AGE-VARYING EFFECTS OF FAMILY, SCHOOL, AND PEERS ON DELINQUENCY: A MULTILEVEL MODELING TEST OF INTERACTIONAL THEORY*

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Few criminologists have directly examined whether the importance of family, school, and peers in the etiology of delinquency changes over the developmental period of adolescence. This study tests hypotheses, derived from Thornberry's (1987) interactional theory, about the age-varying effects of attachment to parents, commitment to school, and association with delinquent peers on delinquency by applying Bryk and Raudenbush's (1992) hierarchical linear models to analyze the first five waves of data from the National Youth Survey. Results show that the direct as well as total effects of delinquent peers and school on delinquency tend to increase from early to middle adolescence, reach a peak at the age of mid-13 and mid-15, respectively, and then decline. This curvilinear pattern of change is interpreted as reflective of the process of adolescent development and the age-delinquency relationship. On the other hand, both direct and total effects of family on delinquency are found to be significant throughout the period of adolescence, but the effects do not systematically vary as hypothesized. Theoretical, methodological, and policy implications of the findings are also discussed.

While criminologists have long recognized the importance of family, school, and peers in the etiology of delinquency, previous studies of their effects on delinquent behavior have largely been nondevelopmental in

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their theoretical perspectives and methodological approaches. Most theorists are not explicit about whether their key variables' effects on delinquency vary over the developmental period of adolescence. Some theorists acknowledge that the explanatory ability of their variables is likely to change with age (e.g., Akers, 1985), but their discussion tends to be too sketchy to specify functional forms of the change. This general lack of theoretical specification inadvertently leads researchers to make an implicit assumption about the age-invariance of delinquency causation when they test those theories.

Research on adolescent development, however, shows that the period of adolescence and early adulthood is full of changes and transitions in social and psychological status (Cooper and Ayers-Lopez, 1985; Lerner, 1985; Petersen and Ebata, 1987; Petersen et al., 1992; Youniss and Smollar, 1985). Those changes and transitions are likely to influence and be reflected in the adolescent's relationships with immediate social environments—like family, school, and peers, which makes their effects on delinquency age-variant (Agnew, 1985; Elliott et al., 1985; Gold and Petronio, 1980; LaGrange and White, 1985). But few theories help hypothesize about those age-varying effects on delinquency.

A major exception is Thornberry's (1987) interactional theory, which posits that the effects of family, school, and delinquent peers on delinquency systematically vary across the developmental stages of adolescence. However, his developmental hypotheses have not been directly tested yet. This study is intended to fill this gap by deriving and testing hypotheses about age-varying effects of family, school, and delinquent peers on delinquency for the crime-prone adolescent years.

THEORETICAL OVERVIEW

The family, school, and peers are the three most important social environments for the adolescent. Adolescents spend most of their time in those environments and their development takes place primarily through the development of relationships with people associated with those environments (Youniss and Smollar, 1985).[1] Thus, it is not surprising to see major theories of delinquency focus on how the adolescent's relationships with immediate environments influence his or her behaviors (Agnew, 1992; Akers, 1985; Hirschi, 1969; Matsueda, 1992; Sutherland and Cressey, 1970). But, it is surprising to see that criminologists in general have shown little interest in studying the age-varying effects of those relational variables on adolescent behavior despite the long history of the conception of

1. While researchers have also studied personality or cognitive development in adolescence, this study focuses on the development of adolescent interaction with the major social institutions of family, school, and peer group.

human development (i.e., humans change across the entire life span) in the social and behavioral sciences (Baltes et al., 1980; Featherman, 1983; Kagan, 1980; Mendelsohn, 1980).[2] This lack of interest is perplexing given the trend of increasing emphasis on developmental and life-course perspectives in contemporary criminology (Farrington, 1986b; Hagan and Palloni, 1988; Loeber and Le Blanc, 1990; Sampson and Laub, 1993; Thornberry, 1987).

Despite such general failure to apply developmental perspectives to the etiology of delinquency, few criminologists would strongly disagree with the plausibility of the age-variance of delinquency causation, perhaps with the major exception of Gottfredson and Hirschi (1990).[3] Agreeing with Gottfredson and Hirschi on the stability of individual differences in self-control, Sampson and Laub (1990, 1993) nevertheless reject the life-course implication of the age-invariance position that criminality, once established during childhood, cannot be desocialized by institutions in later years of life. Instead, they stress an alternative view that both stability and change over the life course can be incorporated into the same theoretical framework. As a key to this incorporation, they focus on a conceptual distinction between within- and between-individual differences. Sampson and Laub point out that the stability to which Gottfredson and Hirschi refer is between-individual, not within-individual, stability, and they argue that Gottfredson and Hirschi's emphasis on the stability of individual differences in low self-control does not preclude a legitimate consideration of within-individual differences over the life course. For example, within-individual differences or changes in social interaction with institutions of informal social control over time can become an important explanation of behavioral changes across ages even if propensity for crime is stable across individuals over the life span.

INTERACTIONAL THEORY

A primary aim of Thornberry's (1987) interactional theory is to specify

2. While confirming repeatedly the etiological importance of family, school, and peer influence on delinquent behavior, previous studies, whether cross-sectional or longitudinal, rarely examined the interaction between age and the predictors of delinquency (e.g., Akers et al., 1979; Cernkovich and Giordano, 1992; Elliott et al., 1985, 1989; Gove and Crutchfield, 1982; Krohn and Massey, 1980; Loeber and Stouthamer-Loeber, 1986; Matsueda, 1982; Patterson and Dishon, 1985; Warr and Stafford, 1991; Wiatrowski et al., 1981).

3. According to Gottfredson and Hirschi's theory, delinquency is a manifestation of low self-control and poor social control (i.e., situational and institutional restraints), which remain stable and/or, at best, vary randomly throughout adolescence and adulthood. Thus, the effects of social institutions like family and school on delinquency are unlikely to follow any systematic pattern.

the age-varying effects of family, school, and peers on delinquency during adolescence.[4] This developmental perspective, however, has not been directly tested even though the theory's reciprocal view tends to receive empirical support (Thornberry, 1996). While this study is not intended to test interactional theory fully, hypotheses are derived from the theory about the age-varying etiological importance of family, school, and delinquent peers.

Thornberry begins by suggesting that an adolescent's behavioral outcomes are formed in interaction or relationships with other people and social institutions. Based on this basic premise, he combines five explanatory variables, derived from Hirschi's (1969) social bonding theory and Akers' (1985) social learning theory, into his "elaborated" theoretical model (Thornberry, 1989b). Among the five concepts, this study focuses on the three most important social institutions of adolescence (i.e., family, school, and peer group): attachment to parents, commitment to school, and association with delinquent peers.[5] Thornberry (1987:866) defines these concepts quite broadly:

> Attachment to parents includes the affective relationship between parent and child, communication patterns, parenting skills such as monitoring and discipline, parent-child conflict, and the like. Commitment to school refers to the stake in conformity the adolescent has developed and includes such factors as success in school, perceived importance of education, attachment to teachers, and involvement in school activities. . . . Association with delinquent peers includes the level of attachment to peers, the delinquent behavior and values of peers, and their reinforcing reactions to the adolescent's own delinquent or conforming behavior.

After specifying causal relationships among these variables for early adolescence (ages 11–13), Thornberry (1987:877) extends the "basic model" into developmental models for middle (ages 15–16) and later (ages 18–20) adolescence (see Appendix 1). He then describes developmental changes in the variables' effects on delinquent behavior across the three substages of adolescence, implying that the age-variance of delinquency causation should be examined separately for direct and total effects.[6]

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4. By *adolescence* Thornberry refers to the period of ages 11 through 20, which might also be labeled as adolescence and early adulthood.

5. The other two concepts (belief in conventional values and delinquent values) are cognitive rather than social relational variables.

6. Thornberry agrees with the author on the type of effects to be hypothesized (personal communication).

ATTACHMENT TO PARENTS

Thornberry (1987:873) argues that attachment to parents has a stronger influence on the life of youth during early adolescence than it does at later ages because "the family is the most salient arena for social interaction and involvement," and parents play a key role in controlling the behavior of youth at these relatively early ages. Specifically, attachment to parents is expected to have strong effects, both direct and indirect (through commitment to school and association with delinquent peers), on delinquent behavior (see Appendix 1). However, the overall strength of parental influence gets weaker at the ages of middle adolescence as the center of the youth's activities gradually moves from home to school and peer networks. This decline in overall parental influence can be explained by attachment to parents having no direct and weakening indirect effects on delinquency. The trend of decreasing effects of attachment to parents continues as the adolescent enters into later adolescence, when it is indirectly related only through commitment to school and through new forms of commitment to conventional activities (e.g., employment and marriage).

Thus, it is hypothesized here that the total effects of family influence (i.e., the constraining effects of the family and parents) on delinquency gradually and monotonically decrease as the adolescent grows older. Specifically, the influence of family on delinquency is both direct and indirect (through school and peer networks) during early adolescence, but mostly indirect during middle adolescence and late adolescence. Thus, the direct family influence on delinquency is expected to follow a monotonically declining pattern across adolescent ages.

COMMITMENT TO SCHOOL

Thornberry expects commitment to school to have significant direct and indirect (mediated by attachment to parents and association with delinquent peers) effects on delinquent behavior at early adolescence. He suggests that during middle adolescence commitment to school shows a greater impact on the youth's behavior compared to early adolescence because the school environment "takes on increasing significance" (Thornberry 1987:879). One reason for the increased effects of commitment to school on delinquent behavior is that the indirect effect is through the adolescent's association with peers rather than attachment to parents (see Appendix 1). But during the late-teen years the effects of commitment to school become weaker than during middle adolescence. Specifically, commitment to school is expected to have weak direct and indirect effects on delinquency, though either attachment to parents or association

with delinquent peers no longer mediates the indirect effects.[7]

In sum, the total effects of school influence (i.e., the constraining effect of the school and teachers) are hypothesized to increase between early and middle adolescence and then gradually decrease as the youth moves toward later adolescence. School effects are also expected to be direct as well as indirect (through the network of family and/or delinquent peers) during early adolescence and, to a greater extent, during middle adolescence, but the direct effects become weaker in the later teenage years. Thus, the direct effect of school influence on delinquency is also expected to follow a curvilinear pattern similar to that of the total effects during the adolescent years.

ASSOCIATION WITH DELINQUENT PEERS

Thornberry expects peers to already have a significant impact on the adolescent's behavior at the early ages of adolescence. The effects are direct and indirect, though indirect effects through commitment to school are stronger than those effects through attachment to parents. This model specification is consistent with his argument that parents still have a strong influence on their children at this stage of adolescence. The impact of delinquent peers on the adolescent's behavior will continue to grow as the locus of interaction and social influence shifts from the family to peer networks during middle adolescence. In the final stage of adolescence, association with delinquent peers still has a strong, primarily direct, influence on delinquent behavior, though its effects are expected to be mediated by variables other than attachment to parents or commitment to school, such as delinquent values (see Appendix 1). In addition, during this developmental stage delinquent peers are likely to compete with newly emerging commitment to conventional activities (e.g., employment, college education, marriage, and military service). Thus, it seems reasonable to expect weaker direct as well as total effects of delinquent peers on delinquency during later compared to middle adolescence.

