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Adolescent Self-Regulation as Resilience: Resistance to Antisocial Behavior within the Deviant Peer Context

Theodore W. Gardner · Thomas J. Dishion · Arin M. Connell

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Abstract This study tests the hypothesis that self-regulation serves as a resiliency factor in buffering youth from negative influences of peer deviance in middle to late adolescence. The interactive effects between peer deviance and self-regulation were investigated on change in antisocial behavior from age 17 to 19 years in an ethnically diverse sample of adolescents. A multi-agent construct was created using adolescent, parent, and teacher reports of self-regulation and peer deviance. Results indicated that self-regulation shows convergent validity and covaries as expected with developmental patterns of adolescent antisocial behavior. Self-regulation moderated the association of peer deviance with later self-reported adolescent antisocial behavior after controlling for prior levels of antisocial behavior. The implications of these findings for models for the development of antisocial behaviors and for intervention science are discussed.

Keywords Self-regulation · Deviant peers · Antisocial behavior · Adolescence

T. W. Gardner (✉) · T. J. Dishion · A. M. Connell
Child and Family Center, University of Oregon,
Eugene, Oregon, USA
e-mail: theodore.gardner@pepperdine.edu

T. W. Gardner · T. J. Dishion · A. M. Connell
Department of Psychology, University of Oregon,
Eugene, Oregon, USA

T. W. Gardner
Pepperdine University,
24255 Pacific Coast Highway,
Malibu, CA 90263, USA

A. M. Connell
Department of Psychology, Case Western Reserve University,
Cleveland, OH, USA

A plethora of longitudinal and intervention research points to the central role of deviant peers in the early emergence and course of antisocial behavior from childhood through adolescence (for reviews see Dishion and Patterson 2006; Dodge et al. 2006). Affiliation with a deviant peer group is associated with both early- and late-onset trajectories of antisocial behavior, amplifying and helping to maintain antisocial behavior manifested in childhood as well as promoting emergence of antisocial behavior during adolescence (e.g., Patterson et al. 1998; Simons et al. 1994; Snyder et al. 2005; Vitaro et al. 1997). The findings relating deviant peer influence range across a number of measurement methods as well as analytic techniques. For example, in an analysis of developmental trajectories, high and chronic levels of antisocial behavior among males were partly characterized by deviant peer affiliation (Wiesner and Capaldi 2003). In two mixed-gender samples van Lier et al. (2005) reported that a subclass of youth characterized by chronic-high antisocial behavior was nearly exclusively male, tended to affiliate more with antisocial peers, and experienced more peer rejection relative to moderate- and low-antisocial behavior groups.

Although it is clear peers can influence the development and course of antisocial behavior, especially among youth who are moderately involved in such behavior (Vitaro et al. 1998), it is also interesting that many youth who have regular, repeated contact and friendships with 'deviant' peers do not seem to be negatively influenced. Indeed, one major theoretical orientation on the development of crime is that those who engage in problem behaviors lack 'self control', and that this personal deficit is the 'cause', and peer deviance is simply the venue (e.g., Gottfredson and Hirschi 1990; Hirschi 2004). In reviewing the literature on the development of antisocial behavior and substance use in children and adolescents, it has been proposed that

children's self-regulation potentially serves as both a main effect on the development of antisocial behavior (as in the Hirschi model) and also as a moderator (Wills and Dishion 2004; Dishion and Patterson 2006). That is, children and adolescents with low self-regulation were hypothesized to be more vulnerable to pathogenic relationship dynamics in general, and to peer influence in particular. Conversely, youth high in self-regulation are more able to resist temptations of peers, and keep track of long-term goals despite opportunities for short-term high intensity social rewards often provided by the adolescent peer network (see Dishion et al. 2004). Figure 1 provides a conceptual overview of the hypothesis of the role of adolescent self-regulation in the development and course of antisocial behavior.

The concept of self-regulation is considered to be an individual-difference dimension that includes goal setting, planning, task persistence, and environmental management as well as modulation of behavioral, emotional, and attentional reactivity (Rothbart and Posner 2005). Self-regulation involves "initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states, emotion-related physiological, attentional processes, motivational states, and/or the behavioral concomitants of emotion in the service of accomplishing affect-related biological or social adaptation or achieving individual goals" (Eisenberg and Spinrad 2004, p. 338). Self-regulation develops over time through transactional processes among constitutionally based differences in reactivity and regulation, maturation of the executive attention system, and socialization through educational and social experiences in school, family, and peer contexts (see Dishion and Patterson 2006; Rothbart and Ahadi 1994; Rothbart and Posner 2005; Wills and Dishion 2004).

