only partially modulated, as these children nonetheless demonstrated increases in HR and more frustrated behavior relative to the other groups. We might infer that the children in the moderately responsive group tried to contain their subjective experience of frustration but were only partially successful, as their frustration was observable. In addition, being in the moderately responsive profile was predicted by lower effortful control, which may mitigate those children's ability to modulate their subjective emotional state.

Although mean differences were not calculated between the moderately responsive and unregulated children in relation to adjustment outcomes, there were some potentially informative differences between the two profiles. Both profiles were positively correlated with depression and conduct problems and negatively correlated with social competence. However, only the moderately responsive group was more likely to be rated as having more anxiety. Thus, although both groups demonstrated conduct problems, lower social competence, and greater depressive symptoms, anxiety symptoms were only associated with the moderately responsive group. Although a pattern of co-occurrence of internalizing and externalizing problems is common in community samples (Ingoldsby, Kohl, McMahon, & Lengua, 2006; Reinke & Ostrander, 2008), these findings may highlight potential specific pathways to depression versus conduct problems. Low effortful control combined with high BAS activity appears to be a specific pathway to conduct problems through unmitigated emotional responses in provocative situations. However, low effortful control that leads to inadequate modulation and perhaps lower expression of frustration, in the absence of high BAS activity, might represent a specific path to depression.

The moderately responsive-expressive frustration profile (Profile 5), characterized by greater observed frustration but lower HR and self-report of frustration, was predicted by less irritability and less shyness at Time 1, and those children had lower adjustment problems and higher social competence at Time 3. Interestingly, these children exhibited higher levels of observed anger in the task. Although at first it seems surprising that these children would be visibly frustrated during the task, in certain situations, displaying a moderate level of frustration actually may be adaptive (Dennis, Cole, Wiggins, Cohen, & Zalewski, 2009; Hubbard et al., 2002) and may mitigate irritability. As this emotion regulation profile had the second highest membership ($N = 68$), it may indicate greater assertiveness or confidence, contributing to their higher social competence.

The responsive but regulated group (Profile 2) was associated with higher shyness but was not related to adjustment problems. These children also reported a high level of subjective frustration. However, their physiological response was less pronounced than the unregulated and moderately responsive profiles, and they demonstrated among the lowest levels of observed angry behavior. Their shyness may have prompted these children to mask their frustration.

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Anxiety Regulation

Responses to the anxiety-eliciting task differed from those to the frustration task both in the profiles that emerged and in their relations to temperament and adjustment. Profiles derived from responses to the speech task were related only to shyness. Children characterized by the unresponsive or well-regulated group (Profile 2), were predicted by lower shyness, whereas the unregulated-responsive group (Profile 4), were predicted by greater shyness. As these patterns may suggest, it is possible that the emotion-eliciting task used was better designed to assess shyness or social anxiety and not fearfulness or more general anxiety, although another study found children's reactions to this task to be related to both social reticence and general anxiety (Fox et al., 1995).

Limitations

The emotion regulation profiles identified in this study and their relations to temperament and adjustment may be limited to community samples. It is unclear whether similar profiles or relations with temperament would emerge in clinical samples. It is possible that similar profiles and patterns of relations would exist but that numbers of children in each profile would change, such that more children would exhibit the more maladaptive styles. Another limitation of this study was the use of HR reactivity and EDR, which measure general autonomic reactivity. It would have been useful to include a measure of parasympathetic activity, such as respiratory sinus arrhythmia (RSA), an indicator of emotion regulation (Beauchaine, 2001). However, a reliable measure of RSA was not available given that HR data were collected using children's finger pulse.

Finally, shared method variance between temperament and adjustment might account for why temperament and not emotion regulation profiles predicted adjustment. However, this explanation does not fully account for the temperament–adjustment associations, because there are significant correlations between ER and adjustment when examining the zero-order correlations. Another possible explanation is that temperament is a common cause of both emotion regulation and adjustment, and once accounted, the relation between emotion regulation and adjustment becomes nonsignificant. In addition, it is possible that temperament and emotion regulation are not distinguishable at this point in development. Future studies should clarify these possibilities.

