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Self-Control and Early Adolescent Antisocial Behavior

A Longitudinal Analysis

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The article discusses a three-wave longitudinal study that investigates the relationship between self-control and aggressive and delinquent behavior of early adolescent boys and girls. The sample consists of 1,012 Dutch adolescents (mean age = 12.3) in their first year of secondary education. Structural equation modeling analyses reveal that high levels of self-control consistently decrease aggressive and delinquent behavior in the subsequent 6 months follow-up intervals. Results for the total sample do not support the hypothesis that self-control is influenced by previous levels of aggression or delinquency. For boys, the partial evidence found indicates reciprocal effects of self-control and delinquency.

Keywords: *aggression; antisocial behavior; delinquency; early adolescence; self-control*

Since the 1990s, one of the most influential theoretical models on the development of antisocial behavior is the general theory of crime (Gottfredson & Hirschi, 1990). According to this theory, low self-control developed during childhood plays a crucial role in the development of deviant behavior, such as substance abuse and antisocial behavior. The general

theory of crime postulates that all forms of deviant behavior, which transgresses socially accepted norms, can be explained by lack of self-control (see also Gottfredson & Hirschi, 1994). Self-control can be defined as the person's ability to control his or her impulses, alter his or her emotions and thoughts, and to interrupt undesired behavioral tendencies and refrain from acting on them (see Muraven & Baumeister, 2000).

Empirical evidence has validated the assumption that low self-control is a valuable concept in explaining early adolescent antisocial behavior, defined as aggressive and delinquent behavior. Cross-sectional studies on adolescents revealed moderate-to-strong relations between levels of self-control and antisocial behavior. Vazsonyi, Pickering, Junger, and Hessing (2001) showed that scores on the self-control scale developed by Grasmick, Tittle, Bursik, and Arneklev (1993) accounted for 10%-16% of the variance of adolescent antisocial behavior in Hungary, the Netherlands, Switzerland, and the United States. Similar results have also been found in a Russian sample (Tittle & Botchkovar, 2005), further supporting the generalizability of the link between low self-control and delinquency across cultures (Vazsonyi & Belliston, 2007). Vazsonyi (2003) showed that self-control contributes to delinquent behavior above and beyond the influence of parenting, underlining the unique explanatory power of low self-control to the development of delinquent behaviors such as vandalism, theft, and assault. Similarly, Benda (2005) found that the association among measures of self-control and property and person offenses remained significant when controlling for predictors such as age, sex, attachment, parental monitoring, and delinquent peers. Although the link between low self-control and antisocial behavior is well established in cross-sectional studies, less is known about the interplay between low self-control and antisocial behavior over time. The main goal of the present research is to illuminate this bidirectional process and examine the reciprocal influence of low self-control and antisocial behavior. In addition, the present research aims to systematically examine sex differences as will be explained below.

To date, only a few longitudinal studies have been reported on the relation between self-control and aggressive and delinquent behavior of early adolescents. Kim and Brody (2005) demonstrated that child's externalizing behaviors, indicated by high levels of aggressive and delinquent behavior, were strongly related to low self-control measured 12 months earlier. A

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study by Feldman and Weinberger (1994) on preadolescent boys showed that the boys' level of self-control predicted engagement in delinquent behaviors 4 years later.

Longshore, Chang, and Messina (2005) demonstrated that low self-control was strongly associated with lower levels of attachment to the family and weaker endorsement of conventional moral belief. In turn, these bonding aspects appeared to be strongly related to reoffending among juveniles of whom most (87%) had been incarcerated for serious offenses. Moral belief and attachment fully mediated the relation between self-control and offending six months later. This latter study controlled for prior levels of delinquency. Thus, existing findings converge to suggest that low levels of self-control can predict future criminal behavior above and beyond prior levels of criminal behavior.

The central aim of the present study is to further explore the longitudinal relationship between early adolescents' self-control and antisocial behavior by examining reciprocal effects in this relationship. Most studies on the relation between self-control and antisocial behavior assume a unidirectional process, in which low levels of self-control increase the likelihood of future antisocial behavior. Although self-control may become relatively stable at early adulthood (Arneklev, Cochran, & Gainey, 1998), it should not be seen as a stable and immutable propensity in adolescence (Burt, Simons, & Simons, 2006). As Gottfredson and Hirschi (1990) assumed, changes occur not only in childhood but also during later stages of life, for example, early adolescence. Turner and Piquero (2002) provided only partial support for this postulate, by demonstrating that nonoffenders gain more self-control than offenders during childhood. Their results showed also that some change in levels of self-control is likely to occur in adolescence (see also Burt et al., 2006; Winfree, Taylor, He, & Esbensen, 2006). Thornberry, Lizotte, Krohn, Farnworth, and Jang (1991) argued that theoretical models that allow for bidirectional causal influences offer more plausible representations of the development of delinquency. Their findings suggested that social control, indicated by attachment to parents and commitment to school, and delinquent behavior are involved in a mutually reinforcing causal relationship in early adolescence. Weak social bonds may undermine the development of adequate self-control and sensitivity to others (Longshore et al., 2005). Consequently, a bidirectional model may better reflect the actual processes of change in self-control and antisocial behavior. Given the important implications of changes in self-control for intervention and possibly prevention, both directions of influence warrant scientific investigation.