The analysis of various facets of self-regulation in children and adolescents has an extensive recent history in developmental psychology. Eisenberg and Spinrad's (2004) definition of self-regulation draws heavily upon the temperamental

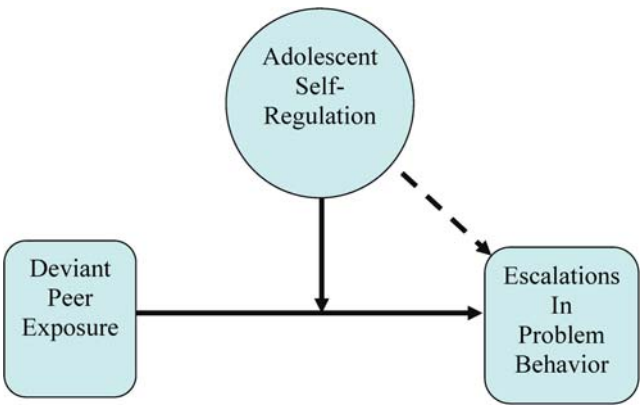

Fig. 1 Self-regulation in the amplification of problem behavior in adolescence

construct of effortful control, which involves the "ability to inhibit a dominant response to perform a subdominant response" (Rothbart and Bates 1998, p. 137). This ability to inhibit an initial prepotent response is a key executive function that creates a delay in responding to the immediate context and creates the temporal space requisite for effortful, or volitional, goal-directed actions (Barkley 2001). In this fashion systems of effortful control "allow the approach of situations in the face of immediate cues for punishment, and avoidance of situations in the face of immediate reward" (Posner and Rothbart 2000, p. 434).

Executive control of attention is considered to be an important underpinning of effortful control and of effective self-regulation. The executive attention network is often studied using tasks involving conflict, most often variants of the Stroop task. Resolving conflict activates anterior cingulate cortex and lateral prefrontal cortex, which are involved in the executive attention network (Botvinick et al. 2001; Bush et al. 2000; Fan et al. 2003). Neuroimaging studies have provided evidence that the executive attention network is involved in self-regulation of both negative and positive emotion (e.g., Beauregard et al. 2001). The executive attention system appears to begin to come online around 2 years of age and changes rapidly during the third year of life and is a central component of the broader temperamental dimension of effortful control (Posner and Rothbart 1998). Executive control of attention is valuable in terms of self-regulation because it allows the individual to distract him or herself from noxious stimuli in the environment (i.e., volitional disengagement). The conflict studies also demonstrate that executive attention is important for filtering out distracting stimuli, and thus maintaining focus in the presence of multiple stimuli competing for attentional resources.

Relevant to the empirical question posed in this paper regarding the development of antisocial behavior, higher levels of effortful control have been linked to the development of conscience (Kochanska 1991, 1995) and empathy (Rothbart et al. 1994). Higher effortful control is associated with fewer conduct problems and better social adjustment in childhood (Eisenberg et al. 2001a, 2000a, 2001b). Similarly, low effortful control is associated with externalizing problems in preadolescence (Oldehinkel et al. 2004). Because many of the neural systems thought to underlie emotion regulation appear to mature throughout adolescence (Spear 2000), it is expectable that individual differences in self-regulation during adolescence play an important role in adolescent psychosocial adjustment as well.

Empirical evidence clearly indicates that self-regulation, variously defined and measured, is a reliable main effect in the development and manifestation of antisocial behavior across childhood and adolescence and into adulthood. For

example, in a study of boys with ADHD, highly aggressive boys scored low on several indices of emotion regulation, whereas boys with ADHD who were not aggressive scored within the range of non-diagnosed boys on every assessed category of emotion regulation (Melnick and Hinshaw 2000). Similarly, poor behavioral self-control (i.e., delay of gratification) has been linked specifically to both aggressive and delinquent externalizing disorders in early adolescence (Krueger et al. 1996). Henry et al. (1996) reported that a temperamental dimension assessed at ages 3 and 5, which they labeled *lack of control*, was related to externalizing behavior problems at ages 9 and 15 and predicted conviction for a violent offense by age 18. Among adults, lower levels of antisocial behavior have been associated with the broad personality dimension of constraint (Krueger et al. 2001), which has a self-regulatory component to it labeled *control*. One limitation of the extant literature addressed in the current study is that much of the research linking self-regulation to problem behavior often include only one reporting agent and there is less measurement work defining individual differences in youth self-regulation from a multi-agent and multi-method framework.

Resilience: Person by Environment Interaction

Although main effects of both deviant peer affiliation and self-regulation on antisocial behavior have been well established in previous research, less is known empirically regarding the transactional relation of these two factors in the development and expression of antisocial behavior. From a development and psychopathology perspective, there is an explicit effort to integrate individual difference constructs with environmental factors when explaining the emergence and course of both adaptation and maladaptation (Cicchetti 1990; Sroufe and Rutter 1984). Accordingly, the research question of interest here is not one of main effects but rather a question of how individual differences in self-regulation modulate the risk for growth in antisocial behavior conveyed by a deviant peer environment.

From a learning perspective, evidence indicates that the toxic influence of the deviant peer group appears to operate, at least in part, via a process of *deviancy training*, in which delinquent dyads of youth primarily react positively to deviant talk, and nondelinquent dyads ignore deviant talk in favor of normative discussions (Dishion et al. 1996). Observational data indicate that deviancy training in delinquent dyads is associated with increased probability of substance use initiation and self-reported delinquency during a two-year period (Dishion et al. 1995, 1996), as well as increases in violent behavior (Dishion et al. 1997). Deviancy training also predicts growth in new forms of antisocial behavior during adolescence (Patterson et al. 2000). Thus, reinforcement contingencies present in the peer ecology appear to play a central role in the emergence, maintenance, and growth of antisocial behavior during adolescence.