In sum, the developmental pattern of delinquent peer influence (i.e., the pro-delinquent influence of unconventional friends) is expected to be quite similar to that of school influence. Specifically, total and direct effects of delinquent peer influence are hypothesized to be already significant at early ages of adolescence, but to continue to increase until they reach a peak during middle adolescence, and then to decline gradually.

7. Thornberry (1987:881) explains that commitment to school will "affect only commitment to conventional activities and, more weakly, delinquent behavior" during later adolescence.

STRUCTURAL VARIABLES

Thornberry (1987:884–885) incorporates "structural variables," which refer to the "person's location in the structure of social roles and statuses" (e.g., race, sex, class, community of residence, and family structure) into his interactional model. He posits that the effects of structural variables on delinquency are mediated by "interactional variables" (i.e., attachment to parents, commitment to school, and association with delinquent peers). While acknowledging that some structural variables, like community of residence or family structure, can change over time (i.e., are time-variant), Thornberry does not hypothesize about their age-varying effects on delinquency. Thus, this study controls for structural variables when the age-varying effects of the interactional variables on delinquency are estimated, but their age-variance is not hypothesized.

PRIOR RESEARCH

Thornberry's (1996) recent review of empirical evidence on interactional theory indicates that the theory's developmental claims cannot be evaluated yet because there are too few criminological studies that directly examine the age-variance of delinquency causation. However, several studies give some support to the general developmental thrust of interactional theory. For example, estimating a three-wave panel model, Paternoster (1988) shows that the direct effect of parental influence was stronger than that of peer influence on marijuana use when the respondents in his sample were 10th graders than they were over the next two years.[8] By contrast, the direct effect of peer influence became stronger over time. While these patterns of change in parental and peer influence on adolescent deviance seem consistent with interactional theory's developmental perspective, the findings are limited in that only a segment of adolescence (i.e., 10th through 12th grade) was examined.

LaGrange and White's (1985) study covers a wider age span than Paternoster's (1988) by estimating a regression equation separately for three

8. An issue relevant to this study is that hypotheses about nonmonotonic patterns of age-varying effects cannot be tested based on a three-wave model. For example, in a panel model in which delinquent peers and delinquency are repeatedly measured at three time points, say, times 1, 2, and 3, the lagged effect of delinquent peers measured at time 1 on delinquency at time 2 is different from that of delinquent peers at time 2 on delinquency at time 3. The former refers to the effect of the *level* of delinquent peers at time 1 on *change* in delinquency at time 2 (i.e., delinquency at time 2 with delinquency at time 1 held constant), whereas the latter is the effect of *change* in delinquent peers at time 2 on *change* in delinquency at time 3. Thus, in this three-wave panel model the two lagged effects are not directly comparable. Even if contemporaneous instead of lagged effects are estimated, only two coefficients (i.e., at times 2 and 3) are comparable, and thus, it is still impossible to examine more than a monotonic pattern of change.

age groups that "roughly represent the developmental benchmarks" (p. 24) of beginning, middle, and late male adolescence (i.e., 12-, 15-, and 18-year-olds, respectively). They find that the effects of family, school, and delinquent peers on delinquency vary substantially across age groups. Specifically, the total effects of parents and school are significant and larger in the middle-adolescence group than in the other two age groups, while the direct effects do not show any clear pattern of change. By contrast, the largest total/direct effects of delinquent peers are observed in the oldest group, followed by the youngest and then the middle-adolescence group. While LaGrange and White's findings are consistent with this study's hypothesis about the total effect of school on delinquency, caution must be taken in interpreting their findings given their use of cross-sectional data, which are not ideal for testing developmental hypotheses.

Analyzing panel data from the Rochester Youth Development Study (RYDS), Thornberry et al. (1991) report that between early and middle adolescence the direct effects of attachment to parents on delinquency tend to decline, as interactional theory predicts,[9] while those of commitment to school remain significant without showing the pattern of increase that the theory postulates. In a separate analysis, they also show that the direct effects of delinquent peers on delinquency tend to increase during the transition from early to middle adolescence, as interactional theory posits (Thornberry et al., 1994). More recently, however, Krohn and his associates (1996) expanded Thornberry et al.s' (1994) model into a five-wave model of adolescent drug use. Findings from estimating two alternative models (i.e., contemporaneous and lagged models) indicate that the effect of peer drug use on a respondent's drug use does not increase, but rather decreases, over the age span that represents early through late adolescence.[10] Besides the limited number of waves and mixed evidence, using these findings from the RYDS studies to test the developmental hypotheses of interactional theory is problematic because the age of respondents varies within each wave, and thus, an estimated effect is a weighted average of possibly different effects associated with different ages rather than an effect associated with a single age.[11]

9. Similarly, a recent study that focuses on African-American respondents and analyzes the same panel data shows that the importance of parental supervision in explaining delinquency tends to peak during early adolescence and remain significant throughout middle adolescence but become nonsignificant into later adolescence (Jang and Krohn, 1995).

10. The coefficients across the five waves are .21, .19, .17, .16 and .15, .11, .08, .15 for the contemporaneous and lagged model, respectively.

11. For example, 77% of the respondents in Krohn et al.'s (1996) study were 13 (41%) or 14 (36%) and the remainder were either younger than 13 (15%) or older than 14 (9%). While all three studies control for age, their models do not include interaction

The literature reviewed above shows that the few studies that have examined the age-varying importance of family, school, and delinquent peers in the etiology of delinquency report mixed results. Also, their limited methodological approaches make their findings inconclusive. Specifically, LaGrange and White (1985) raise the important issue of "age-generalizability" of delinquency theories, but they come short of a proper test of their hypotheses because they analyze cross-sectional data, making comparisons across age groups rather than ages based on longitudinal data. When panel data are employed, the studies do not examine the whole period of adolescence (Paternoster, 1988; Thornberry et al., 1991, 1994) or do not control for age-heterogeneity of respondents within each wave when a longer period of adolescence is examined (Jang and Krohn, 1995; Krohn et al., 1996).

Finally, researchers have focused on between-individual differences in the aggregate over time, rarely examining within-individual differences across the life span. Between- and within-individual continuity and change are different concepts in terms of the level of analysis. The former is an aggregate-level concept in that it is based on an aggregate of respondents whose relative standings on variables of interest become the basis of describing continuity and change in human development. On the other hand, the latter is an individual-level concept that focuses on the over-time consistency or heterogeneity of attributes of interest observed separately for each individual person. Thus, for example, the age-variance of family influence on delinquency can be empirically examined in two ways: either by comparing parallel coefficients estimated in a multiwave panel model under the assumption of stable rank orders of individuals for the variables under consideration or by estimating the across-age pattern of family influence on delinquency separately for each person to find an overall developmental pattern. In other words, the between- and within-individual analyses are compatible, not contradictory (Magnusson, 1988). Consistent with Thornberry's perspective (Sampson and Laub, 1993), this study takes what Magnusson (1988) calls a "person approach" to focus on within-individual differences across ages, using multilevel models to test hypotheses.

METHODS

MULTILEVEL MODELING: HIERARCHICAL LINEAR MODELS

This study applies multilevel models, specifically Bryk and

between age and other theoretical variables within each wave to capture those variables' differential effects across ages.

Raudenbush's (1992) hierarchical linear models (HLM), to test the developmental hypotheses derived from interactional theory. While some researchers have used multilevel modeling to analyze growth curves of delinquent behavior/attitudes (Johnson et al., 1997; Raudenbush and Chan, 1992), the modeling has rarely been applied to developmental research on the age-variance of delinquency causation. When multiple observations are made over time on a group of individuals for developmental research, such data can be viewed as having a multilevel data structure wherein the "higher" level (level 2) units are individuals and the "lower" level (level 1) units are occasions of measurement (e.g., waves in a panel design). The multilevel modeling does not require that the spacing and number of repeated observations be the same for each individual (Bryk and Raudenbush, 1992).

Based on Bryk and Raudenbush's (1987) "two-stage conceptualization," within- and between-individual models are presented. In essence, there is one regression model for each individual that specifies how his or her outcome is affected by time-varying predictors. A second-stage model specifies how the effects of the predictors on the outcome are explained. For simplicity, however, the following illustration focuses on predicting delinquency that is measured at the within-individual level by a single level-1 predictor, association with delinquent peers, and a single level-2 predictor, sex. Let $Y_{i,t}$ represent the measure of the dependent variable, delinquency, for individual i at occasion or time t. In a simple within-individual (i.e., level-1) model, the individual's delinquency measured at time t can be represented as a linear function of the respondent's association with delinquent peers measured at time t-1 plus random error ($r_{i,t}$):

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i} Peer_{i,t-1} + r_{i,t}, \quad (1)$$

where $\beta_{0,i}$ is the intercept for individual i, $\beta_{1,i}$ is the slope of delinquent association for individual i, and $r_{i,t}$ is the residual for individual i at time t. It is assumed that $r_{i,t}$ is normally distributed with homogeneous variance across individuals.

This study, however, is intended to examine the *age-varying* effect of delinquent association, which is hypothesized to follow a curvilinear pattern, represented here by a quadratic growth model. Thus, Equation 1 is expanded to include not only the individual's age[12] and its squared term but also two product terms that represent interaction between age and delinquent association as follows:

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i} Peer_{i,t-1} + \beta_{2,i} Age_{i,t-1} + \beta_{3,i} Age^2_{i,t-1} + \beta_{4,i} Age_{i,t-1} Peer_{i,t-1} + \beta_{5,i} Age^2_{i,t-1} Peer_{i,t-1} + r_{i,t}. \quad (2)$$

12. To avoid the collinearity problem due to a high correlation between the age variable and its squared term, the age variable is "centered" using a specific constant before the squared term is constructed (Cohen and Cohen, 1983).

Equation 2 represents a total-effect model in the sense that the slope of delinquent association ($\beta_{1,i}$) estimates the independent variable's effects on delinquency without holding its key mediating variables (i.e., family and school relations) constant.[13] Thus, delinquent association's direct effects, that is, effects not mediated by either family or school, can be estimated by the following direct-effect model wherein the effects of family and school variables are controlled for:

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i}Peer_{i,t-1} + \beta_{2,i}Age_{i,t-1} + \beta_{3,i}Age^2_{i,t-1} + \beta_{4,i}Age_{i,t-1}Peer_{i,t-1} + \beta_{5,i}Age^2_{i,t-1}Peer_{i,t-1} + \beta_{6,i}Family_{i,t-1} + \beta_{7,i}School_{i,t-1} + r_{i,t}. \quad (3)$$

Multilevel models specify the intercept ($\beta_{0,i}$) as a random variable, but the slopes of the level-1predictors can be specified as either constant across individuals or as varying across individuals as a function of individual-level characteristics and of random individual-level error. While the final model specification is discussed later, this illustrative section uses the following between-individual (i.e., level-2) model, in which the intercept and the slope of delinquent association are specified as random, but varying according to a single level-2 predictor, the individual's sex measured by a dummy variable that represents male:

$$\beta_{0,i} = \gamma_{0,0} + \gamma_{0,1}Male_i + u_{0,i}, \text{ and} \quad (4a)$$

$$\beta_{1,i} = \gamma_{1,0} + \gamma_{1,1}Male_i + u_{1,i}. \quad (4b)$$

In Equation 4, first, $\gamma_{0,0}$ and $\gamma_{1,0}$ are coefficients for the intercept and slope, which represent the mean intercept and mean slope. Second, $\gamma_{0,1}$ represents the main effect of the individual's sex on delinquency because sex predicts differences in individuals' average delinquency over time. On the other hand, $\gamma_{1,1}$ represents a cross-level interaction between sex and delinquent association because sex in Equation 4b predicts how the effects of delinquent peers on delinquency vary across individuals.[14] Finally, $u_{0,i}$ and $u_{1,i}$ represent residual or conditional random variation of individuals around the mean intercept and slope, respectively, and are assumed to be multivariate normally distributed. Thus, the inclusion of any level-2 predictor in the model depends on what theory says about the main effect and cross-level interaction. I come back to this issue when I present the theoretical models after a description of data and measurement.