A few studies have suggested the possibility that levels of self-control are influenced by prior levels of antisocial behavior. Ge and Conger (1999) found that increases in delinquent behaviors in early adolescence contribute to decreasing levels of constraint (i.e., less adherence to moral values, less avoiding of dangerous risks, and less exertion of self-restraint) in late adolescence. Their findings suggest a dynamic process in which some adolescents accumulate an increasing number of behavioral problems that affect levels of self-control that in turn affects future deviant behavior. Some theoretical support for the hypothesis that antisocial behavior influences self-control can be found in Heimer and Matsueda (1994). They assume that having engaged in delinquent behavior directly affects the way the person is being labeled by others and by him or herself. Appraising oneself as a rule violator from the standpoint of others implies a more delinquent attitude. As a consequence, the person is less inclined to inhibit his or her impulses and more likely to solve future problematic situations by breaking the law. Thus, the initial prophecy of the *rule-violator* label is fulfilled. To our knowledge the reciprocal influence between self-control and antisocial behavior has not yet been investigated systematically, and the present study is the first to shed light on the bidirectional interplay of both factors over time.

A second aim of the present study is to explore whether reciprocal associations between self-control and antisocial behavior differ for males and females. In several studies, sex differences have been reported on the levels of self-control and antisocial behavior (Campbell, 2006). In most studies, males score lower on self-control and higher on antisocial behavior than females. Notwithstanding mean differences between the sexes, Gottfredson and Hirschi (1990) argued that the effects of low self-control on aggressive and delinquent behavior would be the same for males and females. A few studies support this contention of general theory of crime. Blackwell and Piquero (2005) showed that sex differences in the self-reported likelihood of committing criminal offences in the future could not be explained by different effects for self-control for men and women. Nichols, Graber, Brooks-Gunn, and Botvin (2006) demonstrated that risk factors such as family disruption and self-control play a similar role in increased engagement in aggression and delinquency for urban minority boys and girls.

Other studies (e.g., Mason & Windle, 2002; Moffitt, Caspi, Rutter, & Silva, 2001), however, indicated that low self-control plays a greater role for men's antisocial behavior than for women's antisocial behavior. Using measures such as impulsivity and risk seeking as indicators of self-control, LaGrange and Silverman (1999) showed that only for boys impulsivity was strongly related to delinquent behavior. A study on African American

adolescents revealed strong associations between low levels of self-control and theft or assault for boys, not for girls (Vazsonyi & Crosswhite, 2004). Similarly, Higgins and Tewksbury (2006) found that the association between self-control and the tendency to show risky behavior, such as hitchhiking or hanging around with someone at night, was greater for boys than for girls. This kind of behavior, involving high opportunities for contact with unknown others in unsupervised settings, appeared to be strongly related to delinquency for boys than for girls. These studies suggest that models explaining antisocial behavior by levels of self-control may vary for boys and girls; however, to our knowledge, this possibility has not yet received systematic attention in the existing literature.

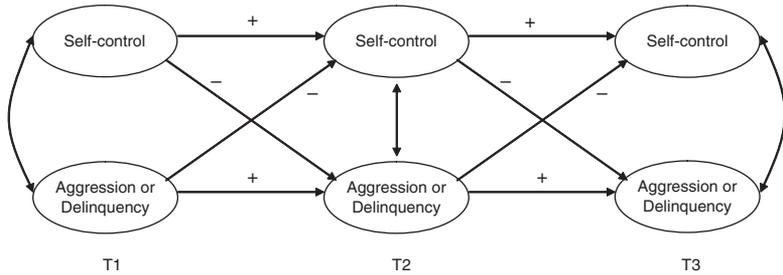
Limitations in Existing Research

The existing research on the association between adolescent self-control and antisocial behavior exhibits several shortcomings which may have distorted the conclusions that have been drawn about the relation between self-control and antisocial behavior. First, most of the past longitudinal studies did not control for prior levels of delinquent or aggressive behavior. Controlling for prior levels of delinquent and aggressive behavior in longitudinal designs is necessary to strengthen arguments about the causal nature of self-control and future antisocial behavior (see Adams & Evans, 1996). Second, most studies have ignored the possibility that the association between self-control and delinquency reflects a bidirectional process. Finally, sex differences in the relationship between self-control and deviant behavior should be tested using a formal test of interaction rather than analyzing the data separately for boys and girls or using sex as a control variable (Nichols et al., 2006). Many reported findings of sex differences on the association between self-control and antisocial behavior may not be robust.