Conceptually, because effortful control, and thus the broader construct of self-regulation, facilitates avoidance of situations in the face of immediate reward it is reasonable to propose that individual differences in self-regulation moderate the relationship between deviant peer affiliation and antisocial behavior. Within the deviant peer context, as discussed previously, there are often contingencies that serve to reinforce youth antisocial behavior. Logically, within the deviant peer ecology, the behaviors of youth with greater self-regulation would likely be less influenced by the immediate reinforcement contingencies present in the deviant peer group. In this manner self-regulation may be considered a source of resilience—relatively positive adaptation in the face of heightened risk for maladaptation (Luthar 2006). Consistent with the characterization of self-regulation as a source of resilience, the central hypothesis of this study is that individual differences in self-regulation moderate the relation between peer deviance and growth in antisocial behavior during middle- to late-adolescence.

Some evidence of a transactional relation between self-regulation and risk for antisocial behavior conveyed by environmental factors was reported by Henry et al. (1996) who reported significant statistical interactions between temperamental lack of control and two environmental variables: single-parent home at age 13 and number of changes in the family configuration since the last assessment. The presence of both low control and the experience of a single-parent home at age 13 were associated with increased likelihood of conviction for a nonviolent offense. The interaction between temperamental lack of control and the number of changes in family configuration was associated with increased likelihood of conviction for a violent offense. Also relevant to the conceptualization of self-regulation as a protective factor that moderates environmental risk is evidence that effortful control, a temperamental construct considered central to the regulation of emotion and behavior (Eisenberg et al 2000a; Rothbart and Bates 1998), is associated with resiliency in the presence of multiple environmental risk factors (Eisenberg et al. 2004).

In a very recent study Goodnight et al. (2006) examined the moderating role of self-regulation with respect to deviant peer influences on adolescent delinquency. In this study the authors focused on the construct of reward dominance, which involves a greater sensitivity to reward than to punishment. Individuals higher in reward dominance are less likely to interrupt goal-directed behavior to evaluate its potential negative consequences and, consequently, are less likely to regulate their impulsive behavior (Newman and Wallace 1993). The results indicated that

peer deviance is associated with later externalizing behavior among youth with medium and high levels of reward dominance, but not among youth who are low in reward dominance (Goodnight et al. 2006). The authors suggest that the observed relations among these variables may be attributable, at least in part, to heightened susceptibility of reward dominant youth to the rewards provided by deviant friends in the context of the peer groups' deviancy training process.

The primary aim of the current study was to test the prediction that for understanding adolescent antisocial behavior, a transactional, ecological perspective is most appropriate. From this perspective, three hypotheses are proposed: First, that self-regulation varies as a function of the developmental history of a youth's antisocial behavior. This hypothesis is designed to provide evidence of the ecological validity of the multi-informant self-regulation construct, and we specifically predict that low levels of self-regulation are associated with an early-onset, persistent pattern of antisocial behavior while high levels of self-regulation are associated with low levels of antisocial behavior throughout adolescence. Second, in predicting change in antisocial behavior from middle to late adolescence, both self-regulation and peer deviance will serve as main effects. Third, that there will be a statistically reliable interaction between self-regulation and peer deviance in accounting for change in antisocial behavior from middle to late adolescence. In essence, we predict that youth with high levels of self-regulation during adolescence are less vulnerable to the influence of deviant peers with respect to growth in antisocial behavior.

Method

Participants

The data presented here are from an ongoing longitudinal study. The sample and methodology have been described in detail in other publications (Dishion and Kavanagh 2003; Dishion et al. 2002, 2003). In brief, participants were recruited from the entire population of 6th-grade students in three middle schools in an ethnically diverse metropolitan community. A total of 999 children and their families completed the initial assessment at Wave 1 (T1). Families were randomly assigned to intervention and control conditions. Each year student surveys were conducted primarily in the school context. If students moved out of their original schools, they were followed to their new location. At T6 and T7, students were assessed through the mail and through the school system.

The current analyses focus on data from T6 (11th grade, approximately 17 years old) and T7 (approximately 19 years old). Out of the original sample, 803 provided data at T6, and 802 provided data at T7. Attrition from the study was not related to demographic factors, including gender, ethnic background, or socioeconomic indicators. The sample at T6 and T7 included 44.4% European American adolescents, 30.9% African American adolescents, 5.7% Hispanic adolescents, 3.3% Asian American adolescents, 2.3% Native American adolescents, 1.6% Pacific Islander adolescents, and 11.7% adolescents with multiple ethnic or racial backgrounds. Forty-nine percent of the adolescents were female, and 34.7% were from single-parent families. Gross annual household income ranged from less than $4999 (9.0%) to over $90,000 (12.8%), and the median annual household income was $30,000$39,999. The majority of primary caregivers completed at least high school (88.4%) and many (22.2%) had graduated college.

Measures

Self-regulation Three indicators of self-regulation were derived from the T6 assessment based on youth, parent and teacher reports. Adolescents and their parents completed the short form of the Early Adolescent Temperament Questionnaire-Revised (EATQ-R; Ellis and Rothbart 2002) to assess youths' effortful control. Effortful control is composed of 16 items that assess three aspects of self-regulation: *activation control, attention*, and *inhibitory control*. Questions that assess activation control provide information regarding whether the youth typically performs an action even when there is a strong proclivity to avoid it. Questions regarding attention assess youths' abilities to concentrate, to filter out distractions, to attend to multiple tasks, and to shift from one task to another. Questions that evaluate youths' inhibitory control provide information about whether the youth sticks with plans and goals, is able to keep secrets, and is able to control impulses (Ellis 2002). Together these capacities form the core of effective self-regulation (Eisenberg et al. 2000b). Items were rated on a 5-point scale (1=almost always untrue of you, 2=usually untrue of you, 3=sometimes true, sometimes untrue of you, 4=usually true of you, 5=almost always true of you). Internal consistency of the effortful control scale was acceptable for both youth report (α=0.62) and parent report (α=0.76).