13. This study assumes that all effects are indirect in the sense that causation operates almost always indirectly through some intermediate variable(s). Thus, the "simplest way to estimate a total effect rather than a direct effect is simply to leave the mediating variables out of the regression" (Darlington, 1990:188).

14. The meaning of $\gamma_{0,1}$ and $\gamma_{1,1}$ becomes clear when the level-2 model (Equation 4) and the simple level-1 model (Equation 1) are combined into a single model: $Y_{i,t} = \gamma_{0,0} + \gamma_{0,1}Male_i + \gamma_{1,0}Peer_{i,t-1} + \gamma_{1,1}Male_i\ Peer_{i,t-1} + u_{0,i} + u_{1,i}Peer_{i,t-1} + r_{i,t}$.

DATA

The data to test hypotheses come from the National Youth Survey (NYS), a longitudinal study of a national probability sample of 1,725 persons aged 11 to 17 in early 1977 (Elliott et al., 1985). The sample was obtained through a multistage cluster sampling of households in the continental United States. The seven birth cohorts in the sample and their parents were first interviewed in early 1977 about their attitudes at the time of the interview and their behavior during the previous year. This study analyzes the first five waves of data collected, when the respondents were of early through later adolescence—the focus of interactional theory.

Table 1 summarizes sociodemographic characteristics of the total sample at each wave. First, the respondents are almost equally distributed across seven birth cohorts; the percentages range from 11.3 (17-year-olds) to 15.7 (13-year-olds) at the first wave. The observation of little across-wave change in this sample's sociodemographic composition is consistent with Elliott et al.'s (1989) report of a relatively low attrition rate over the first six waves of data (13%) and its minimal impact on the representativeness of the sample with respect to age, sex, race/ethnicity, social class, and place of residence. According to parent data on family structure variables collected only at the initial wave, a majority of the total respondents were living in a household in which a principal wage earner (PWE) was employed at the time of the wave-1 interview (95%), no public assistance including food stamps or welfare was received during 1976 (82%), and both biological parents were living together at the time of an interview (70%).

MEASUREMENT

Attachment to Parents

The affective relationship and close communication between adolescent and parents or, more broadly, family, are measured by items tapping family involvement (i.e., the amount of time spent with family) and attachment to family (i.e., perceived closeness to family and whether family listens to or is not interested in problems the respondent has). Maximum likelihood exploratory factor analysis and reliability analysis, applied to each dimension-group of items, showed that the selected items load on a common factor with high loadings (i.e., at least .40 as a general rule) and have acceptable interitem reliability coefficients (which range from .69 to .84) (see Appendix 2 for factor loadings and alpha coefficients as well as a description of items used). Based on these findings, items were first summed for a total score on each dimension, and then the total scores

Table 1. Sociodemographic Characteristics of the Total Sample: Waves 1 Through 5 (in Percentages)

Variable	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Year of Interview	1977	1978	1979	1980	1981
Age					
11	14.6				
12	14.9	14.7			
13	15.7	15.2	14.8		
14	15.0	15.7	15.3	15.0	
15	14.6	14.7	15.5	15.3	15.4
16	13.9	14.7	14.7	16.2	15.3
17	11.3	14.0	14.5	14.4	16.4
18		11.1	13.9	14.2	14.2
19			11.2	13.7	13.9
20				11.3	13.7
21					11.1
Mean	13.9	14.9	15.9	16.8	17.8
S.D.	1.9	1.9	1.9	1.9	1.9
Sex					
Male	53.3	53.1	53.1	52.2	52.4
Female	46.7	46.9	46.9	47.8	47.6
Ethnicity					
Anglo	79.1	79.3	79.7	79.2	79.1
Black	15.1	14.7	14.7	15.0	15.2
Chicano	4.4	4.2	3.9	4.1	4.1
American Indian	.5	.5	.5	.5	.5
Asian	.9	1.0	.9	.9	.9
Other	.0	.2	.2	.2	.2
Race					
White	79.1	79.3	79.7	79.2	79.1
Nonwhite	20.9	20.7	20.3	20.8	20.9
Place of Residence					
Urban	25.9	25.6	25.2	26.4	26.2
Suburban	44.9	44.1	44.2	44.2	43.8
Rural	29.3	30.3	30.6	29.4	30.0
PWE Unemployed at Wave 1					
Yes	5.5				
No	94.5				
Family on Welfare at Wave 1					
Yes	18.4				
No	81.6				
Intact Family at Wave 1					
Yes	70.0				
No	30.0				

were combined after standardization into a single composite measure.[15]

Commitment to School

To operationalize the "stake in conformity" the adolescent has developed in the domain of school and education, items were selected that measure involvement in homework (i.e., time spent on studying after school or on weekends), attachment to school or teachers (e.g., "I don't belong at school" or "teachers don't call on me"), and school performance (i.e., self-reported grade point average). The first two groups of items (i.e., involvement and attachment) were factor-analyzed and their reliabilities were checked. All factor loadings are high, and alpha coefficients are acceptable, ranging from .52 to .71 (see Appendix 2). A single measure of commitment to school was constructed by following the same procedures as for the measure of attachment to parents.

Association with delinquent peers

This study's measure of association with delinquent peers focuses on peers' delinquent behavior. Five items are used that measure the proportion of a respondent's "close friends" who engage in each of three types of nondrug offense: personal (1 item), property (3 items), and illegal service (1 item) offense.[16] These three offense-type dimensional measures load on a single factor and show acceptable alpha coefficients (see Appendix 2). A composite measure of delinquent association was constructed first by summing scores on the dimensional measures and then standardizing the total scores.

Delinquency

For Thornberry (1987:867), *delinquency* "refers to acts that place the youth at risk for adjudication; it ranges from status offenses to serious violent activities." Thus, this study constructs an omnibus rather than an offense-specific measure of delinquency. The self-reported delinquency inventory of the NYS was designed to represent the entire range of norm-violating acts for which juveniles could be arrested, including drug use.

15. For this standardization procedure, I used means and standard deviations of dimension measures for birth cohort 11 (i.e., those who were 11 years old at the initial wave of interview) at wave 1, given the importance of comparing unstandardized regression coefficients across ages.

16. As an alternative measure, I also examined what Elliott et al. (1985:97) call the "Involvement with Delinquent Peers Index" by jointly considering time spent with peers and their delinquent orientation. However, a preliminary analysis showed little difference in structural coefficients between that measure and this study's measure, which has also been used by most previous studies that examine delinquent peer influence.

This study does not include drug use offenses because the etiology and developmental patterns of this type of behavior tend to be different from those of nondrug offenses (Agnew and White, 1992; Elliott et al., 1989; Jang and Krohn, 1995), though selling drugs is included in the index of general delinquency. The NYS measured delinquency using two response sets: an open-ended frequency count and a series of categories for all frequency responses of 10 or higher. This study uses the categorical responses rather than incidence (i.e., frequency count) measure because the distribution of the former is less skewed. A total of 22 items regarding personal, property, illegal service, public disorder, and status offenses are combined into a single scale of general delinquency. Specifically, the general delinquency scale consists of three "felony assault" items, three "minor assault" items, three "robbery" items, four "felony theft" items, three "minor theft" items, three "illegal services" items, and three items measuring "public disorder" and "status offenses" (Elliott et al., 1989:12–13, Table 1.1; see Appendix 2).

Structural Variables

The theoretical model also includes six sociodemographic background variables that previous researchers identify as most relevant to the study of delinquency (Gottfredson and Hirschi, 1990; Hirschi, 1969; Loeber and Stouthamer-Loeber, 1986; Sampson and Laub, 1993; Thornberry, 1987; Wilson and Herrnstein, 1985). They are sex (0 = female, 1 = male); race (0 = nonwhite, 1 = white); class (0 = not underclass, 1 = underclass);[17] intact family (0 = not living with both biological parents, 1 = living with both biological parents); family size (the number of children or youth under 18 in the respondent's family, ranging from 0 to 9 or more); and community of residence (which is operationalized by two dummy variables of place-of-residence, living in "suburban" or "urban" areas, with living in "rural" areas as the reference category).

THEORETICAL MODELS

This study tests the hypotheses about the age-varying effects of family,

17. Although a variety of social class measures are used in criminological research (Tittle and Meier, 1990), this study uses a measure of underclass status defined by a combination of primary wage earner's employment status (0 = not unemployed, 1 = unemployed) and family's welfare status (0 = not receiving any public assistance, 1 = receiving public assistance). The choice of underclass status as a social class measure is based on a recent study that shows the measure's greater relevancy to contemporary theories of delinquency, including interactional theory, compared to other alternatives (Farnworth et al., 1994). A respondent is coded as coming from an underclass family if his or her family's primary wage earner was unemployed *and* his or her family received public assistance during the year prior to the first-wave interview.

school, and delinquent peers on delinquency by estimating within-individual models. Specifically, the age-variance of their total effects are first examined by estimating the following level-1 equation, which includes only one of the three key predictors (*X1*) as well as the age variables (i.e., linear and quadratic terms after centering using the age of maximum delinquency, 16.9, found by a preliminary analysis for the sample), two interaction terms involving age and the key predictor, *X1*, and the structural variable of place-of-residence measured by two dummy variables, *Suburban* and *Urban*:[18]

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i}Age_{i,t-1} + \beta_{2,i}Age^2_{i,t-1} + \beta_{3,i}X1_{i,t-1} + \beta_{4,i}Age_{i,t-1}X1_{i,t-1} + \beta_{5,i}Age^2_{i,t-1}X1_{i,t-1} + \beta_{6,i}Suburban_{i,t-1} + \beta_{7,i}Urban_{i,t-1} + r_{i,t}, \quad (5)$$

where *X1* represents attachment to parents, commitment to school, or association with delinquent peers.[19] Next, the hypotheses concerning direct effects are tested by adding the other two key predictors (*X2* and *X3*) to the total-effect model (Equation 5) as follows:

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i}Age_{i,t-1} + \beta_{2,i}Age^2_{i,t-1} + \beta_{3,i}X1_{i,t-1} + \beta_{4,i}Age_{i,t-1}X1_{i,t-1} + \beta_{5,i}Age^2_{i,t-1}X1_{i,t-1} + \beta_{6,i}Suburban_{i,t-1} + \beta_{7,i}Urban_{i,t-1} + \beta_{8,i}X2_{i,t-1} + \beta_{9,i}X3_{i,t-1} + r_{i,t}. \quad (6)$$

"LIMITED" INTERCEPTS- AND SLOPES-AS-OUTCOMES MODELS

In the total- and direct-effect models, an individual's delinquency at time t is regressed on level-1 predictors measured at time t-1, that is, approximately one year prior to the measurement of the dependent variable, to address the issue of causal ordering. Specifically, all the measures of the independent variables are derived from waves 1 through 4 (when the respondents were 11 through 20 years old), whereas those of the dependent variable are from waves 2 through 5 (when the respondents, being 12 through 21 years old, reported delinquency approximately at the

18. Consistent with interactional theory, the place-of-residence variable is specified as a time-varying or wave-varying, but not age-varying, level-1 predictor of delinquency. While the percentage distribution of place-of-residence across urban, suburban, and rural areas remains stable across waves (see Table 1), this aggregate-level stability does not necessarily reflect individual-level stability. On the other hand, while the family structure variables (i.e., intact family and number of children) should have been specified as time-varying level-1 predictors, like the place-of-residence variable, they both are specified as "time-invariant" level-2 predictors mainly because they were measured only once, at wave 1, in the NYS.