The Present Study

To circumvent the shortcomings of past studies, the present study used a three-wave longitudinal survey across a 12-month period to examine bidirectional influences of early adolescent self-control and antisocial behavior. Based on Gottfredson and Hirschi's (1990) assertion that self-control causes criminal behavior, we hypothesized that low levels of self-control would increase future levels of antisocial behavior (aggressive and delinquent behavior) among early adolescents from a normal sample, controlling

Figure 1
Cross-Lagged Model for Self-control and Aggression/Delinquency



for prior antisocial behavior (see Figure 1). Second, we examined whether antisocial behavior would decrease future levels of self-control. We hypothesized that prior aggressive or delinquent behavior would be associated with lower levels of future self-control. Support for these two hypotheses would indicate reciprocal effects of self-control and antisocial behavior. Third, we examined whether the associations between self-control and antisocial behavior were different for males and females. We did not formulate a hypothesis for sex differences on the relationship between self-control and antisocial behavior, as past studies yielded conflicting findings.

Method

Participants and Procedure

Data for analyses were derived from a large-scale survey carried out in the fall of 2000 in the Netherlands. The survey involved 1,232 adolescents aged 11-14 years. Five high schools were selected in the region of Utrecht. All students of the first grade of secondary education of these schools were included with a total of 45 classes. In the Netherlands, children start their education at the age of four, enroll in primary education later at the age of 8 years, and enter secondary-school-level education at the age of 12 years. Before the questionnaires were administered, parents were informed about the aims of the study and the parents were told to return the questionnaires issued prior to the study, if they did not want their child to participate. Although some parents called the institute for additional information, none

of the parents returned this questionnaire. The questionnaires were filled out in the classrooms in the presence of a teacher. No explicit refusals were recorded; nonresponse was exclusively due to the adolescent's absence on the day of assessment. Attention was drawn to the confidentiality of responses (see Botvin & Botvin, 1992). The letters of introduction and the questionnaires emphasized privacy aspects and clearly stated that no information about the specific responses of participants would be passed on to teachers or parents. Only the principal researcher matched numbers and names. In order to motivate respondents to participate, adolescents and parents were included in a lottery in which compact disc certificates could be won.

The first wave of the study was conducted in the fall of 2000, the second wave 6 months after the first wave (i.e., in the spring of 2001), and the third wave 12 months after the first wave (i.e., in the fall of 2001). A total of 1,332 adolescents participated in the first wave, 1,153 (94% response rate) adolescents participated in the second wave, and another 1,012 (82%) adolescents in the third wave. The participants received the same format of questionnaires in each wave. The longitudinal sample consisted of 520 (51.4 %) boys and 492 (48.6%) girls who participated in all three waves of the study. The mean age of the participants was 12.3 ($SD = .51$) at the first wave. The large majority of adolescents (95.9%) were of Dutch origin. Another 20% were involved in lower education (trade school education), 28% in middle education and, 52% in the higher level of secondary school in the Netherlands, namely, preuniversity education. In all, 90% of the adolescents lived with both parents, 8% lived with their mother, 1% lived with their father, and 2% lived in other living arrangements (e.g., other family members, institutions, adoptive parent).

Logistic regression analyses were conducted to verify whether adolescents who participated in all three waves differed from those who did not. Results showed remarkably small differences. Those who dropped out were slightly less well educated and were less likely to live in a two-parents household as compared to those who participated in all waves (explained variance < 3%). No differences were found for sex, age, and ethnicity.

Measures

Self-control. To assess self-control, a Dutch translation of the self-control scale developed by Tangney, Baumeister, and Boone (2004) was employed. The self-control scale aims to assess people's ability to control their impulses, alter their emotions and thoughts, and to interrupt undesired behavioral tendencies and refrain from acting on them (for a review on the

conceptualization see Muraven & Baumeister, 2000). This conceptualization allows us to assess self-control as a capacity that is not designed to address any particular behavior, thought, or emotion but to alter many responses of the self, ranging from behavior to inner processes (see Baumeister & Vohs, 2003). The self-control scale has been shown to be a reliable indicator of self-control, even among young adolescents (Finkenauer, Engels, & Baumeister, 2005) and adult male and female participants (e.g., Finkenauer et al., 2005; Frijns, Finkenauer, Vermulst, & Engels, 2005).