The Teacher Scale of Self-Regulation used for this study included four items adapted from Humphrey (1982) that provide teacher perceptions of youth behaviors and activities within the school environment. The scale provides information regarding whether the youth: (1) thinks ahead about the consequences of his or her actions, (2) plans ahead before acting, (3) pays attention to what s/he is doing, and (4) sticks to what s/he is doing until it is

finished, even on unpleasant tasks. Items were rated on a 5-point scale (1=never, 2=almost never, 3=sometimes, 4=often, 5=always). High internal consistency was found for this scale (α=0.95).

Mother, youth, and teacher scales were significantly intercorrelated. Due to the differences in perspectives (i.e., self and other) and contexts (i.e., non-home and home) the concordance among the three reporters is expectably within the low to moderate range, with the convergence between self- and other reports predictably being the lowest (Achenbach et al. 1987). The low to moderate correlation between informants is likely reflective of valid measurement of the unobservable self-regulation construct without inflation of intercorrelation due to shared perspective or context (Kraemer et al. 2003). The youth report scale correlated significantly with both the parent scale (r=0.31, $p<0.05$) and the teacher scale (r=0.21, $p<0.05$), while the parent report correlated significantly with the teacher report (r=0.41, $p<0.05$). To create the composite score, z-scores for mother, youth, and teacher scales were calculated, and the self-regulation composite scale was calculated as the mean of these z-scores. A principal components factor analysis constrained to a single solution revealed factor loadings ranging from 0.63 to 0.80, which indicates that these three indices are an acceptable index of the latent self-regulation factor. The self-regulation composite scores approximated a normal distribution.

Deviant peer affiliation Deviant peer affiliation at T6 was measured by adolescent, parent, and teacher reports on four items that assess the number of youths' peers who engage in a variety of deviant behaviors including misbehaving, breaking rules, and substance use. Items were rated on a 5-point scale, with higher scores reflecting more frequent affiliation with deviant peers. Internal consistency of this scale was acceptable for all reporters (youth: α=0.69; parent: α=0.66; teacher: α=0.84). The youth report scale correlated significantly with both the parent scale (r=0.34, $p<0.05$) and the teacher scale (r=0.31, $p<0.05$), while the parent report correlated significantly with the teacher report (r=0.39, $p<0.05$). To create the composite score, z-scores for mother, youth, and teacher scales were calculated, and the peer deviance composite scale was calculated as the mean of these z-scores. A principal components factor analysis constrained to a single solution revealed factor loadings ranging from 0.72 to 0.77, which indicates that these three indices are an acceptable index of the latent peer deviance factor. The peer deviance composite scores were slightly positively skewed, but reasonably approximated a normal distribution.

Antisocial behavior Adolescent antisocial behavior was measured at T6 via self-report of nine items that assess frequency of antisocial behaviors during the past month on a 6-point scale (1= "never," 6= "more than 20 times"). The frequencies of the following behaviors were assessed: (a) lying to parents, (b) skipping school, (c) staying out all night without permission, (d) stealing, (e) panhandling, (f) carrying a weapon (g) hitting or threatening to hit a person, (h) damaging property, and (i) spending time with gang members as friends. Internal consistency of this scale was acceptable (α=0.73).

For a subset of analyses designed to evaluate the relation of the composite measure of self-regulation to the developmental status of the adolescent, individuals were grouped into one of three antisocial behavior patterns based on self-report of these nine items at earlier assessment waves. Reliability analyses indicated that internal consistency of this scale was strong for each of the earlier waves of assessment: T1 (6th grade; α=0.83), T2 (7th grade; α=0.84), and T3 (8th grade; α=0.77). Information contained in juvenile court records of youth until age 16 was also used in an analysis to support the ecological validity of the a priori antisocial behavior grouping procedure. For this analysis, a sum score of number of documented arrests for misdemeanors and felonies by age 16 was used.

Antisocial behavior at T7 was measured via self-report on the Adult Self Report questionnaire (Achenbach and Rescorla 2003). Items measuring T6 antisocial behavior were not collected at T7. In order to maximize content similarity across T6 and T7, the DSM-IV Antisocial Behavior scale score from the ASR was used. This scale consists of 20 items assessing youth engagement in antisocial behaviors (e.g. "I break rules at work or elsewhere," "I don't feel guilty after doing something I shouldn't," "I get in many fights"), with items measured on a 3-point scale (0=not true, 1=sometimes true, 2=often true). High internal consistency for this scale was observed in the current sample (α=0.81). Expectably, distributions of both T6 and T7 antisocial behavior were positively skewed.

Analysis

To test the multivariate relation between self-regulation, peer deviance and antisocial behavior, a 5-step hierarchical regression analysis was employed to determine the degree to which self-regulation influences the later development of antisocial personality problems. Step one included the covariates treatment condition (whether they received treatment or not), gender, and ethnicity. Step two added T6 antisocial score to account for previous antisocial behavior levels. Step three entered peer deviance, a known predictor variable, to the regression equation. Step four entered the self-regulation variable, and step five entered the self-regulation by peer deviance interaction term. The predictor variables were centered to maximize interpret-

ability and to minimize potential problems with multicollinearity among the predictor variables and their higher order terms as a result of scaling (Aiken and West 1991).