19. While the age-varying effects of attachment to parents on delinquency are hypothesized to follow a monotonically declining pattern, the quadratic term of age as well as its linear term are included in the equation based on a preliminary analysis (see footnote 27) expecting only the linear term to be found significant if the hypothesized pattern is supported.

ages of 11 through 20). While each respondent was observed only for a 5-year period, this study's multilevel modeling approach, which does not require a standard data structure, enables me to examine a 10-year period of adolescence as ages observed by the 5-year period vary and overlap across 1,725 individual respondents, covering the entire age span of interest (i.e., ages 11 through 20).

However, the limited number of waves (level-1 units) per individual (level-2 unit) puts constraints on the number of level-1 predictors whose coefficients can be specified as random slopes. Specifically, in this study there are only four level-1 units per level-2 unit, which allows me to estimate random slopes for only up to three level-1 predictors, including the intercept.[20] Given these data constraints, the models of total and direct effects (Equations 5 and 6) are specified as "limited" intercepts- and slopes-as-outcomes models. They are "limited" in that each model specifies only three level-1 predictors' coefficients as random slopes and the other predictors' as fixed slopes. Besides the intercept, among the level-1 predictors of delinquency, I decided to specify the coefficients of the two age variables, linear and quadratic terms, as randomly varying across individuals. This decision was based on a need to examine whether any age-cohort interaction exists in the data and to specify the theoretical model accordingly to control for cohort effects, which tend to seriously confound with age effects when data from an "accelerated" longitudinal design like the NYS are analyzed (Raudenbush and Chan, 1992).

AGE-COHORT INTERACTIONS

Raudenbush and Chan (1992) point out that although the accelerated longitudinal design of the NYS is advantageous to use for practical (e.g., reducing the time period of the study) and inferential (e.g., period and age effects are not completely confounded) purposes, it also allows age-cohort interactions to be present in the data if the birth cohorts included in the survey differ. Specifically, in this study the effect of age on delinquency (i.e., delinquency growth trajectory) might vary across cohorts if the cohorts have differential rates of change in delinquency across ages. Since the seven birth cohorts are observed at different age intervals (see Table 1), such differences in rate of change could be mistakenly interpreted as developmental effects. Thus, it is necessary to examine whether an age-cohort interaction exists before any time-varying or time-invariant

20. While this study analyzes the five waves of data (i.e., five observations per respondent), the number of level-1 units is four, not five, since each level-1 unit or occasion consists of the dependent variable measured at time t and the independent variable at time t-1, where times t-1 and t represent waves 1 through 4 and 2 through 5, respectively.

covariates are included in a theoretical model. If significant interactions are found, a model should be estimated with the cohort differences in age effects held constant.

Following Raudenbush and Chan's (1992) approach to the analysis of age-cohort interaction, I conducted cohort-specific and cohort-combined analyses. Specifically, first, data from each of the seven cohorts were analyzed separately by estimating the following level-1 linear and quadratic model, which includes an intercept and the age variables after centering using the average age of each cohort (i.e., 13 through 19 for cohorts 11 through 17, respectively):

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i} Age_{i,t-1} + r_{i,t}, \text{ and} \tag{7a}$$

$$Y_{i,t} = \beta_{0,i} + \beta_{1,i} Age_{i,t-1} + \beta_{2,i} Age^2_{i,t-1} + r_{i,t}. \tag{7b}$$

And the following unconditional level-2 model was estimated:

$$\beta_{0,i} = \gamma_{0,0} + u_{0,i}, \text{ and} \tag{8a}$$

$$\beta_{k,i} = \gamma_{k,0} + u_{k,i}, \tag{8b}$$

where k refers to the age variables ($k = 1, 2$). Results from these cohort-specific analyses provide preliminary evidence for an age-cohort interaction (see below).

Second, I also formally test the hypothesis of age-cohort interaction by conducting a cohort-combined analysis. Specifically, the data from the seven cohorts were pooled to determine whether the age-delinquency relationship follows an expected developmental trajectory (i.e., the standard age-crime curve) by estimating the level-1 quadratic model (Equation 7b) and the simple level-2 model (Equation 8). Then, to directly test the age-cohort interaction hypothesis, six cohort dummy variables are constructed, with the youngest cohort as the reference category (i.e., cohort 11), and included in the level-2 model, as follows:

$$\begin{aligned}\beta_{0,i} = {} & \gamma_{0,0} + \gamma_{0,1} Cohort12_i + \gamma_{0,2} Cohort13_i + \gamma_{0,3} Cohort14_i \\ & + \gamma_{0,4} Cohort15_i + \gamma_{0,5} Cohort16_i + \gamma_{0,6} Cohort17_i + u_{0,i}, \text{ and}\end{aligned} \tag{9a}$$

$$\begin{aligned}\beta_{k,i} = {} & \gamma_{k,0} + \gamma_{k,1} Cohort12_i + \gamma_{k,2} Cohort13_i + \gamma_{k,3} Cohort14_i \\ & + \gamma_{k,4} Cohort15_i + \gamma_{k,5} Cohort16_i + \gamma_{k,6} Cohort17_i + u_{k,i},\end{aligned} \tag{9b}$$

where k refers to the age variables ($k = 1, 2$). Combining this level-2 model with the quadratic level-1 model above (Equation 7b) is equivalent to writing a single prediction equation containing interactions between age and cohort and age-squared and cohort (see Bryk and Raudenbush, 1992:14).

If the coefficients of the cohort dummy variables are significant, I can conclude that significant age-cohort interaction exists in the data, and thus, I must control for the interactions when I estimate the age-varying effects

of family, school, and delinquent peers on delinquency. For the significance test of the cohort variables' fixed effects (i.e., $\gamma_{0,1}, \ldots, \gamma_{0,6}$; $\gamma_{1,1}, \ldots, \gamma_{1,6}$; and $\gamma_{2,1}, \ldots, \gamma_{2,6}$), multiparameter tests are conducted with the null hypothesis that all the fixed effects are null (i.e., H_0: $\gamma_{0,1} = \gamma_{0,2} = \gamma_{0,3} = \gamma_{0,4} = \gamma_{0,5} = \gamma_{0,6} = 0$; $\gamma_{1,1} = \gamma_{1,2} = \gamma_{1,3} = \gamma_{1,4} = \gamma_{1,5} = \gamma_{1,6} = 0$; and $\gamma_{2,1} = \gamma_{2,2} = \gamma_{2,3} = \gamma_{2,4} = \gamma_{2,5} = \gamma_{2,6} = 0$) as "protection against the heightened probability of type I errors" (Bryk and Raudenbush, 1992:52).

Table 2 summarizes results from estimating cohort-specific and cohort-combined models of the age-delinquency relationship. The cohort-specific analysis shows that the age effect on delinquency follows an inverted U-shaped pattern (Equation 7b) in all the cohorts except cohort 11, for which the linear model (Equation 7a) is found to be significant (see the columns of cohorts 11 through 17). This pattern of increasing delinquency was expected given the ages covered by the youngest cohort (i.e., ages 11–14), and is consistent with what is known about developmental change in delinquent involvement during early adolescence.

Based on these cohort-specific analyses, I examined whether data from the seven cohorts jointly reveal a single delinquency growth trajectory for ages 11 through 20 with cohort-specific trajectories smoothly connected with one another at ages of overlap (e.g., trajectories of cohorts 11 through 14 at ages 12 through 14). To the extent to which cohort-specific trajectories are disconnected at those ages, cohorts are dissimilar to one another in the effects of age on delinquency, or put differently, age-cohort interactive effects exist in the data. Figure 1 indicates that not all cohort-specific trajectories are smoothly connected at ages of overlap.

For example, Figure 1 shows that the trajectories of cohorts 12 and 13 are perfectly connected; they have exactly the same expected delinquency score (i.e., 1.138) at age 13 (see Table 3). But they become disjointed at age 14 because they have different expected delinquency scores (i.e., 1.149 and 1.178, respectively), which was anticipated given their differential rates of change at age 13 (i.e., .023 and .054, respectively). Similarly, at age 14, cohort 13's trajectory (i.e., expected delinquency score = 1.178; expected rate of change = .027) can be connected with cohort 14's (i.e., expected delinquency score = 1.170; expected rate of change = .077), but the two trajectories cannot be connected at age 15. Given that the three cohort-specific trajectories have different expected delinquency scores and different rates of change in delinquency at ages 13 and 14, the three trajectories cannot be said to jointly represent a single underlying delinquency growth trajectory, which indicates the existence of age-cohort interaction in the data. This finding suggests that I should control for the age-cohort interaction to properly test my hypotheses of primary interest. To conclude whether such statistical control is necessary, however, I formally

Table 2. Estimated Cohort-Specific and Cohort-Combined Models of Age-Delinquency Relationship