The shortened version consists of seven items rated on a scale ranging from 1 (*not at all*) to 5 (*very much*). Examples of items are, "I wish I had more self-discipline" (reversed scored) or "Sometimes I can't stop myself from doing something, even if I know it is wrong" (reverse scored). Responses were averaged to yield a self-control scale with higher values indicating greater feelings of self-control. In our study, the internal consistency of the shortened scale was Cronbach's $\alpha = .68$ at Time 1 (T1), $.71$ at Time 2 (T2), and $.74$ at Time 3 (T3).

Delinquent behavior. Delinquency was assessed with a Dutch questionnaire that specifies the frequency of participation in small criminal acts of adolescents (Houtzager & Baerveldt, 1999). The respondents were asked whether they engaged in minor delinquent activities in the last 6 months (e.g., "Have you stolen a moped or a scooter?" "Have you set a fire?"). This questionnaire is comprised of 14 items, scored on 4-point scale: 1 = *never*, 2 = *once*, 3 = *two or three times* and 4 = *four or more times*. Cronbach's α was $.81$ at T1, $.92$ at T2, and $.89$ at T3. A high mean score indicated that the adolescent frequently participated in criminal activities in the past 6 months.

Aggressive Behavior. Aggressive behavior was measured with a subscale from the Dutch version of the youth self-report (Achenbach, 1991; Verhulst, van der Ende, & Koot, 1996). The subscale consists of eight items tapping explicit aggressive behavior over the past six months (e.g., "I engage in physical fights" and "I destroy other people's things"). The respondents rated the items on a 3-point scale: 1 = *does not apply to me at all*, 2 = *sometimes applies to me*, and 3 = *often applies to me*. The internal consistency of the scale in our study was $.70$ at T1, $.75$ at T2, and $.82$ at T3. A high mean score indicated more frequent aggressive behavior of the adolescent in the last 6 months.

Strategy of analyses. We applied multivariate general linear modeling (GLM) using SPSS (version 13.0) to determine sex differences in mean

scores on self-control, aggression, and delinquency at each wave. The repeated measures design of GLM was used to test time effects on each of the model variables.

To test the cross-lagged model as depicted in Figure 1, we applied structural equation modeling with help of the software package MPLUS (version 4.2; Muthén & Muthén, 1998-2006). The longitudinal relationships were examined using cross-lagged panel analysis (Finkel, 1995). The aim of this type of analysis is to examine the possible causal ordering of variables. We tested two cross-lagged models, one with self-control and aggression and one with self-control and delinquency. These models were tested for the total sample and for boys and girls separately. The cross-lagged model consisted of two types of paths: stability paths expressing the relations of the same latent variable over time and cross paths expressing the relation of a latent variable to another latent variable over time. Because the panel waves were equally spaced, it is expected that the stability paths of self-control and aggression (or delinquency) are equal across waves. As a consequence the cross-lagged effects between variables from the first wave to the second wave should be equal to their values from the second wave to the third wave. We constrained the paths from first wave to the second wave to be equal to their corresponding paths from the second wave to the third wave (4 constraints). We compared first the unconstrained models with the constrained ones via chi-square difference tests and found no significant differences for all six models (see also Finkel, 1995, p. 29). This justifies performing the panel analyses with these four constraints. If we find only significant cross paths from self-control to aggression or delinquency we may infer that self-control is predominant; on the other hand, if aggression or delinquency is predominant we will find only significant cross paths from these variables to self-control.

At T1, T2, and T3 three latent variables were defined: *self-control*, *aggression*, and *delinquency*. The use of individual items as indicators for each of the latent variables is problematic: The number of parameters to be estimated will become too large with respect to the sample size.

To solve this problem we used parcels as indicators for the latent variables. A parcel is a combination of a subset of items underlying a latent variable. For each of the three latent variables the items were split up into two equivalent subsets.¹ We adopted the strategy of Yuan, Bentler, and Kano (1997) to construct parcels. The score on a parcel is the mean value of a subset of items. For self-control, the original 7 items were replaced by 2 parcels of 4 and 3 items¹; for delinquent behavior, the 14 items were replaced by 2 parcels of 7 items each; and for aggressive behavior, the 8 items

were replaced by 2 parcels of 4 items each. The same subsets of items are used over time. The effect of parceling on structural parameter estimates are investigated by Bandalos and Finney (2001) and Nasser and Wisenbaker (2006). Their conclusion was that the effects of parceling on structural parameter estimates are negligible if the original scales are unidimensional. The latter was verified by performing two factor analyses, one on the self-control items in combination with the delinquency items and one on the self-control items in combination with the aggression items. In both cases, we found a clear two-factor solution with items only substantially loading on the factors they were intended to. These results indicated that the original scales were unidimensional. The measurement part of the two models derived from Figure 1 (the factor model) is presented in the appendix. From this appendix, it can be seen that the loadings of the parcels are sufficiently high varying between .62 and .98.