Results

Bivariate correlations among demographic variables, self-regulation, deviant peer affiliation, and T6 and T7 antisocial behavior are presented in Table 1. Intervention status was not significantly associated with any other variable in the analysis. Gender was significantly associated with deviant peer affiliation and self-reported antisocial behavior at T6 and T7. Males reported significantly more involvement with a deviant peer group and more frequent engagement in antisocial behavior at both time points. Ethnicity was recoded to create a dichotomous variable representing whether the adolescent identified him or herself as European American or as non-European American. Non-European American youth reported significantly more involvement with peers who engage in deviant behavior than youth who self-identified as European American.

Of primary interest for the empirical question posed by this study were the associations between deviant peer affiliation, antisocial behavior at wave 6 and wave 7, and self-regulation. As shown in Table 1, the intercorrelations among these variables were all statistically significant in the expected directions. Youth who spent more time with deviant peers reported more engagement in antisocial behaviors at both wave 6 and wave 7 relative to youth who spent less time in a deviant peer group, and youth who affiliated more with deviant peers were lower in self-regulation. Expectably, levels of antisocial behavior at wave 6 and wave 7 were significantly associated with one another, with higher levels of antisocial behavior at wave 6 associated with higher levels of antisocial behavior at wave 7. Youth who were rated higher in self-regulation reported less engagement in antisocial behavior at both time points relative to youth rated lower in self-regulation.

Self-Regulation and Developmental Status of the Adolescent

Three a priori groups of youth were formed based on their reported patterns of antisocial behavior. Youth were classified as manifesting an early-onset persistent developmental pattern of antisocial behavior if they scored above the sample median on the antisocial behavior index at T1 (6th grade), at either T2 (7th grade) or T3 (8th grade), and again at T6 (11th grade). Youth who were at or below the sample median on the antisocial behavior index at T1, T2, and T3, but were above the sample median at T6 were classified as reporting late-onset antisocial behavior. A third subgroup of youth was identified that did not manifest elevated antisocial behavior at any of the four assessment points. Only youth who provided data at each of the four time points were eligible for inclusion in these groups. The a priori decision rules resulted in a group of 66 youth (54.5% male, 43.9% European American) who reported early-onset antisocial behavior that persisted through T6 (approximately age 17), a group of 70 youth (54.3% male, 71.4% European American) who reported their first elevated level of antisocial behavior at T6, and a group of 215 youth (38.6% male, 54.9% European American) who reported levels of antisocial behavior at or below the sample median at all 4 assessment points. As a simple test of external validity of the a priori grouping procedure, the number of arrests for misdemeanors and felonies of the three resultant groups of youth were compared using analysis of variance procedures. The omnibus analysis of variance was statistically significant, $F(2, 320) = 18.88$, $p<0.001$. As shown in Table 2, planned contrasts revealed that the group of youth who reported early-onset antisocial behavior had a significantly higher number of arrests for misdemeanor and felony offenses than the other two groups of youth. Youth who reported late-onset of antisocial behavior did not differ statistically from the group of youth who reported no relative elevations in antisocial behavior between age 12 and age 17.

Table 1 Correlations among antisocial behavior, peer deviance, self-regulation, and demographic variables

	2	3	4	5	6	7
1. Treatment (1=intervention)	−0.02	−0.01	−0.05	−0.01	−0.02	0.02
2. Gender (1=female)	–	0.02	−0.15***	−0.07*	−0.08*	0.13***
3. Ethnicity (1=ethnic minority)		–	0.07*	−0.06	0.02	−0.02
4. Peer deviance			–	0.30***	0.30***	−0.47***
5. Wave 6 antisocial behavior				–	0.32***	−0.30***
6. Wave 7 antisocial behavior					–	−0.36***
7. Self-regulation						–

*$p<0.05$
*** $p<0.001$

Table 2 Analysis of variance for antisocial behavior groups

	Developmental pattern of antisocial behavior			
	Early onset[a] *M* (SD)	Late onset[b] *M* (SD)	Never antisocial[c] *M* (SD)	Planned contrasts
Number of arrests	1.66 (3.23)	0.33 (1.30)	0.19 (0.86)	*a* > *b*, *t*(320)=−4.50***
				a > *c*, *t*(320)=−6.09***
				b > c, *t*(320)=−0.61
Self-regulation (*z*-score)	−0.36 (0.69)	−0.09 (0.67)	0.34 (0.71)	*a* < *b*, *t*(348)=2.26*
				a < *c*, *t*(348)=7.16***
				b < *c*, *t*(348)=4.50***

*$p<0.05$
***$p<0.001$

To gauge the theoretical relevance (i.e., external validity) of the multi-informant self-regulation construct, the three developmental patterns of antisocial behavior were compared on this variable as well. According to Moffitt's (1993) developmental taxonomy of antisocial behavior, low self-regulatory ability ought to be most highly associated with early-onset antisocial behavior and less strongly associated with more normative patterns of development including both late-onset antisocial behavior and consistently low antisocial behavior throughout childhood and adolescence. Again, the omnibus analysis of variance was statistically significant, $F(2, 348)=29.73$, $p<0.001$. As shown in Table 2 planned contrasts revealed that the group of youth who reported early-onset antisocial behavior was rated significantly lower on self-regulation than the other two groups of youth. Similarly, youth who reported late-onset antisocial behavior were rated significantly lower on self-regulation than the group who reported no elevations in antisocial behavior between age 12 and age 17.