Conclusions

During preadolescence, there are a variety of ways children regulate their emotions. Moderate responsiveness in the frustration task appeared to increase risk for developing depression problems, over and above the effects of lower effortful control, and unregulated frustrated responsiveness appeared to increase the risk for developing conduct problems, over and above the effects of lower effortful control. Our findings suggest that temperament represents a direct risk for adjustment problems but also appears to operate indirectly through children's emotion regulation during challenging or provocative situations.

This study has implications for future emotion regulation research in showing that person-oriented approaches can be useful in understanding the patterns of relations among variables within a person and adds to the small number of studies using this approach (Hill et al.,

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2006; Maughan et al., 2007). The other major implication of this study is that future work should address the paucity of studies that examine how temperament shapes an individual's emotion regulation style or strategies and how emotion regulation may be an additional pathway through which temperament predicts adjustment problems. The findings of this study provide initial evidence for the likelihood that such investigations will provide a wealth of information regarding our understanding of how preadolescent children develop adjustment problems.

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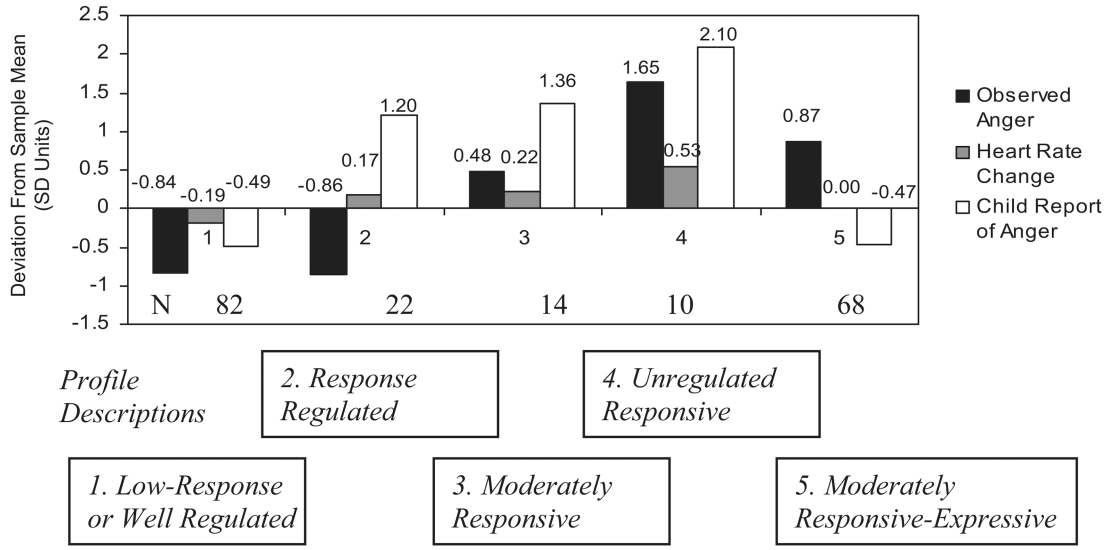
(a)