Because the indicators (parcels) of the variables are moderately nonnormal for aggression (skewness < 2 and kurtosis < 4) and severely nonnormal for delinquency (skewness > 3 and kurtosis > 10; see also Finney & DiStefano, 2006), all SEM models were tested with help of the MLMV (maximum likelihood with mean- and variance-adjusted chi-square statistic) estimation method. The standard errors of the parameters are corrected as well as the chi-square statistic and the number of degrees of freedom. Standard chi-square variates are replaced by robust chi-square variates to test model fit (Muthén, 1998-2004).

To test moderation effects of sex on structural paths in the model, we used multigroup analysis (Bollen, 1989). For boys and girls two separate models were created. A significant difference between estimates of the unstandardized beta weights of corresponding paths (relations) in the two models means that sex moderates this relationship. Before testing moderation effects, the corresponding factor loadings (λ 's) of boys and girls are constrained to be equal as a default in MPLUS. First, the chi-square value of this lambda-constrained model (of boys and girls together) is computed. The next step is to constrain all corresponding unstandardized beta weights (relationships between endogenous variables) of boys and girls of the stability paths to be equal. If a significant difference exists between the chi-square of the lambda-constrained model and the beta-constrained model, one or more beta weights are different between two groups. The beta weights responsible for this significant difference are found by repeating the foregoing step for each of the beta weights separately. The same procedure applies for the cross paths (for more information about this procedure see Byrne, 1998). Because the difference between two robust

Table 1
Means and Standard Deviations and Test Results of the Model
Variables at Time 1, Time 2, and Time 3 (Total Sample $N = 1,012$)

Variables	Time 1	Time 2	Time 3	$F(2, 1010)$	p	Bonferroni post hoc tests
Aggression	1.25 (.25)	1.27 (.28)	1.29 (.33)	6.90	.001	T1 < T3
Delinquency	1.16 (.27)	1.20 (.42)	1.19 (.37)	6.06	.002	T1 < T2
Self-control	3.56 (.65)	3.53 (.68)	3.51 (.69)	2.60	.075	

chi-square statistics is not a chi-square statistic, the robust chi-square statistics are first rescaled in MPLUS before calculating the (unbiased) chi-square difference.

In combination with the chi-square variates, we used two fit measures recommended by several authors: (a) the root mean square error of approximation (RMSEA; Byrne, 1998) and (b) the comparative fit index (CFI) of Bentler (Marsh, Balla, & McDonald, 1996).

Results

Table 1 presents the means and standard deviations of the central variables in this study. With GLM repeated measures we tested time (within-factor) effects on each of the variables. The overall test shows that significant differences exist over time: for aggression, $F(2, 1010) = 6.90$, $p < .001$, and partial Eta squared (PES) = .013; for delinquency $F(2, 1010) = 6.06$, $p < .01$, and PES = .012. According to Cohen (1988), these effect sizes (PES) are small. Bonferroni's post hoc tests indicate that aggression at T1 is lower than aggression at T3 ($p < .05$), and delinquency at T1 is significantly lower than delinquency at T2 ($p < .05$), indicating that levels of antisocial behavior tend to increase with time. No significant difference was found for self-control: $F(2, 1010) = 2.60$, $p > .05$, and PES = .005.

Several sex differences emerged in the GLM analyses (see Table 2). At each wave boys reported higher levels of aggressive behavior, $F(3, 1008) = 20.83$, $p < .001$; higher levels of delinquent behavior $F(3, 1008) = 54.74$, $p < .001$; however, no significant differences were found in self-control, $F(3, 1008) = 2.34$, $p > .05$.

Correlations among self-control, aggression, and delinquency at T1, T2, and T3 are presented in Table 3. Self-control shows negative correlations

Table 2
Means and Standard Deviations of the Model Variables
at Time 1, Time 2, and Time 3 (Boys and Girls)

Variables	Boys (<i>N</i> = 520)			Girls (<i>N</i> = 492)		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Aggression	1.31 (.28)	1.31 (.31)	1.34 (.36)	1.19 (.21)	1.23 (.25)	1.24 (.29)
Delinquency	1.25 (.32)	1.31 (.52)	1.28 (.46)	1.06 (.17)	1.08 (.22)	1.08 (.20)
Self-control	3.54 (.66)	3.55 (.67)	3.54 (.69)	3.59 (.65)	3.51 (.68)	3.48 (.68)

with aggression and delinquency: Higher levels of self-control are associated with less aggression and delinquency. These patterns of correlations are consistent over time.