Antisocial Behavior Development

A 5-step hierarchical regression analysis was employed to determine the degree to which self-regulation influences the later development of antisocial personality problems as described in the analysis section. Listwise deletion resulted in a reduced sample size of 655 adolescents. The results of the multiple regression analysis are presented in Table 3. Male gender was associated with higher self-reported antisocial behavior, deviant peer affiliation was positively associated with self-reported antisocial behavior, and effortful control was negatively associated with self-reported antisocial behavior. As hypothesized, the results also revealed a statistically significant interaction between effortful control and deviant peer affiliation associated with self-reported antisocial behavior. Results of the final iteration revealed that significant predictors of age 19 antisocial behavior problems predictors were age 17 antisocial behavior ($b=3.24$, $SE=0.58$, $p<0.001$), self-regulation ($b=-2.43$, $SE=0.39$, $p<0.001$) and the interaction of peer deviance with self-regulation ($b=-0.92$, $SE=0.40$, $p<0.05$). Treatment and ethnicity were non-significant predictors in each step, and male gender and peer deviance were non-significant predictors in the final model. The final model accounted for approximately 20% of the variance in the data.

Following procedures described by Aiken and West (1991), simple slopes were plotted for the relation between deviant peer affiliation and self-reported antisocial behavior at age 19 for high levels, mean levels, and low levels of self-regulation (high=+1 *SD*; low=−1 *SD*) after controlling for the demographic variables and antisocial behavior at age 17. As shown in Fig. 2, the simple slope for youth low on self-regulation differed significantly from zero ($p<0.001$), the simple slope for youth at the mean level of self-regulation was at the threshold for statistical significance ($p=0.05$), and the simple slope for youth high on self-

Table 3 Multiple regression model predicting age 19 antisocial behavior

Step	R^2	*B* (*SE*) at entry	*t*
1. Treatment (1=intervention)		−0.45 (0.55)	−0.81
Gender (1=female)		−1.13 (0.55)	−2.05*
Ethnicity (1=ethnic minority)	0.01	0.09 (0.56)	0.17
2. Age 17 antisocial behavior	0.11	4.94 (0.57)	8.60***
3. Age 17 peer deviance	0.15	1.88 (0.33)	5.70***
4. Age 17 self-regulation	0.19	−2.28 (0.39)	−5.86***
5. Self-regulation × peer deviance	0.20	−0.92 (0.40)	−2.31*

*$p<0.05$
*** $p<0.001$

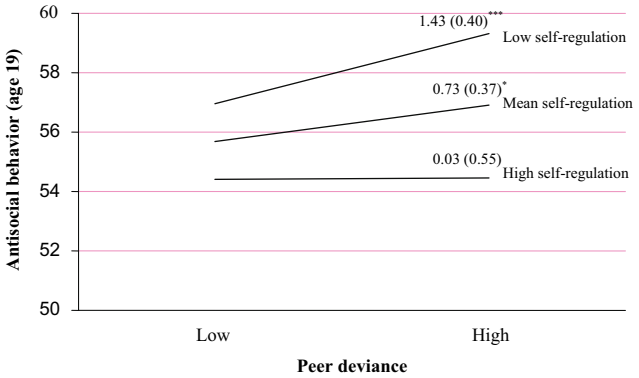

Fig. 2 Simple slopes of age 19 antisocial behavior predicted by age 17 peer deviance at three levels of self-regulation (mean level, 1 SD above mean, and 1 SD below mean) controlling for treatment status, gender, ethnicity, and age 17 antisocial behavior. Values depicted are nonstandardized regression coefficients, with standard errors in parentheses (*p=0.05; ***p<0.001)

regulation did not differ significantly from zero (p=0.96). This pattern of results indicates that age 17 peer deviance was a strong predictor of growth in antisocial behavior from age 17 to age 19 among youth who were rated low in self-regulation and was a less strong, albeit statistically significant, predictor of growth in antisocial behavior among youth who were rated average in self-regulation. Peer deviance was not a significant predictor of growth in antisocial behavior among youth who were high in self-regulation.

One concern present in the multiple regression analysis was the loss of a substantial proportion of the data as a result of listwise deletion. To evaluate the impact of missing data on the obtained results, a parallel multiple regression analysis was run in M-Plus 3.0 (Muthén and Muthén 2004) using the Full-Information Maximum Likelihood method, which incorporates missing data by using all information in the observed data to estimate missing data that have the greatest likelihood of reproducing the observed data (Muthén and Muthén 2004). The results indicated that the model fit the data well, χ^2 (n=998, df=7)=145.99, p<0.001, and there were no significant differences in the pattern or the interpretation of the results obtained in the two parallel analyses. Details of these results are available from the first author upon request.