Profile Descriptions

2. Response Regulated

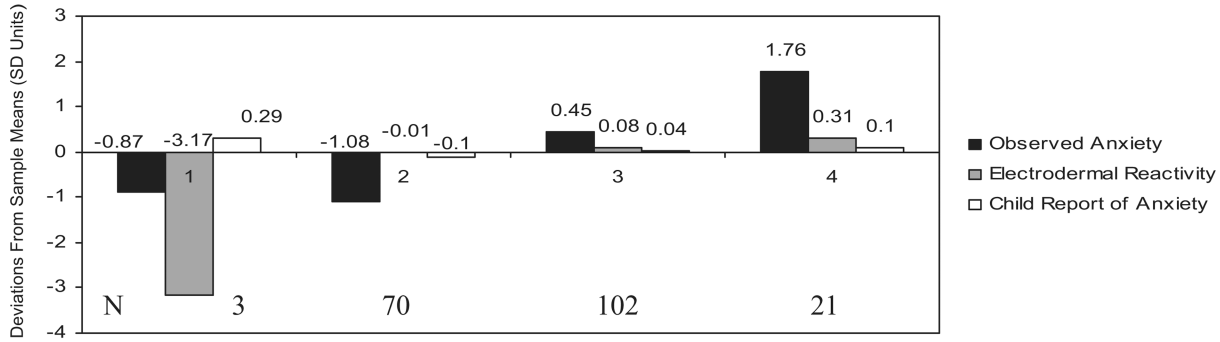
4. Unregulated Responsive

1. Low-Response or Well Regulated

3. Moderately Responsive

5. Moderately Responsive-Expressive

(b)



Profile Descriptions

2. Low Responsive or Well-Regulated

4. Unregulated Responsive

1. Response Regulated

3. Response Regulated

Figure 1.

Standard deviations from the overall sample mean of each class for observed emotion, physiological response, and child report of emotion for the (a) five-mixture model solution identified for frustration regulation and (b) four-mixture model solution identified for anxiety regulation.

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Table 1

Means, Standard Deviations, and Composite Alphas for Child Temperament and Adjustment

	Mother report *M(SD)*	Child report *M(SD)*	Composite alpha
Temperament			
Irritability	26.61 (5.27)	25.69 (5.43)	.74
High intensity pleasure	25.51 (5.98)	19.46 (5.27)	.78
Fearfulness	17.58 (3.73)	19.89 (4.67)	.61
Shyness	17.01 (5.50)	17.82 (3.87)	.80
Effortful control	43.19 (6.22)	73.80 (10.91)	.78
Adjustment			
Depression	2.54 (2.42)	4.28 (5.08)	.78
Anxiety	3.91 (2.97)	21.96 (4.18)	.78
Externalizing/conductproblems	3.49 (3.30)	4.00 (4.18)	.86
Social competence	42.79 (7.05)	63.26 (10.03)	.91

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Table 2

Summary of BIC and AIC Measures for Latent Profile Analyses of Emotion Responses to Frustration- and Anriety-Eliciting Tasks

No. classes	BIC	Adjusted BIC	AIC	Entropy
Frustration (Bead)				
Class 1	1,572.02	1,553.02	1,552.36	—
Class 2	1,543.63	1,511.95	1,510.85	.90
Class 3	1,550.95	1,506.60	1,505.06	.87
Class 4	1,553.52	1,496.50	1,494.52	.76
Class 5[a]	1,563.07	1,493.37	1,490.95	.88
Anxiety (Speech)				
Class 1	1,555.16	1,532.99	1,532.21	—
Class 2	1,547.60	1,512.75	1,511.54	.93
Class 3	1,555.16	1,507.64	1,505.99	.82
Class 4	1,499.51	1,439.33	1,437.33	.95
Class 5	1,524.24	1,451.37	1,448.84	.84

Note. BIC = Bayesian information criterion; AIC = Akaike information criterion.

[a]Class 6 did not identify a fit.

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Table 3

Profile Means and Standard Deviations for Observed Emotions, Physiological Reactivity, and Child Reports of Emotion During the Frustration and Anxiety Regulation Tasks