The two models as depicted in Figure 1 (Model 1: self-control and aggression, Model 2: self-control and delinquency) were tested for the whole sample, and for boys and girls separately. The factor loadings of the measurement part of the six models and the correlations between the two latent variables at T1 and between the disturbance terms (i.e., error terms) of the same variables at T2 and T3 are given in the appendix. As expected, the correlations between the disturbance terms are lower than the correlations between the latent variables because correlations between disturbance terms are partial correlations controlling for their common causes (Kline, 1998). The structural parameter estimates of the six models are given in Table 4. The fit of the six models is good with RMSEA values below .05 and CFI values above .95. The number of degrees varies across the six models as a consequence of the use of the MLMV estimator. The six tested models were identical.

For each of the six models the beta weights of the paths to corresponding variables (stability paths) were high for self-control (ranging from .56 to .70), indicating that most adolescents who scored high on self-control compared to scores of others also scored relatively high six months later. Moderate stabilities were found for aggression (ranging from .37 to .46) and delinquency (ranging from .37 to .54).

For the aggression model, we found significant cross paths from self-control to aggression for the total sample as well as for boys and girls. The betas ranged from $-.13$ to $-.17$ indicating that higher levels of self-control were associated with lower levels of aggression. No significant cross paths were found from aggression to self-control. These results showed that self-control predominated within the relation of self-control and aggression.

Table 3
Correlations Between the Research Variables (N = 1,012)

Variables	1	2	3	4	5	6	7	8	9
Self-control, T1									
Self-control, T2	.47								
Self-control, T3	.46	.53							
Aggression, T1	-.32	-.24	-.21						
Aggression, T2	-.18	-.37	-.21	.41					
Aggression, T3	-.19	-.25	-.33	.40	.42				
Delinquency, T1	-.19	-.16	-.10	.40	.30	.30			
Delinquency, T2	-.16	-.20	-.14	.27	.42	.34	.48		
Delinquency, T3	-.14	-.19	-.18	.29	.30	.49	.42	.50	

Note: All correlations are significant with $p < .001$. T1, T2, and T3 stand for Time 1, Time 2, and Time 3, respectively.

Table 4
Structural Parameter Estimates and Fit Measures of the Six Models (Standardized Beta Weights)

		Aggression			Delinquency		
		Total	Boys	Girls	Total	Boys	Girls
Stability paths							
From	To (beta's)						
Self-control, T1	Self-control, T2	.59	.56	.61	.58	.55	.61
Self-control, T2	Self-control, T3	.67	.64	.70	.66	.63	.69
Aggression/ delinquency, T1	Aggression/ delinquency, T2	.41	.37	.41	.49	.45	.37
Aggression/ delinquency, T2	Aggression/ delinquency, T3	.45	.41	.46	.54	.50	.40
Cross paths							
Self-control, T1	Aggression/ delinquency, T2	-.13	-.15	-.13	-.10	-.12	-.14
Aggression/delinquency, T1	Self-control, T2	-.01 ^a	-.02 ^a	-.01 ^a	-.05 ^a	-.11	-.01 ^a
Self-control, T2	Aggression/ delinquency, T3	-.15	-.17	-.16	-.12	-.14	-.17
Aggression/delinquency, T2	Self-control, T3	.01 ^a	-.02 ^a	.01 ^a	-.06 ^a	-.12	.01 ^a
Fit measures							
	Chi-square	94.65	70.51	45.77	56.06	44.06	19.02
	<i>df</i>	29	28	24	23	22	16
	<i>p</i>	.000	.000	.005	.000	.004	.268
	RMSEA	.047	.049	.043	.038	.044	.020
	CFI	.967	.957	.972	.960	.963	.964

Note: T1, T2, and T3 stand for Time 1, Time 2, and Time 3, respectively; CFI = comparative fit index; RMSEA = root mean square error of approximation.

a. Not significant.

For the delinquency model we found significant cross paths from self-control to delinquency (betas ranging from $-.10$ to $-.17$) for the total sample and for boys and girls. A higher level of self-control is associated with a lower level of delinquency. No significant cross paths were found from delinquency to self-control except for boys (the betas for boys were $-.11$ and $-.14$). These results showed that for boys no causal ordering is possible in the relation of self-control with delinquency. For girls self-control predominated within this relation.

