Developmental trajectories of boys' delinquent group membership and facilitation of violent behaviors during adolescence

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Abstract
Being part of a delinquent group has been shown to facilitate the expression of an individual's own delinquent propensities. However, this facilitation effect has not been investigated from a developmental perspective within a population heterogeneity model. Using a semiparametric mixture model with data from the Montreal Longitudinal Experimental Study, this article addresses important issues in the developmental trends of membership to delinquent groups. We explore how the rate of violent behaviors follows delinquent peer group trajectories and investigate a differential facilitation effect of delinquent peers on violence across multiple developmental pathways. Results suggest that 25% of males followed a childhood or an adolescence delinquent group affiliation trajectory. These two groups account for most of the violent acts assessed during adolescence. In addition, the rate of violent behaviors follows these developmental trajectories. Controlling for these delinquent group trajectories, we also found that being involved in a delinquent group at any specific time during adolescence is associated with an increased rate of violent behaviors, and that leaving these groups results in a decrease in violent behaviors. This facilitation effect appears homogeneous over time and across developmental trajectories. Results are discussed from a social interactional perspective.

A growing body of evidence suggests that involvement in a delinquent peer group, including its more extreme form, gang membership, facilitates or enhances antisocial behaviors (Bjerregard & Lizotte, 1995; Dishion, Patterson, & Griesler, 1994; Patterson, 1993; Patterson, Dishion, & Yoerger, 2000; Patterson & Yoerger, 1997; Thornberry, 1998; Thornberry, Krohn, Lizotte, & Chard–Wierschem, 1993; Vitaro, Brengden, & Tremblay, 2000; Vitaro, Tremblay, Kerr, Pagani, & Bukowski, 1997; Warr, 2002) and criminal acts such as aggravated assaults and homicides (see Howell, 1999, for a complete review on gang membership and homicides). Although recent studies suggest a facilitation effect, much remains to be done to describe the various developmental aspects of affiliation to delinquent groups and its relation to violent behaviors. This article studies the link between delinquent groups and violence within a developmental framework. The purpose is three-fold: to contribute to the body of evidence regarding a violence facilitation effect of delinquent peers; to present and apply a novel approach for distinguishing a facilitation ef-

fect from a selection effect; and, most important, to contribute to developmental theories suggesting that the facilitation effect may vary based on timing, duration, and recency of affiliation with delinquent peers.

From the earliest studies (Shaw & McKay, 1931; Short, 1957; Trasher, 1927) to the most recent (Battin, Hill, Abbott, Catalano, & Hawkins, 1998; Brengden, Vitaro, & Bukowski, 2000; Patterson & Yoerger, 1997; Thornberry, 1998; Thornberry et al., 1993; Vitaro et al., 2000), a moderate to strong correlation has been found between peer delinquency and individual delinquent behaviors. Although there is a consensus on the reality of this empirical association, the debate surrounding its interpretation has led to two contrasting views. Glueck and Glueck's (1950) use of the expression "birds of a feather flock together" illustrates one perspective. This adage suggests a *selection effect* whereby disruptive individuals will choose or self-select themselves into deviant groups. Selection theories are often described as population heterogeneity processes, meaning that individual differences, which are established early in life, will make some children more likely than others to commit delinquent acts as they grow older. Gottefredson and Hirschi's (1990) self-control theory is a good example of this population heterogeneity process, wherein early acquisition of self-control predicts both future delinquent behaviors and affiliation to deviant peers. A second theoretical framework based on state dependence processes is consistent with Sutherland's (1939) socialization theory, which predicts that interaction with deviant peers will facilitate the expression of antisocial behaviors through self-definition as a delinquent. In a similar process, delinquent behaviors at one point in time can modify individual propensity for crime by worsening life circumstances. For example, "normal" peers may reject already aggressive children, who in turn will affiliate with disruptive or aggressive peers, thus making them more inclined to adopt aggressive behaviors in the future. For an extensive review of population heterogeneity and state dependence interpretation of developmental processes, see Nagin and Paternoster (1991, 2000). For a more spe-

cific review regarding peers and delinquency, see Thornberry and Krohn (1997) or Hartup (1999). Recent reviews suggest that the most promising theories are those that combine divergent approaches. Advocates of social interactional theories have tried to do this by integrating both selection and facilitation effects in their developmental models (Dishion, Patterson, Stoolmiller, & Skinner, 1991; Matsueda & Heimer, 1997; Patterson & Yoerger, 1997; Thornberry, 1987).

In developmental research, many have tried to explain how changes in criminal behaviors evolve across the life span. Researchers in this field have argued that nondevelopmental perspectives fail to address important issues such as prevalence, age of onset of offending, duration of criminal careers, and escalation–deescalation in frequency and seriousness of delinquent behaviors (Thornberry, 1997). Recent developmental studies conclude that when early and stable aggressive behaviors appear during childhood, they can predict violent criminal behaviors during adolescence and adulthood. In contrast, when antisocial behaviors appear during adolescence, they tend to be generally more transient and less violent (Farrington & Hawkins, 1991; Moffitt, 1993; Patterson, DeBaryshe, & Ramsey, 1989; Patterson & Yoerger, 1997; Simons, Wu, Conger, & Lorenz, 1994).