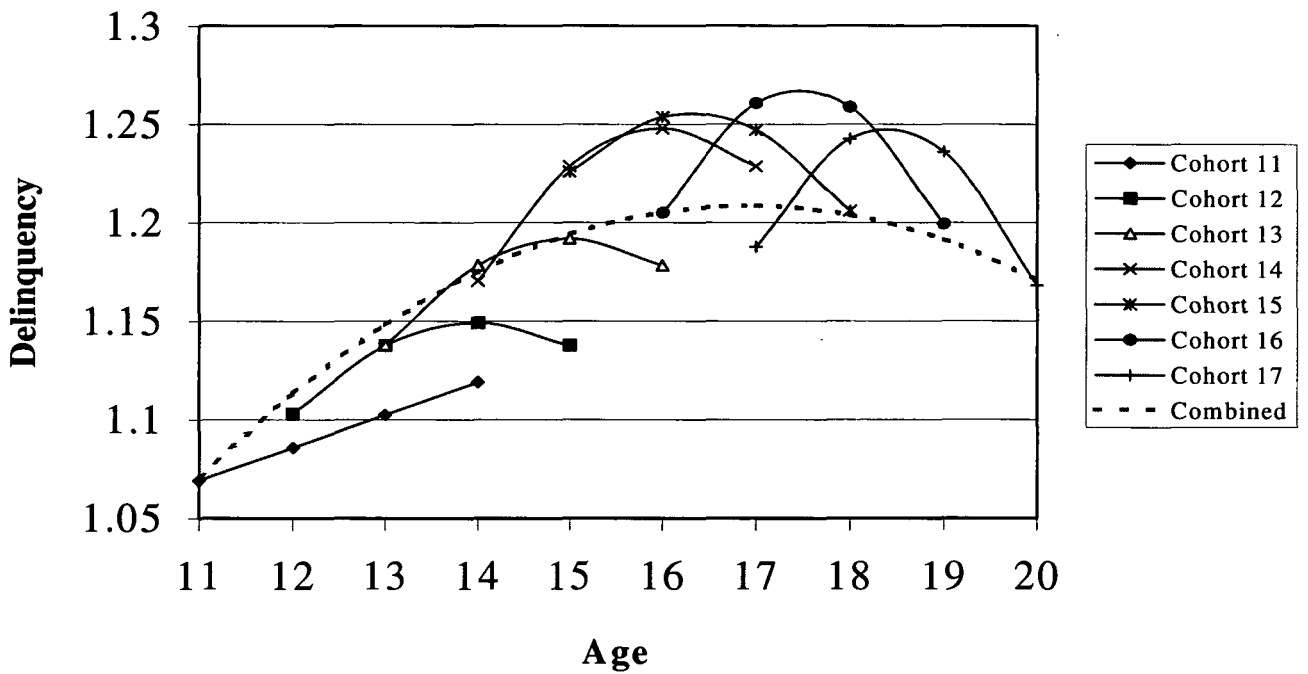
	Cohort 11 (11–14)[a]		Cohort 12 (12–15)		Cohort 13 (13–16)		Cohort 14 (14–17)		Cohort 15 (15–18)		Cohort 16 (16–19)		Cohort 17 (17–20)		Cohort–Combined Model (11–20)			
Fixed Effect	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio
Intercept, $\gamma_{0,0}$	1.102	86.385	1.149	86.023	1.192	63.747	1.248	60.148	1.247	69.825	1.259	63.270	1.236	78.362	1.209	170.241	1.086	11.588
Cohort 12, $\gamma_{0,1}$																	−.026	−.242
Cohort 13, $\gamma_{0,2}$																	.043	.436
Cohort 14, $\gamma_{0,3}$																	.139	1.458
Cohort 15, $\gamma_{0,4}$																	.161	1.690
Cohort 16, $\gamma_{0,5}$																	.172	1.807
Cohort 17, $\gamma_{0,6}$																	.095	.986
Age, $\gamma_{1,0}$	.017	2.925	.004	.517	−.007	−.854	−.010	−1.111	−.024	−3.664	−.031	−3.541	−.037	−4.479	.000	.001	−.023	−.529
Cohort 12, $\gamma_{1,1}$																	−.041	−.762
Cohort 13, $\gamma_{1,2}$																	−.035	−.714
Cohort 14, $\gamma_{1,3}$																	−.019	−.412
Cohort 15, $\gamma_{1,4}$																	−.001	−.019
Cohort 16, $\gamma_{1,5}$																	.055	1.236
Cohort 17, $\gamma_{1,6}$																	.114	2.396
Age^2, $\gamma_{2,0}$			−.012	−2.517	−.013	−2.255	−.019	−3.424	−.017	−3.474	−.029	−4.642	−.031	−5.308	−.004	−7.311	−.004	−.915
Cohort 12, $\gamma_{2,1}$																	−.007	−1.046
Cohort 13, $\gamma_{2,2}$																	−.009	−1.293
Cohort 14, $\gamma_{2,3}$																	−.014	−1.981
Cohort 15, $\gamma_{2,4}$																	−.013	−1.814
Cohort 16, $\gamma_{2,5}$																	−.024	−3.367
Cohort 17, $\gamma_{2,6}$																	−.026	−3.456

										Multiparameter Test[b]		
Reliability Coefficient	Cohort 11	Cohort 12	Cohort 13	Cohort 14	Cohort 15	Cohort 16	Cohort 17	Cohort-Combined	H_0	χ^2	D.F.	*p* Value
Intercept, $\beta_{0,i}$	.920	.817	.865	.897	.841	.874	.736	.479	(1)	27.223	5	.000
Growth Rate, $\beta_{1,i}$	.743	.472	.475	.545	.166	.407	.191	.084	(2)	40.899	5	.000
Curvature, $\beta_{2,i}$		.283	.393	.353	.091	.397	.114	.023	(3)	12.643	5	.026

Random Effect	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2
Intercept, $u_{0,i}$	.035	234	3090*	.036	244	1322*	.077	247	1846*	.091	226	2234*	.061	220	1387*	.075	210	1719*	.032	168	647*	.060	1542	5114*	.060	1536	5113*
Age, $u_{1,i}$	.006	234	934*	.006	244	463*	.009	247	475*	.011	226	502*	.002	220	248	.006	210	357*	.002	168	204*	.003	1542	1998*	.003	1536	1964*
Age², $u_{2,i}$				.002	244	325*	.004	247	418*	.003	226	368*	.000	220	229	.003	210	367*	.001	168	187	.000	1542	1761*	.000	1536	1728*
Level-1 Effect, $r_{i,t}$	.009			.014			.022			.018			.020			.019			.020			.022			.022		

[a] The range of values in parentheses indicate ages for which delinquency is measured in each data set.
[b] The null hypotheses (H_0) being tested are (1) $\gamma_{0,1} = \gamma_{0,2} = \gamma_{0,3} = \gamma_{0,4} = \gamma_{0,5} = \gamma_{0,6} = 0$; (2) $\gamma_{1,1} = \gamma_{1,2} = \gamma_{1,3} = \gamma_{1,4} = \gamma_{1,5} = \gamma_{1,6} = 0$; and (3) $\gamma_{2,1} = \gamma_{2,2} = \gamma_{2,3} = \gamma_{2,4} = \gamma_{2,5} = \gamma_{2,6} = 0$.
* $p < .05$.

Figure 1 Delinquency Growth Trajectories: Expected Delinquency as a Function of Age for Cohorts 11 through 17 and Total Sample Based on Cohort-Specific and Cohort-Combined Analyses



tested the hypothesis of age-cohort interaction by conducting cohort-combined analysis based on the data pooled from the seven cohorts.

Table 3. Expected Delinquency Scores and Growth Rates Based on Cohort-Specific Analysis

	Expected Delinquency							Expected Rate of Change						
Age	C11	C12	C13	C14	C15	C16	C17	C11	C12	C13	C14	C15	C16	C17
11	1.069							.017						
12	1.086	1.103						.017	.046					
13	1.102	1.138	1.138					.017	.023	.054				
14	1.119	1.149	1.178	1.170				.017	.000	.027	.077			
15		1.138	1.192	1.229	1.226				-.023	.000	.039	.045		
16			1.178	1.248	1.254	1.205				-.027	.000	.011	.084	
17				1.229	1.247	1.261	1.188				-.039	-.024	.027	.086
18					1.206	1.259	1.242					-.058	-.031	.024
19						1.199	1.236						-.088	-.037
20							1.168							-.099

The cohort-combined model was estimated without as well as with the cohort dummy variables in the level-2 equation (see the "Cohort-Combined Model" column of Table 2). Estimation of the unconditional model[21] (which is plotted in Figure 1) enabled me to examine the extent to which the variance in the estimated growth parameters (i.e., $\hat{\beta}_{p,i}$, where p = 0, 1, and 2; see Equations 7 and 8) is due to variance in true parameters, which Bryk and Raudenbush (1992:137) call "reliability" of the estimated parameters. I have to check the reliability before interpreting results from estimating the cohort-combined model so that I do not falsely conclude that there is no age-cohort interaction, "when in fact the data may simply be incapable of detecting such relations" (Bryk and Raudenbush, 1992:137).

Reliability coefficients for the growth parameters were estimated for each cohort as well as all the cohorts combined and are presented in the second panel of Table 2. Cohort-specific reliability estimates range in

21. The estimated unconditional model (i.e., $Y_{i,t} = 1.209 + .000Age_{i,t-1} - .004Age^2_{i,t-1} + r_{i,t}$) shows the existence of an inverted U-shaped age-delinquency curve at the *individual* or *within-individual* level. This pattern is consistent with the standard age-crime curve observed at the *aggregate* or *between-individual* level based on official and self-reported data, including the NYS data (e.g., Blumstein et al., 1986; Elliott et al., 1989; Farrington, 1986a; Gottfredson and Hirschi, 1990; Osgood et al., 1989; Warr, 1993a; but see Thornberry, 1989a, for an exception). While this convergence is not unexpected, this finding is not simply redundant of the previous findings given that they address different levels of analysis.

magnitude from being moderate to large, with some exceptions, which indicates that the NYS data are reliable enough to study within-individual change in delinquency over time (i.e., across ages). In contrast, the estimated reliabilities for the cohort-combined model are relatively low. Given the sufficiently high cohort-specific reliabilities, it is reasonable to proceed to estimate the cohort-combined model with the cohort dummy variables included in the level-2 equation (see the last two columns of Table 2).

Results from multiparameter hypothesis tests (presented in the second panel) show that the cohort variable significantly explains within-individual change in delinquency across ages (which is *ex post facto* evidence that the pooled data are still reliable enough to study the within-individual change despite the cohort-combined low reliabilities), which indicates significant age-cohort interaction in the data. These results parallel those from the cohort-specific analyses and confirm the need to specify the age effects as varying across cohorts. A failure to model these interactions would result in improper tests of the main hypotheses about the age-varying effects of family, school, and delinquent peers on delinquency.

Based on these analyses, I estimated the following level-2 models for the random intercept (Equation 10a), the two random level-1 predictors (Equation 10b), and five (total-effect model) or seven (direct-effect model) fixed level-1 predictors (Equation 10c):

$$\begin{aligned}\beta_{0,i} = {} & \gamma_{0,0} + \gamma_{0,1} Male_i + \gamma_{0,2} White_i + \gamma_{0,3} Underclass_i + \gamma_{0,4} Intact\text{-}Family_i \\ & + \gamma_{0,5} Number\text{-}of\text{-}Children_i + \gamma_{0,6} Cohort12_i + \gamma_{0,7} Cohort13_i \\ & + \gamma_{0,8} Cohort14_i + \gamma_{0,9} Cohort15_i + \gamma_{0,10} Cohort16_i \\ & + \gamma_{0,11} Cohort17_i + u_{0,i}, \end{aligned} \tag{10a}$$

$$\begin{aligned}\beta_{k,i} = {} & \gamma_{k,0} + \gamma_{k,1} Cohort12_i + \gamma_{k,2} Cohort13_i + \gamma_{k,3} Cohort14_i \\ & + \gamma_{k,4} Cohort15_i + \gamma_{k,5} Cohort16_i + \gamma_{k,6} Cohort17_i + u_{k,i}, \text{ and} \end{aligned} \tag{10b}$$

$$\beta_{l,i} = \gamma_{l,0} \tag{10c}$$

where k and l refer to the age variables ($k = 1, 2$) and the other level-1 predictors in the total- ($l = 3, \ldots, 7$) and direct- ($l = 3, \ldots, 9$) effect models, respectively.

THE FINAL COMBINED MODEL

Combining the level-1 model (Equation 5 or 6) and the level-2 model (Equation 10) yields the final model, which specifies that delinquency at time t is a linear function of: the overall intercept ($\gamma_{0,0}$); the main effects of the individual background characteristics ($\gamma_{0,1}, \ldots, \gamma_{0,11}$), age ($\gamma_{1,0}$ and $\gamma_{2,0}$), the key predictor(s) of delinquency ($\gamma_{3,0}$ for the total effect model, and $\gamma_{3,0}$, $\gamma_{8,0}$, and $\gamma_{9,0}$ for the direct effect model), and place of residence ($\gamma_{6,0}$ and

$\gamma_{7,0}$); two interaction terms involving the age and key predictor of delinquency ($\gamma_{4,0}$ and $\gamma_{5,0}$); and the cross-level interactions involving the age and cohort dummy variables ($\gamma_{1,1}$, . . ., $\gamma_{1,6}$ and $\gamma_{2,1}$, . . ., $\gamma_{2,6}$) plus random error ($u_{0,i} + u_{1,i} + u_{2,i} + r_{i,t}$).[22]

ESTIMATED MODELS

Table 4 summarizes results from estimating the total- and direct-effect models of attachment to parents, commitment to school, and association with delinquent peers based on those respondents who provided sufficient data at both levels (whose number varies from 1,532 to 1,537 across models). One-tailed tests of statistical significance ($\alpha = .05$) are conducted given the hypothesized directions of relationships.