Differences in structural parameters between the models of boys and girls were tested with chi-square difference tests. First, the lambda-constrained chi-square value of the combined model of boys and girls was computed. Then the four stability paths were constrained to be equal for boys and girls. The increase in chi-square compared to the lambda-constrained model was not significant: for Model 1 (self-control and aggression) $\Delta\chi^2(2) = .42, p = .812$; for Model 2 (self-control and delinquency) $\Delta\chi^2(2) = 5.09, p = .078$. This means that no significant difference was found in stability paths between boys and girls. The same procedure was applied for the four cross paths: for Model 1 (self-control and aggression), $\Delta\chi^2(2) = .97, p = .616$; for Model 2 (self-control and delinquency), $\Delta\chi^2(2) = 4.52, p = .105$. No significant difference was found between boys and girls for the parameter estimates of the cross paths.

Discussion

Although the general theory of crime (Gottfredson & Hirschi, 1990) has been recognized as one of the most influential theoretical models on the development of antisocial behavior, the number of empirical studies demonstrating that the concept of self-control is valuable in explaining future aggressive and delinquent behavior of early adolescents is limited. The results of the present longitudinal study indicate quite clearly that in a normal sample of early adolescents higher levels of self-control are associated with less antisocial behavior. The SEM analyses show that higher levels of self-control are consistently associated with less aggressive and delinquent behaviors in subsequent six months intervals. This finding is consistent with the general theory of crime and previous findings on longitudinal associations in early adolescence (see, for example, Feldman & Weinberger, 1994; Kim & Brody, 2005).

Our main interest was to examine bidirectional effects of self-control and antisocial behavior. The results of the SEM analyses for the total sample did not indicate that self-control was influenced by previous levels of

aggression or delinquency; thus, no reciprocal effects of self-control and antisocial behavior were demonstrated. However, separate analyses for both sexes showed reciprocal effects of self-control and delinquency for boys. The cross-lagged associations between delinquency and self-control suggest that higher levels of delinquent behavior contribute to lower levels of self-control. This finding is in line with the contentions of Ge and Conger (1999), who argued that during adolescence persistent and increasing behavioral problems affect personality characteristics, including self-control. These changes in personality characteristics exacerbate social and behavioral problems in late adolescence and early adulthood. The mutual influence between delinquency and self-control of boys in early adolescence, as shown in our study, may reflect a part of the dynamic process proposed by Ge and Conger. The influence of boys' delinquency on future levels of self-control can be explained by the labeling theory. Official deviant labeling by juvenile justice contributes to a deviant self-concept, which in turn may result in seeking deviant peer groups who share similar deviant self-concepts and attitudes, and who provide opportunities for deviant behavior (Bernburg, Krohn, & Rivera, 2006). If adolescents think that parents, friends, and teachers perceive them to be rule breakers and trouble makers, they will adopt a more delinquent attitude and affiliate with deviant peers (Heimer & Matsueda, 1994).

Remarkably, the multigroup analyses do not show significant sex differences in the longitudinal associations between self-control and future antisocial behavior. High levels of self-control appear to play a similar role in decreasing future aggressive and delinquent behavior for boys and girls. Results of these analyses are consistent with the findings of Blackwell and Piquero (2005) and Nichols et al. (2006) who suggested that the effects of low levels of self-control are similar for boys and girls. Because multigroup analyses do not show significant ($p = .105$) differences between boys and girls for the parameter estimates of the cross paths, the reciprocal effects for boys, as found in the separate analysis, may need to be replicated in studies including measurement of opportunities for deviant behavior (e.g., seeking someone to hang around with). These studies may yield higher associations between self-control and opportunities, as well as larger effects of opportunities on delinquency for boys (Higgins & Tewksbury, 2006).

Chief among the strengths of this study was the longitudinal design that controlled for previous levels of aggressive and delinquent behavior. Using this design, the results of our analyses extend previous findings on the predictive value of self-control, by demonstrating the unique contribution of self-control to short-term changes in antisocial behavior in early adolescence.

The use of relatively short time intervals of six months enabled us to show that effects of self-control on aggressive and delinquent behavior occur. Furthermore, we used a valid measure of self-control that is linked to a broad range of psychosocial outcomes, which, however, does not measure problem behavior itself (Tangney et al., 2004). This is important to rule out the possibility that observed longitudinal associations between self-control and antisocial behavior actually reflect high levels of stability of antisocial behavior. The use of a cross-lagged design and the use of multigroup analyses to test for sex differences give us greater confidence in the validity of the present results.