Discussion

Resilience has been defined as "a phenomenon or process reflecting relatively positive adaptation despite experiences of significant adversity and trauma" (Luthar 2006). Peer deviance is a well-documented risk factor for maintenance and growth of antisocial behavior during adolescence and therefore can be reasonably considered to constitute "significant adversity" as it relates to development of antisocial behavior. The results of this study provide evidence that self-regulation, and perhaps more specifically volitional control of attention and behavior, is a protective factor for antisocial behavior and a source of resilience within the context of peer deviance.

The central hypothesis of this study was that individual differences in self-regulation moderate the relation between peer deviance and development of antisocial behavior. As expected, the results of the multiple regression analysis indicated that after controlling for demographic variables and initial levels of antisocial behavior there was a statistically significant interaction between self-regulation and peer deviance in the prediction of later antisocial behavior. Simple slope analysis of the interaction term revealed that after controlling for levels of antisocial behavior at wave 6 (approximately age 17), peer deviance at wave 6 was a significant predictor of antisocial behavior at wave 7 (approximately age 19) among youth who had either relatively low (i.e., −1 *SD*) or average scores on self-regulation at wave 6. In contrast, among youth who were rated relatively high (i.e., +1 *SD*) on self-regulation, peer deviance was not a significant predictor of wave 7 antisocial behavior. These results indicate clearly that the predictive relation of peer deviance with later antisocial behavior is moderated by youths' self-regulatory abilities.

The moderation of the predictive relation between peer deviance and later antisocial behavior reported in this study replicates findings reported by Goodnight et al. (2006) in which peer deviance was associated with later antisocial behavior among youth with low or medium self-regulatory abilities but not among youth with high self-regulatory abilities. The current study extends the pattern of results reported by Goodnight and his colleagues by assessing self-regulation from multiple perspectives (self and other) in multiple settings (i.e., school and home). By considering multiple perspectives and multiple settings the self-regulation construct used in this study provides an index of self-regulation that is salient to youths' everyday functioning, and thus complements the computer administered laboratory-based task of reward dominance used by Goodnight and his colleagues.

A number of studies have reported a protective role, in terms of main effects, of self-regulatory abilities in psychosocial development (e.g., Barkley 1997; Block et al. 1988; Kochanska and Knaack 2003), and there is evidence that self-regulatory processes operate similarly in non-Western samples (e.g., Eisenberg et al. 2001b). The long-term predictive power of self-regulation has been captured in an analysis reported by Caspi (2000). Caspi reported that children in the Dunedin study who were rated as temperamentally undercontrolled at age 3 showed coherence across development and at age 21 were impul-

sive, unreliable, and antisocial, and had more employment difficulties and higher levels of interpersonal conflict in their relationships at home and with romantic partners. The contribution of the present study to the empirical literature is its focus on the interactive relation between individual differences and environmental risk in the development of behavior problems. Relatively few of these types of interactions have been replicated in the empirical literature (Rothbart and Bates 1998), which makes it notable that the results of this study are consistent with earlier findings reported by Henry et al. (1996) in which a temperamental index of self-regulation interacted with environmental conditions to predict risk for later antisocial behavior. In both instances low self-regulation in the context of environmental adversity conveyed heightened risk for later antisocial behavior, and conversely, high self-regulation served a protective function in the context of environmental adversity.

The results of the simple slopes analysis depicted in Fig. 2 indicate that, in terms of reducing risk for the development of antisocial behavior in middle-to-late adolescence, 'more is better' when it comes to self-regulation. There is some evidence, however, that high levels of self-regulation may increase risk for internalizing symptoms in young children (e.g., Murray and Kochanska 2002). Bearing this in mind, it is important that internalizing symptoms be considered also in future research on adolescent self-regulation. Given evidence of attention biases in depressive and anxiety disorders (e.g., MacLeod et al. 2002; Williams et al. 1996; but for evidence of lack of attention biases in youth depression see small-sample studies reported by Neshat-Doost et al. 2000; Taghavi et al. 1999) it may be reasonable to predict that individual differences in the ability to exert volitional control over attention and behavior would also moderate the relation between environmental stressors and internalizing symptomatology.

In addition to the regression analysis testing the central hypothesis, analyses were conducted in an effort to gauge the external validity of the multi-agent self-regulation construct employed in this study. The results of these analyses provide evidence that self-regulation and documented arrests covary with developmental patterns of antisocial behavior in a manner consistent with predictions from Moffitt's (1993) developmental taxonomy of antisocial behavior. Specifically, youth who consistently reported relatively elevated levels of antisocial behavior between ages 12 and 17 (approximately) had significantly greater incidence of arrest for misdemeanor and felony offences and had significantly lower scores on self-regulation than youth who were classified in the more normative developmental patterns of antisocial behavior. The group of youth who first reported elevated levels in antisocial behavior at approximately age 17 (i.e., late onset) did not differ significantly on number of arrests from the group of youth who reported no elevations in antisocial behavior at any assessment point, which is consistent with Moffitt's characterization of the late-onset trajectory of antisocial behavior as normative. There was, however, a significant difference on scores of self-regulation between the late-onset and the stable-low classes of antisocial behavior, with the late-onset group having lower self-regulation relative to the stable-low group. This finding is consistent with the notion that late-starting antisocial behavior is at least partly a function of immediate reinforcement contingencies available in the deviant peer context and a desire for adult-like status conveyed by engagement in problem behaviors (Moffitt 1993).