RANDOM INTERCEPT AND STRUCTURAL VARIABLES

First, the main effects of the level-1 (i.e., community of residence) and level-2 (i.e., sex, race, class, intact family, family size) structural variables on delinquency are significant in expected directions, with the exception of the number-of-children variable.[23] Second, the main effects on delinquency of the cohort dummy variables of 14 through 16 tend to be larger than the effects of the variables of 11 through 13 and 17, which is consistent with the standard age-delinquency curve, which peaks during middle adolescence (Farrington, 1986a; Gottfredson and Hirschi, 1990; Hirschi, 1969). The multiparameter tests (see the second panel of each model) show that these main effects are significant for all models (e.g., $\chi^2 = 26.098$, d.f. = 5, $p < .05$ for the total-effect model of attachment to parents), which means the intercept ($\beta_{0,i}$) significantly varies across cohorts. Last, the random-effect panel, presented at the bottom of each model, reveals that after including all the level-2 predictors, the residual variance of the random intercept remains significant in the total- and direct-effect models of family, school, and peer influence (e.g., .052, $\chi^2 = 4525$, d.f. = 1531, $p < .05$

22. The model cannot specify cross-level interactions other than the age-cohort interaction, especially ones that involve the key predictors of delinquency and individual characteristics, due to the data constraints discussed above. However, this model specification is consistent with interactional theory, which does not theorize such cross-level interaction (Thornberry, 1987:884–885).

23. While the race difference (i.e., higher delinquency among whites than nonwhites) looks opposite to what previous researchers often report, recall that this study focuses on general delinquency, which includes less serious offenses, for a national representative sample, for which other researchers report similar findings: "Blacks have higher prevalence rates for the more serious offenses . . ., but whites have higher prevalence rates for the *less serious offenses* and for *general delinquency*." (Elliott et al., 1989:32, italics added). In addition, the nonwhite category includes a small proportion of Asian-American adolescents, whose delinquency tends to be lower than their white counterparts' (Jang, 1998).

Table 4. Estimated Models of Attachment to Parents, Commitment to School, Association with Delinquent Peers, and Delinquency

	Attachment to Parents				Commitment to School				Association with Delinquent Peers			
	Total Effect		Direct Effect		Total Effect		Direct Effect		Total Effect		Direct Effect	
Fixed Effect	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio
Intercept, $\gamma_{0,0}$	.982	10.206	.912	9.376	.975	10.137	.915	9.405	.912	9.395	.916	9.411
Male, $\gamma_{0,1}$	.084	8.716	.068	7.385	.079	8.130	.070	7.523	.074	7.812	.068	7.288
White, $\gamma_{0,2}$	.051	3.880	.046	3.688	.051	3.928	.046	3.686	.046	3.578	.043	3.416
Underclass, $\gamma_{0,3}$	.071	4.965	.063	4.612	.069	4.833	.064	4.689	.064	4.633	.061	4.425
Intact Family, $\gamma_{0,4}$	−.036	−3.086	−.030	−2.692	−.036	−3.058	−.030	−2.719	−.034	−2.997	−.030	−2.695
Number of Children, $\gamma_{0,5}$	.000	.044	−.002	−.483	−.000	−.176	−.001	−.452	−.001	−.279	−.001	−.390
Cohort 12, $\gamma_{0,6}$	−.025	−.229	.004	.032	−.022	−.206	.000	.003	.023	.212	.022	.199
Cohort 13, $\gamma_{0,7}$	.042	.428	.074	.751	.054	.545	.071	.716	.089	.904	.094	.945
Cohort 14, $\gamma_{0,8}$	.132	1.384	.166	1.718	.145	1.514	.162	1.680	.179	1.863	.185	1.923
Cohort 15, $\gamma_{0,9}$	.159	1.662	.188	1.954	.173	1.810	.185	1.914	.207	2.158	.208	2.163
Cohort 16, $\gamma_{0,10}$	.165	1.721	.198	2.055	.183	1.915	.195	2.023	.217	2.261	.220	2.285
Cohort 17, $\gamma_{0,11}$	.088	.916	.118	1.217	.099	1.027	.114	1.174	.144	1.484	.147	1.510
Age, $\gamma_{1,0}$	−.028	−.639	−.044	−.994	−.034	−.767	−.043	−.961	−.020	−.460	−.027	−.603
Cohort 12, $\gamma_{1,1}$	−.039	−.712	−.025	−.451	−.038	−.695	−.026	−.467	−.016	−.295	−.016	−.297
Cohort 13, $\gamma_{1,2}$	−.032	−.637	−.017	−.345	−.030	−.598	−.019	−.387	−.012	−.248	−.009	−.176
Cohort 14, $\gamma_{1,3}$	−.015	−.320	.002	.043	−.012	−.261	−.000	−.005	.007	.159	.012	.249
Cohort 15, $\gamma_{1,4}$	.006	.129	.025	.548	.010	.222	.023	.504	.026	.587	.032	.723
Cohort 16, $\gamma_{1,5}$	.060	1.353	.078	1.732	.067	1.492	.076	1.686	.077	1.723	.084	1.855
Cohort 17, $\gamma_{1,6}$	.120	2.506	.141	2.905	.134	2.798	.141	2.896	.134	2.776	.142	2.944
Age^2, $\gamma_{2,0}$	−.005	−1.040	−.007	−1.388	−.006	−1.184	−.007	−1.371	−.003	−.676	−.004	−.832
Cohort 12, $\gamma_{2,1}$	−.007	−1.000	−.005	−.782	−.007	−.994	−.005	−.780	−.004	−.627	−.004	−.653
Cohort 13, $\gamma_{2,2}$	−.008	−1.198	−.007	−1.029	−.008	−1.248	−.007	−1.069	−.007	−.969	−.006	−.914
Cohort 14, $\gamma_{2,3}$	−.013	−1.869	−.012	−1.626	−.014	−1.936	−.012	−1.677	−.011	−1.521	−.010	−1.465
Cohort 15, $\gamma_{2,4}$	−.011	−1.530	−.008	−1.191	−.011	−1.616	−.009	−.414	−.009	−1.299	−.008	−1.128
Cohort 16, $\gamma_{2,5}$	−.023	−3.239	−.022	−2.969	−.024	−3.384	−.022	−3.083	−.021	−2.929	−.021	−2.896
Cohort 17, $\gamma_{2,6}$	−.026	−3.362	−.025	−3.180	−.028	−3.661	−.026	−3.325	−.023	−3.003	−.023	−2.996
XI^a, $\gamma_{3,0}$	−.011	−4.711	−.008	−3.308	−.012	−5.858	−.008	−3.914	.177	4.926	.153	4.226

	Attachment to Parents				Commitment to School				Association with Delinquent Peers			
	Total Effect		Direct Effect		Total Effect		Direct Effect		Total Effect		Direct Effect	
Fixed Effect	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio	Coeff.	*t* Ratio
Age x *X1*, $\gamma_{4,0}$	.002	1.315	.001	1.048	.002	1.522	.001	1.217	−.115	−6.009	−.113	−5.874
Age^2 x *X1*, $\gamma_{5,0}$	.000	1.449	.000	1.207	.001	2.411	.001	2.197	−.017	−4.151	−.016	−3.946
Suburban, $\gamma_{6,0}$	.039	3.886	.038	3.960	.040	4.046	.038	3.929	.037	3.757	.037	3.848
Urban, $\gamma_{7,0}$	.046	3.860	.040	3.520	.046	3.939	.041	3.563	.038	3.301	.038	3.342
X2[a], $\gamma_{8,0}$			−.007	−4.376			−.009	−4.528			−.007	−3.790
X3[a], $\gamma_{9,0}$			.230	7.936			.230	7.908			−.007	−4.401

Multiparameter Test[b]	χ^2	D.F.	*p* Value	χ^2	D.F.	*p* Value	χ^2	D.F.	*p* Value	χ^2	D.F.	*p* Value	χ^2	D.F.	*p* Value	χ^2	D.F.	*p* Value
Intercept, $\beta_{0,i}$ (1)	26.098	5	.000	27.766	5	.000	29.583	5	.000	27.701	5	.000	29.144	5	.000	29.181	5	.000
Growth Rate, $\beta_{1,i}$ (2)	41.218	5	.000	41.878	5	.000	44.788	5	.000	41.691	5	.000	37.220	5	.000	39.018	5	.000
Curvature, $\beta_{2,i}$ (3)	11.546	5	.041	9.869	5	.078	12.694	5	.026	10.691	5	.057	9.866	5	.078	9.539	5	.088

Random Effect	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2	Variance Comp.	D.F.	χ^2
Intercept, $u_{0,i}$	.052	1531	4525*	.046	1531	4142*	.050	1531	4464*	.045	1531	4119*	.050	1531	4425*	.048	1531	4249*
Age, $u_{1,i}$	.003	1536	1935*	.003	1536	1935*	.003	1536	1951*	.003	1536	1939*	.003	1536	1934*	.003	1536	1927*
Age^2, $u_{2,i}$	.000	1536	1704*	.000	1536	1709*	.000	1536	1718*	.000	1536	1711*	.000	1536	1714*	.000	1536	1709*
Level-1 Effect, $r_{i,t}$	.022			.023			.022			.023			.022			.023		

[a] The variables *X1*, *X2*, and *X3* refer to the key predictor of delinquency in each model as follows:

	Attachment to Parents Model	Commitment to School Model	Association with Delinquent Peers Model
X1	Attachment to Parents	Commitment to School	Association with Delinquent Peers
X2	Commitment to School	Attachment to Parents	Attachment to Parents
X3	Association with Delinquent Peers	Association with Delinquent Peers	Commitment to School

[b] The null hypotheses (H_0) being tested are (1) $\gamma_{0,6} = \gamma_{0,7} = \gamma_{0,8} = \gamma_{0,9} = \gamma_{0,10} = \gamma_{0,11} = 0$; (2) $\gamma_{1,1} = \gamma_{1,2} = \gamma_{1,3} = \gamma_{1,4} = \gamma_{1,5} = \gamma_{1,6} = 0$; and (3) $\gamma_{2,1} = \gamma_{2,2} = \gamma_{2,3} = \gamma_{2,4} = \gamma_{2,5} = \gamma_{2,6} = 0$.
* $p < .05$.

and .046, χ^2 = 4142, d.f. = 1531, $p < .05$ for the attachment-to-parents model). This indicates a need to search for individual-level variables, other than the structural background variables included in the present model, that would help further account for the remaining variation in the intercept.[24]

AGE EFFECTS ON DELINQUENCY

The multiparameter tests indicate that the effects of the linear term of age on delinquency (i.e., growth rate, $\beta_{1,0}$) significantly interact with cohort in all models, but the age-cohort interaction for curvature (i.e., $\beta_{2,0}$) is found to be significant only in the total-effect models of attachment to parents (χ^2 = 11.546, d.f. = 5, p = .041) and commitment to school (χ^2 = 12.694, d.f. = 5, p = .026). A key difference between these two models and the others in terms of model specification is whether the variable of association with delinquent peers is included in the model, which might suggest that a significant proportion of age-cohort interaction could be attributed to cohort differences in association with delinquent peers.[25] On the other hand, residual variances of the age variables' random slopes remain significant across all models (see the second and third rows of the random-effect panel), which indicates that the age effects on delinquency significantly vary across individuals.[26]

To test the developmental hypotheses of the age-varying effects of family, school, and delinquent peers on delinquency, I focus now on the three fixed slopes associated with each of the three key predictors of delinquency and their interactions with the age variables (see the boxed area in Table 4 and Figure 2).