Despite these strengths, the study is limited by characteristics of its sample. A large majority of the adolescents were of Dutch origin (96%), living with both parents (90%), and involved in middle and higher levels of secondary education (80%). Given these characteristics, our findings may not be generalized to populations that are more heterogeneous. Although cross-cultural studies show similar associations between self-control and various measures of delinquency and school misconduct (Vazsonyi, Clifford Wittekind, Belliston, & Van Loh, 2004), studies on ethnic minorities could yield different results, due to the influence of economic deprivation on parenting (Perrone, Sullivan, Pratt, & Margaryan, 2004). Lynam et al. (2000) showed that impulsivity was strongly related to offending in poorer neighborhoods. The latter two studies suggest that ethnic differences and poverty status may intensify the risk of low self-control. Stronger reciprocal effects of self-control and delinquency may be found on samples characterized by less favorable conditions (e.g., ethnic minorities, poverty, and neighborhood disadvantage).

In the tested model, parental functioning and parenting practices were not included. These parental characteristics appear to play a significant role in future levels of self-regulation of African American early adolescents living in single-parent households (Kim & Brody, 2005). Finkenauer et al. (2005) showed that self-control partially mediated the relation between parenting (i.e., parental acceptance and psychological control) and antisocial behavior. Burt et al. (2006) demonstrated that more authoritative parenting, less attachment to teachers, and more deviant friends explained a substantial increase in self-control among early adolescents. Contrary to Gottfredson and Hirschi's (1990) assertions that after the first 10 years of life parenting has no effect on levels of self-control, these studies indicate that parenting characteristics remain significant for positive changes in self-control. Recognizing that self-control is an important characteristic that may prevent serious problem behavior during adolescence warrants observational studies aimed at discovering which parenting behaviors are most effective for training self-control.

Preliminary evidence for the reciprocal effects of self-control and delinquency of boys may question the causal role of self-control articulated in the general theory of crime. It has been argued that theoretical models stressing bidirectional causal influences between social-control factors (family management, commitment to school, interaction with peers, and criminal justice sanctions) and delinquency will provide a better understanding of processes in the development of a criminal career (Krohn & Thornberry, 2003; Sampson & Laub, 1997; Thornberry et al., 1991). Longshore et al. (2005) suggested that weak social bonds jeopardize the development of adequate self-control and sensitivity to others, thus yielding a vicious cycle in which weak social bonds and low self-control reinforce each other. As shown in our study, similar vicious cycles between self-control and delinquency may occur, which may be explained by labeling theory (Bernburg et al., 2006; see also Sampson & Laub, 1997). A thorough testing of the theoretical models that include reciprocal effects of social control factors, self-control, and anti-social behavior is a challenge for future research.

Appendix

Factor Loadings (Lambda's) for the Six Tested Models and Correlations Among Latent Variables at T1 and Between Disturbance Terms of Latent Variables at T2 and T3

Indicators for latent variables	Aggression			Delinquency		
	Total	Boys	Girls	Total	Boys	Girls
Self-control parcel 1, T1	.68	.70	.66	.77	.81	.68
Self-control parcel 2, T1	.75	.74	.76	.67	.64	.76
Self-control parcel 1, T2	.69	.63	.76	.79	.72	.83
Self-control parcel 2, T2	.76	.76	.75	.64	.63	.68
Self-control parcel 1, T3	.76	.76	.76	.88	.85	.86
Self-control parcel 2, T3	.77	.74	.79	.66	.67	.70
Aggression/delinquency parcel 1, T1	.71	.73	.72	.87	.86	.72
Aggression/delinquency parcel 2, T1	.73	.72	.70	.86	.86	.91
Aggression/delinquency parcel 1, T2	.77	.80	.76	.94	.93	.82
Aggression/delinquency parcel 2, T2	.76	.76	.71	.93	.95	.96
Aggression/delinquency parcel 1, T3	.83	.87	.84	.95	.92	.88
Aggression/delinquency parcel 2, T3	.80	.80	.77	.86	.88	.82
Correlations of self-control with aggression/delinquency						
T1	-.54	-.52	-.60	-.30	-.35	-.27
T2	-.33	-.36	-.33	-.08 ^a	-.08 ^a	-.14
T3	-.25	-.26	-.26	-.06 ^a	-.08 ^a	-.06 ^a

Note: Time 1, 2, and 3 stand for T1, T2, and T3, respectively.

a. Not significant.

Note

1. The choice for only two parcels is based on the recommended subject/parameter ratio of 10.1 or 20.1 (Kline, 1998, p. 112). For the multiple group analysis in a model with 2 parcels for each latent variable 100 parameters must be estimated, a ratio of about 10:1.

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