These results provide support for the theoretical and ecological validity of the multi-agent self-regulation construct developed for these analyses, however several limitations must be acknowledged. Although the decision rules used in this study to classify adolescents into trajectories of antisocial behavior were comparable to strategies reported in other studies and appear to provide a reasonable approximation of developmental trajectories of antisocial behavior (e.g., Aguilar et al. 2000; Brennan et al. 2003; Moffitt and Caspi 2001), it is likely that these decision rules add noise to these analyses. Clearly not all youth fell neatly into one of the three developmental patterns proposed by Moffitt's (1993) taxonomy, and consistent with other reports (e.g., Broidy et al. 2003) some youth in this sample appeared to manifest a desisting pattern of antisocial behavior characterized by relatively elevated levels of antisocial behavior during the early waves of assessment but not at age 17. Of the 655 youth who were included in the regression analysis, 66 (10.1%) were classified as manifesting early-onset persistent antisocial behavior. This percentage is somewhat high and likely represents the use of the median score on antisocial behavior as the criterion point for being classified as reporting elevated antisocial behavior at that wave of assessment. Other theoretically defensible cut-points may have been either one or two standard deviations above the mean, however attempts to define groups by either of these decision rules resulted in an extremely high proportion of youth not being classified into any of the developmental groups and greatly limited the representativeness of the groups with respect to the sample. The net result of the chosen decision rules is that the early-onset persistent developmental group in this study may consist of youth who are less extreme in their levels of offending relative to analogous developmental groups identified in other studies.

As with all empirical studies, the reported results must be interpreted within the context of limitations of the study. In addition to the limitations already discussed regarding the a priori formation of developmental subgroups of

antisocial behavior, one concern present in the multiple regression analysis was the presence of missing data resulting from study attrition, and the use of listwise deletion for the main multiple regression analysis. As reported, results of a parallel analysis using missing-data estimation techniques resulted in nearly identical findings as the analysis with missing data, and so we are reasonably confident that attrition did not substantially affect the results of these analyses. Nevertheless, replication of these results in future studies is important.

A second concern regarding the regression predicting age 19 antisocial behaviors was the potential for an inflated correlation between peer deviance and self-reported antisocial behavior resulting from an item on the antisocial behavior scale that asked for the amount of time spent "with gang members as friends." As a precaution, the antisocial behavior scale was computed without this item and all the analyses were rerun. Internal consistency of the alternative antisocial behavior scale was reduced (α=0.64), and the bivariate correlation matrix was essentially identical to the data presented in Table 1. Accordingly, removing this item from the antisocial behavior scale did not significantly alter the results of the regression analysis.

A third concern is the potential loss of specificity in terms of the use of frequency data across a wide range of antisocial behaviors as the outcome variable of interest. That is, the potential exists that the relations among peer deviance, self-regulation, and growth in antisocial behaviors reported here are more salient for a subset of behaviors that are either more or less frequent, or more or less severe. Different measures of antisocial behavior at T6 and T7 limit the ability to adequately address growth on an item-by-item basis to evaluate whether the interaction operates differently as a function of the frequency or the severity of a behavior, and efforts to identify subsets of behaviors that varied in terms of severity in the two antisocial behavior measures were not compelling given the internal reliability of both scales. However, in the context of low to moderate strength intercorrelations observed at the item level of both T6 and T7 antisocial behavior scales with peer deviance and self-regulation it seems unlikely that the results reported here were idiosyncratic to a unique subset of either very frequent or very severe antisocial behaviors.

Finally, a fourth concern is that half of the youth had been assigned to a school-based multilevel prevention program targeting family process related to the risk for antisocial behavior. In the current analyses, we did not find an effect of random assignment to intervention on age 19 antisocial behavior. It is worth highlighting, however, that the multilevel nature of the intervention reduces the likelihood of such Intent-To-Treat (ITT) analyses documenting significant intervention effects, as only a small subset of youth receives the selected and indicated levels of intervention that are most likely to reduce problem behavior (see Connell et al. 2007). Indeed, in more detailed analyses of intervention effects among families that engaged with the active levels of the intervention program, we have documented significant intervention effects on antisocial behavior trajectories from age 11 to age 19 (Connell et al. 2007). As these effects are primarily limited to the smaller subset of families that engaged with the selected and indicated levels of intervention (approximately 25% of youth in the intervention condition), the presence of this limited intervention effect is unlikely to seriously bias the current results for the entire sample.

In summary, despite some salient limitations, the results of this study add to the growing evidence regarding the importance of individual differences in understanding psychosocial maladjustment and its treatment. The results reported here indicate that interventions that target self-regulation skills can be expected to ameliorate risk for development of antisocial behavior, which is consistent with empirical and theoretical evidence for improved outcomes among children at risk for emotional and behavioral problems in randomized prevention and intervention trials that target self-regulation skills (e.g., Brotman et al. 2003; Izard et al. 2002). Within the context of accumulating evidence that patient moderators are important determinants of the effectiveness of interventions (Beutler et al. 2004), the results reported here raise the possibility that youth low in self-regulation may be more vulnerable to processes such as deviancy training and, by extension, may be poor candidates for group-administered preventive interventions (Dishion et al. 1999). Continued work that furthers understanding of how individual characteristics interact with environmental factors in the development of psychosocial (mal)adjustment will be valuable for identification of adolescents who experience a particularly elevated risk when exposed to contexts that convey risk for psychosocial difficulties and may help inform treatment decisions.

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