	Profile					
	1	**2**	**3**	**4**	**5**	**Grand mean**
Frustration regulation profiles						
Observed (scale 0–3)	0.90 (.30)	0.90 (.31)	2.00 (.00)	3.00 (.00)	2.32 (.47)	1.61 (.82)
HRR[a]	0.01 (.51)	0.17 (.55)	0.20 (.44)	0.34 (.52)	0.10 (.40)	0.09 (.48)
Child report (scale 1–4)	1.41 (.50)	3.09 (.29)	3.21 (.43)	3.80 (.43)	1.43 (.50)	1.86 (.93)
	Profile					
	1	**2**	**3**	**4**	**Grand mean**	
Anxiety regulation profiles						
Observed (scale 0–3)	1.00 (.00)	0.84 (.00)	2.00 (.04)	3.00 (.00)	1.66 (.06)	
EDR[b]	−0.07 (.00)	−0.01 (.02)	0.00 (.01)	0.00 (.02)	−0.01 (.02)	
Child report (scale 1–4)	2.50 (.71)	2.16 (.96)	2.32 (.83)	2.33 (.86)	2.20 (.90)	

Note. HRR = heart rate reactivity; EDR = electrodermal reactivity.

[a] Higher values of HRR indicate greater HRR slope across the task.

[b] Higher values of EDR indicate greater EDR slope across the task.

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Table 4

Regression β Coefficients for the Effects of Covariates, Temperament, and Frustration Regulation Profiles on Adjustment

	Depression			Anxiety			Conduct problems			Social competence		
	β at entry	ΔR^2	β last step	β at entry	ΔR^2	β last step	β at entry	ΔR^2	β last step	β at entry	ΔR^2	β last step
Step 1		.06**			.06**			.19**			.20**	
Age	.05		.05	−.03		−.02	.11†		.13*	−.12†		−.15*
Gender	.09		.01	−.06		−.12†	.32**		.19**	−.34**		−.25**
SES	−.22**		−.14†	−.23**		−.18*	−.27**		−.13*	.26**		.16*
Step 2		.10**			.07**			.19**			.15**	
Irritability	−.03		−.02	.07		.09	.07		.08	.02		.02
High-intensity pleasure	.04		.04	.05		.07	.22**		.21**	−.05		−.03
Effortful control	−.34**		−.29**	−.22**		−.19*	−.35**		−.30**	.40**		.37**
Step 3		.05*			.03			.04*			.02	
Profile 1	—		−.05	—		−.19†	—		−.13	—		.02
Profile 3	—		.17*	—		.05	—		.07	—		−.03
Profile 4	—		.10	—		−.07	—		.11†	—		−.11
Profile 5	—		−.04	—		−.07	—		−.10	—		.09

Note. Child gender is coded 1 = female, 2 = male. SES = socioeconomic status.

† $p \leq .10$.

* $p \leq .05$.

** $p \leq .01$.

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Table 5

Regression β Coefficients for the Effects of Covariates, Temperament, and Anxiety Regulation Profiles on Adjustment

	Depression			Anxiety			Conduct problems			Social competence		
	β at entry	**ΔR^2**	**β last step**	**β at entry**	**ΔR^2**	**β last step**	**β at entry**	**ΔR^2**	**β last step**	**β at entry**	**ΔR^2**	**β last step**
Step 1		.06**			.06**			.19**			.20**	
Age	.05		.07	−.03		.10	.11		.14*	−.12†		−.15*
Gender	.09		.02	−.06		−.09	.32**		.23**	−.34**		−.27**
SES	−.22**		−.16	−.23**		−.17*	−.27**		−.22”	.26**		.18**
Step 2		.10**			.16**			.17**			.16**	
Fearfulness	−.02		−.02	.22**		.22**	.03		.02	.08		.07
Shyness	−.01		−.09	.00		.01	−.16*		−.14*	.09		−.07
Effortful control	−.34**		−.35**	−.20**		−.21**	−.41**		−.41**	.40**		.40**
Step 3		.01			.17			.01			.01	
Profile 1	—		.04	—		.03	—		.00	—		.09
Profile 2	—		.10	—		.09	—		.06	—		.02
Profile 4	—		.08	—		.06	—		−.06	—		−.06

Note. Child gender is coded 1 = female, 2 = male. SES = socioeconomic status.

† $p \leq .10$.

* $p \leq .05$.

** $p \leq .01$.