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24. For example, recent studies based on developmental and life-course perspectives identify certain personality traits (e.g., hyperactivity and impulsivity) and relatively stable emotional characteristics (e.g., temperament) as risk factors that have significant effects on delinquency independently of sociodemographic and contextual variables (Loeber and Farrington, 1998; Sampson and Laub, 1993).

25. In another set of findings (not presented here), the effects of the age quadratic term on delinquency tend to be explained by the delinquent association variable, specifically, its interaction with the age variables (results are available upon request). That is, the curvilinear relationship between age and peer influence on delinquency significantly accounts for the age-delinquency curve. Warr (1993a) reports a similar finding based on his between-individual analysis of pooled data from the same five waves of the NYS using the same measure of peer influence as this study employs.

26. The (residual) variances remain significant even after the structural variables (i.e., sex, race, class, intact family, and family size) are added to the level-2 equations of the age variables (i.e., Equation 9b, where k = 1, 2). However, cross-level interactions involving the age and structural variables are found to be nonsignificant, which indicates that the age effect on delinquency does not significantly vary across individuals in terms of their sociodemographic characteristics. Results are available upon request.

DEVELOPMENTAL HYPOTHESES

First, the total- and direct-effect models of family influence show that the main effects of attachment to parents on delinquency remain significant throughout the whole period of adolescence (–.011 and –.008, respectively). Before the age-cohort interaction is controlled for, the total (but not direct) effects of attachment to parents on delinquency is age-variant, but following a quadratic pattern, not a monotonically declining pattern as hypothesized (not presented in the table).[27] However, once cohort effects on age are partialled out, neither the total (.002 and .000) nor direct (.001 and .000) effects of attachment to parents on delinquency significantly vary across ages, as shown in Figure 2.[28] This confirms that it was important to control for age-cohort interaction in the analysis.

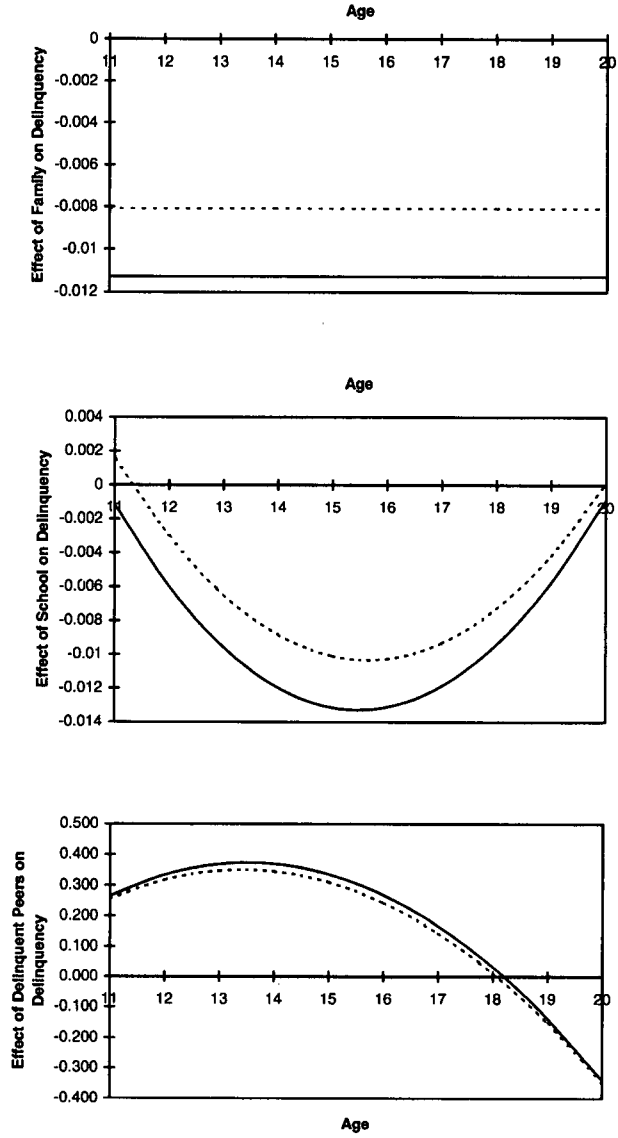
Second, estimated models of commitment to school show that the developmental hypothesis of age-varying school effects on delinquency receives empirical support in both models. Specifically, the negative effects (both total and direct) of commitment to school become larger in magnitude from early to middle adolescence until they become strongest at the age of mid-15 (15.5 and 15.6, respectively) and then decrease in magnitude, as shown in Figure 2.

Last, results from estimating the models of association with delinquent peers also support the age-variance hypothesis of the variable's effect on delinquency. That is, the total and direct effects of delinquent association increase from early adolescence until they reach a peak at the age of mid-13 (13.5 and 13.4, respectively) and then decline. While the impact of delinquent peers on delinquency tends to peak somewhat earlier than hypothesized, specifically during the period of transition from early to

27. In a preliminary analysis I estimated the total and direct effects of attachment to parents on delinquency by focusing on between-individual instead of within-individual differences over time. Specifically, using the ordinary least squares regression method, I estimated the effects repeatedly by analyzing 28 sets of data (i.e., four sets of two adjacent waves x seven birth cohorts), which generated two sets of 28 data points of unstandardized regression coefficients. Each set of the 28 regression coefficients constitutes the value of a new variable that measures different levels of total or direct effects of attachment to parents on delinquency at different ages (11 through 20). When this new variable was regressed on age to test the developmental hypothesis, the direct as well as total effects of attachment to parents on delinquency increased from early to middle adolescence and then decreased after reaching a peak. This finding suggests that between- and within-individual analyses do not always generate the same results because they are different approaches to the study of human development. On the other hand, the age-varying effects of school and delinquent peers on delinquency were consistent with what is presented below.

28. The diagram of the age-varying family influence presented in Figure 2 was drawn by treating the two interaction terms' nonsignificant coefficients as zero coefficients even though a nonsignificant effect does not necessarily mean no effect at all.

Figure 2 Effects of Family, School, and Delinquent Peers on Delinquency During Adolescence



NOTE: Solid lines represent total effects; dotted lines represent direct effects.

middle adolescence, its overall pattern is consistent with the hypothesis, including the already significant peer influence at early ages of adolescence, as Figure 2 shows.[29]

DISCUSSION AND CONCLUSION

Prior research on delinquency provides ample evidence of the importance of an adolescent's relations with family, school, and peers in explaining his or her behavioral patterns. But beyond speculative and suggestive discussion, little is known about whether the etiological importance remains constant or systematically varies throughout the adolescent years. Criminological research on this question has been long overdue despite its potential policy relevance as well as theoretical and methodological implications. In this study I intended to answer the research question directly by testing developmental hypotheses about the age-varying effects of the three key social domains of adolescence on delinquency, drawn from Thornberry's (1987) interactional theory.

First, the hypothesis about monotonically declining effects of attachment to parents on delinquency fails to receive empirical support. However, direct as well as total effects of family on delinquency were found to remain significant throughout the period of adolescence, which is inconsistent with what previous studies that analyzed the NYS data tend to report: that is, family influence on delinquency is relatively weak and/or indirect and becomes nonsignificant once school and peer variables are controlled for (e.g., Agnew, 1991; Elliott et al., 1985, 1989; Warr, 1993b). Given that the same data, though not necessarily same waves of data, were analyzed, the observed inconsistency can be attributed at least partly to different analytic approaches taken in this and previous studies, that is, within-individual and between-individual analysis. Since within- rather than between-individual analysis is more consistent with Thornberry's (1987) perspective (Sampson and Laub, 1993), that is, "person approach" (Magnusson, 1988), I argue that this study's within-individual analysis is more appropriate for testing the developmental hypotheses derived from his interactional theory than previous studies' between-individual analysis.

Second, my findings support the hypothesis about the age-varying

29. After the age of 18, both the total and direct effects of delinquent association on delinquency become negative. This counterintuitive finding might be suspect given that the average trajectory of delinquent peer influence at the ages of 19 and 20 is based on a relatively small proportion of total respondents' trajectories (see Table 1). Alternatively, the finding might indicate that a significant proportion of respondents who had had delinquent peers throughout adolescence were turning conventional as they were preparing for lives as adults, but not necessarily immediately disassociating themselves from their long-time friends, at least during their transition from adolescence to early adulthood.

effects of commitment to school and association with delinquent peers on delinquency. Specifically, as hypothesized, the total and direct effects of school tend to increase between early and middle adolescence and then decline as the adolescent moves toward his or her later adolescence and early adulthood. While it reached a peak somewhat earlier than expected, peer influence was also found to be age-variant, following a curvilinear pattern. These curvilinear patterns can be understood as a combination of two main features of adolescent life: developmental challenges and delinquent activity.

According to research on adolescent development, biopsychosocial changes begin to increase in early adolescence (Petersen and Taylor, 1980; Petersen et al., 1992; Steinberg and Silverberg, 1986). While those changes continue until adolescents leave their parental home, their struggle to adjust to their developmentally interim status (i.e., between child and adult status) and to respond to changing and increasing expectations from society is likely to become most intense during middle adolescence, before they learn how they should express their needs and desire for independence and autonomy. This developmental pressure during middle adolescence will become even more stressful to adolescents if they find no proper social support from immediate surroundings. In this sense, middle adolescence represents a critical period of adolescent development.

From a developmental perspective, problem behavior, including delinquency, is a result of inadequate coping with the challenges of the developmental transition taking place in key domains of adolescence (Petersen and Ebata, 1987). In fact, middle adolescence is the period of maximum delinquent activity, whether one examines self-report or official data (Elliott et al., 1989; Gottfredson and Hirschi, 1990; Greenberg, 1981; Hirschi, 1969). However, what is more important for this discussion is the fact that the age-crime curve primarily reflects changes in prevalence rather than incidence of delinquent involvement (Farrington, 1986a; see also Jang and Krohn, 1995, for sex-specific analysis). That is, middle adolescence is the period of time when the largest proportion of adolescents engage in delinquent activities, and thus, an individual adolescent is likely to face perhaps the greatest temptation and pressure toward deviance in his or her adolescent years.

As Thornberry (1987) argues, school and peers come to play a crucial role during middle adolescence in leading youths to properly or improperly respond to and cope with developmental pressures because the door to delinquent activities is most widely open to them. This, however, does not mean that school and peers play an insignificant role during early and later adolescence, as this study has shown. The key social domains are expected to have significant impact on adolescent behavior to the extent to which they function as networks of social support to help the adolescent

cope with various developmental challenges that continue to exist throughout adolescence. But the influence of school and peers on adolescent behavior is likely to be most salient during middle adolescence, when cognitive, emotional, and instrumental support and guidance are most needed as the adolescent struggles with maximum pressure from bio-psychosocial changes to internalize (e.g., depression) or externalize (e.g., delinquency and drug use) their growing-up pains (Petersen et al., 1992). It is in this substage of adolescence when the relative importance of school and peers is crystallized because they not only counteract and compete but also collaborate with one another (Warr, 1993a, 1993b; Youniss and Smollar, 1985).

While the transitions from childhood to adolescence and from adolescence to adulthood are not free of developmental pressures, youth are expected to be less vulnerable to and better protected from pro-delinquent influence during those transitional periods than during middle adolescence. Specifically, youth in transition from childhood to adolescence are likely to still remain under the control of conventional authorities (e.g., teachers) and to lack a network of pro-delinquent friends whose influence and social support are strong enough to override conventional authorities. On the other hand, most, though not all, older adolescents in preparation of early adulthood are increasingly pressured to become conventional again as new social roles and expectations are created and new networks of attachment and commitment to conventional relationships (e.g., marriage relations) and conventional activities (e.g., employment, attending college, and military service) emerge (Sampson and Laub, 1993; Thornberry, 1987). Hence, the influence of school and delinquent peers peak during the middle stage of adolescence.

These findings have theoretical, methodological, and policy implications. First, the age-varying effects of school and peers on delinquency suggest that existing theories of delinquency and their empirical tests should be reevaluated with respect to their implicit or unintended assumptions about the age-invariant effects of their key variables on delinquency from a developmental perspective. Second, unlike previous studies that are based on between-individual differences, this study focused on within-individual differences over time. These differences cannot be examined with cross-sectional data, and thus, this study emphasizes the importance and necessity of longitudinal research in the etiology of delinquency. Agreeing with Sampson and Laub (1992, 1993), who consider Gottfredson and Hirschi's (1990) criticisms of longitudinal research as pointing to the ineffective and limited ways longitudinal data have been used, this study also illustrates how existing longitudinal data can be effectively reused by applying a multilevel modeling approach to analyze important but underutilized panel data. Finally, while people tend to perceive parents as

likely losers in the competition with their children's friends over influencing adolescent behavior, the direct as well as total effects of attachment to parents on delinquency were found to be consistently significant, independent of peer influence, throughout the period of adolescence. Thus, this study suggests that delinquency intervention and prevention policies focus on strengthening family and parental influence as well as utilizing school environment and peer pressure on adolescent behavior.

In conclusion, this study contributes to the understanding of delinquent behavior by demonstrating the importance of developmental perspectives in the etiology of delinquency. This is the first attempt to examine developmental issues raised by previous researchers but never directly addressed: that is, whether the effects of family, school, and delinquent peers on delinquent behavior are age-variant, and if so, what patterns those age-varying effects follow during the most crime-prone periods of adolescence.

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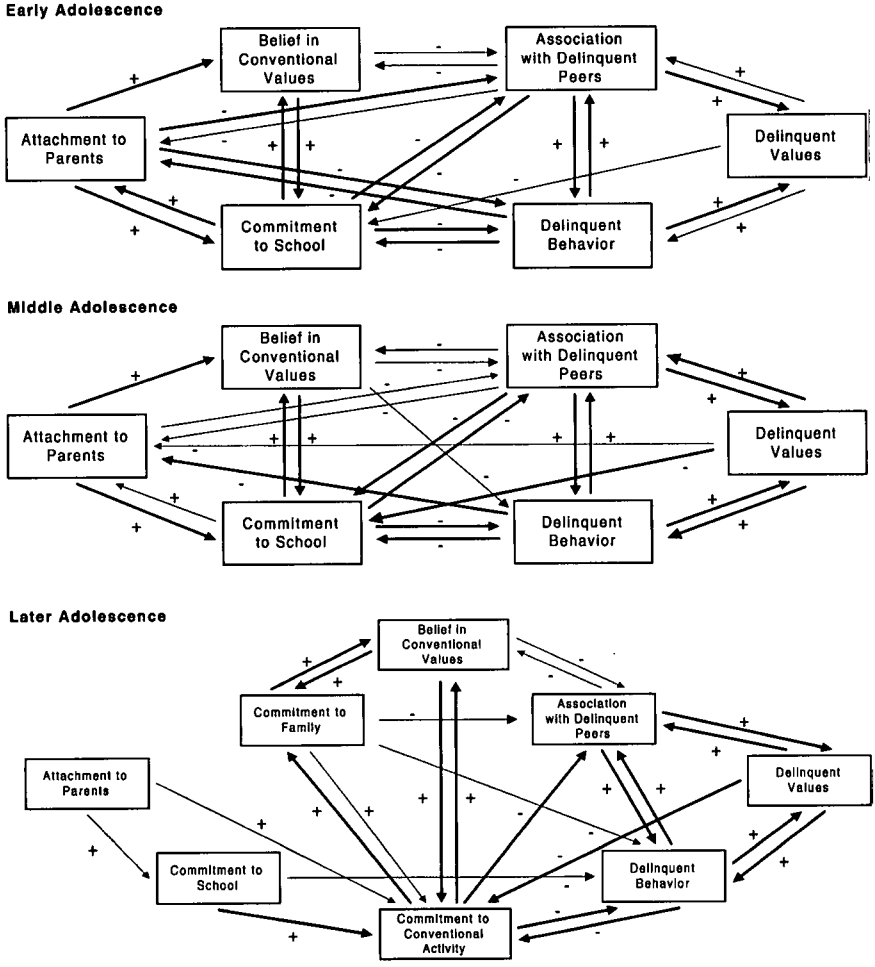
Sung Joon Jang is Assistant Professor of Sociology at The Ohio State University. His research focuses on the effects of family, school, peers, and community on adolescent deviance. His latest research explores a developmental approach to the explanation of the age-crime curve and the etiology of delinquency based on multilevel modeling. It also examines race/ethnic differences in delinquency and drug use with an emphasis on Asian American adolescents. He is currently collaborating with Byron R. Johnson, David B. Larson, and Spencer De Li on a series of studies investigating the effects of individual religiosity on adolescent deviance.

Appendix 1. Thornberry's (1987) Interactional Model of Delinquent Involvement at Early, Middle, and Later Adolescence



NOTE: Thick lines represent stronger effects; thin lines represent weaker effects.

Appendix 2. Items Used for Analysis

Constructs, Dimensions, and Description of Items	Factor Loadings				Reliability Coefficients (α)			
	W1	W2	W3	W4	W1	W2	W3	W4
Attachment to Parents								
Family Involvement								
"On the average, how many ___ during the school week have you spent talking, working, or playing with your family?" (0 through 5)								
(a) afternoons . . . from the end of school or work to dinner	.69	.72	.71	.70	.69	.72	.74	.74
(b) evenings . . . from dinnertime to bedtime	.77	.80	.80	.82				
"On the weekends, how much time have you generally spent talking, working, or playing with your family?" (1=very little; 2=not too much; 3=some; 4=quite a bit; 5=a great deal)	.52	.55	.58	.57				
Family Attachment								
"How much do you agree or disagree with (that) . . .?" (1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree)								
(a) I feel like an outsider with family	.63	.66	.74	.75	.73	.76	.81	.84
(b) My family is willing to listen if I have a problem	.58	.64	.64	.78				
(c) Sometimes I feel lonely when I'm with my family	.43	.40	.47	.53				
(d) I feel close to my family	.68	.74	.82	.79				
(e) My family doesn't take much interest in my problems	.65	.70	.74	.73				
Commitment to School								
Involvement in Homework								
"On the average, how many ___ during the school week have you spent studying?" (0 through 5)								
(a) afternoons . . . from the end of school or work to dinner	.44	.51	.59	.64	.52	.57	.69	.71
(b) evenings . . . from dinnertime to bedtime	.51	.55	.70	.70				
"On the weekends, how much time have you generally spent studying?" (1=very little; 2=not too much; 3=some; 4=quite a bit; 5=a great deal)	.60	.60	.67	.68				

Constructs, Dimensions, and Description of Items	Factor Loadings				Reliability Coefficients (α)			
	W1	W2	W3	W4	W1	W2	W3	W4
Attachment to School/Teachers								
"How much do you agree or disagree with (that) . . .?" (1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree)								
(a) Teachers don't call on me in class, even when I raise my hand	.47	.48	.46	.58	.64	.68	.66	.69
(b) I often feel like nobody at school cares about me	.55	.68	.64	.54				
(c) Teachers don't ask me to work on special classroom projects	.48	.45	.39	.64				
(d) I don't feel as if I really belong at school	.53	.61	.62	.50				
(e) Even though there are lots of kids around, I often feel lonely at school	.53	.51	.55	.53				
School Performance								
"What is your grade point average?" (1=mostly F's; 2=mostly D's; 3=mostly C's; 4=mostly B's; 5=mostly A's)								
Association with Delinquent Peers								
"During the last year how many of (your close friends) have . . .?" (1=none of them; 2=very few of them; 3=some of them; 4=most of them; 5=all of them)								
Personal Offense	.39	.41	.49	.62	.60	.57	.67	.72
(a) hit or threatened to hit someone without any reason								
Property Offense	.99	.99	.92	.87				
(a) stolen something worth less than $5								
(b) stolen something worth more than $50								
(c) broken into vehicle or building to steal something								
Illegal-Service Offense	.44	.37	.53	.58				
(a) sold hard drugs such as heroin, cocaine, and LSD								
Delinquency								
"How (often) in the last year have you . . .?" (1=never; 2=once or twice a year; 3=once every 2–3 months; 4=once a month; 5=once every 2–3 weeks; 6=once a week; 7=two to three times a week; 8=once a day; 9=two to three times a day)								
Felony Assault								
(a) attacked someone with the idea of seriously hurting or killing him/her								

Constructs, Dimensions, and Description of Items	Factor Loadings				Reliability Coefficients (α)			
	W1	W2	W3	W4	W1	W2	W3	W4
(b) had (tried to have) sexual relations with someone against their will								
(c) been involved in gang fights								
Minor Assault								
(a) hit (or threatened to hit) a teacher or other adult at school								
(b) hit (or threatened to hit) one of your parents								
(c) hit (or threatened to hit) other students								
Robbery								
(a) used force (strong-arm methods) to get money or things from other students								
(b) used force (strong-arm methods) to get money or things from a teacher or other adults at school								
(c) used force (strong-arm methods) to get money or things from other people (not students or teachers)								
Felony Theft								
(a) stolen (or tried to steal) a motor vehicle, such as a car or motorcycle								
(b) stolen (or tried to steal) something worth more than $50								
(c) broken into a building or vehicle (or tried to break in) to steal something or just to look around								
(d) knowingly bought, sold or held stolen goods (or tried to do any of these things)								
Minor Theft								
(a) stolen (or tried to steal) things worth $5 or less								
(b) stolen (or tried to steal) things worth between $5 and $50								
(c) taken a vehicle for a ride (drive) without the owner's permission								
Illegal Services								
(a) been paid for having sexual relations with someone								
(b) sold marijuana or hashish ("pot," "grass," "hash")								
(c) sold hard drugs such as heroin, cocaine, and LSD								

Constructs, Dimensions, and Description of Items	Factor Loadings				Reliability Coefficients (α)			
	W1	W2	W3	W4	W1	W2	W3	W4
Public Disorder/Status Offenses								
(a) been loud, rowdy, or unruly in a public place (disorderly conduct)								
(b) run away from home								
(c) had sexual intercourse with a person of the opposite sex other than your wife/husband								