Although onset of disruptive behaviors is a significant breakthrough in understanding the stability of delinquent behaviors, it also seems important to clarify what role timing of affiliation with delinquent friends plays in the frequency and stability of violent behaviors throughout adolescence. This issue becomes even more prominent as findings suggest that social behaviors, such as affiliation with delinquent peers and delinquency, vary as a function of age. In terms of prevalence, association with delinquent groups tends to increase during early to mid-adolescence and declines after age 15 or 16 (Elliott & Menard, 1996; Warr, 1993). These changes in pattern of peer affiliation follow delinquency trends often described as the age–crime curve (Blumstein, Cohen, Roth & Visher, 1986; Farrington, 1986). Nevertheless, although both curves vary similarly, we cannot attribute these vari-

ations to either a facilitation effect or a selection effect.

As these results show, a key inferential issue has yet to be addressed: distinguishing a facilitation effect, from a selection effect, of delinquent peers (Rutter, Giller, & Hagell, 1998; Thornberry, 1998; Thornberry et al., 1993, 1997). Some empirical findings suggest a facilitation effect of delinquent peers on antisocial behavior. Through observational studies, Buelher, Patterson, and Furniss (1966), Dishion et al. (1994), and Patterson et al. (2000) have shown that delinquent peers seem to reinforce delinquent behaviors by highly approving them, therefore increasing their occurrence. In addition, random assignment studies have also demonstrated that reducing contact with delinquent peers resulted in long-term reductions in delinquency, police arrest, and substance use (Chamberlain & Reid, 1998; Vitaro, Brengden, & Tremblay, 2001).

Few longitudinal studies have considered either developmental careers or stability of delinquent group membership and its impact on facilitating delinquency. In a pioneering study, Warr (1993) considers the effects of duration and recency of affiliation with delinquent peers on delinquent behaviors. Warr predicts that the longer the exposure to deviant friends, the greater frequency of delinquent behaviors. Specifically, he argues that a temporary exposure to deviant peers closely preceding the assessment can increase the frequency of antisocial behaviors. Using regression analyses Warr (1993) found evidence of both duration and recency effects on drug use and nonviolent delinquent behaviors at age 17. Brengden et al. (2000), Thornberry (1998), and Thornberry et al. (1993) have also investigated the duration and recency effects while controlling for childhood characteristics (delinquent values and behaviors). By analyzing transitions from a dichotomous state (being part of a delinquent group or not) at time t to a same or different state at time $t + 1$ and variations in frequency of delinquent behaviors, these two studies suggest that both facilitation and selection processes are at work. According to Thornberry (1998), the facilitation effect predominates. He observed that the frequency of crimes against people doubled when

adolescents were part of a criminal gang as opposed to when they were not. He also showed, using regression analysis, that a facilitation effect was maintained while controlling for prior violent–aggressive behaviors.

Work to date has not considered how developmental pathways of membership to delinquent groups could contribute to increasing violent behaviors at any given age. In addition, these studies did not consider that a facilitation effect could be subject to variations across different developmental trajectories. Moffitt (1993), and Patterson et al. (1997) are among the few who have developed explicit theories relating age of onset (early vs. late) of problem behaviors and association to deviant peers. Both have described a different influence of deviant peers based on the age of onset of disruptive behaviors. From Moffitt's point of view, early onset individuals (life-course persistent type), who are more impulsive in early childhood, will be less susceptible to peer influences because neurological deficits or other time stable characteristics (poor relationships with parents) not peers drive their behaviors. On the other hand, the late onsets (referred to as adolescent-limited type) will be more sensitive to their peers. As they join delinquent peer groups, these adolescent-limited individuals will mimic early onsets' behaviors in order to gain more privileges and have access to their resources (i.e., adult life-styles, more power, and more sexual partners). Although both authors suggest that late onsets will be more sensitive to their peers' influence, Patterson et al. (1997) also argue that peers will influence aggressive antisocial behaviors in the early onset group through intensive behavioral conditioning.

Most research on peer influences has used regression procedures to test for facilitation effects. These methods may confound facilitation and selection effects because they are not generally designed to control for persistent unobserved individual differences. Here we use a group-based approach to define developmental trajectories of membership in delinquent groups. The trajectory groups capture long-term differences in behavior across distinctive clusters of individuals. Thus, trajectory group membership provides a statistical

basis to control for persistent unobserved individual differences that predispose individuals to follow a specific trajectory. A facilitation effect can then be assessed by measuring the impact on violent behavior of active involvement in delinquent groups or transitions from delinquent groups to nondelinquent groups conditional upon different developmental trajectories membership.

In summary, this study tries to contribute to developmental research by focusing on both stable and dynamic aspects of delinquent group membership with a new methodology. More specifically this study attempts to: (a) identify the different developmental trajectories of delinquent group membership; (b) estimate the proportion of adolescents following these different trajectories from ages 11 through 17; (c) track variations in rate of violent behaviors with delinquent group developmental trajectories; and (d) assess if being part of a delinquent group at any point in time will contribute to an increase in violent behaviors regardless of developmental pathways.

Method

Sample

Adolescent boys who participated in this research project were part of a longitudinal study that began in 1984. All males, from kindergarten classes in 53 schools of low socioeconomic areas of Montreal (Canada) were recruited. To control for cultural effects, the sample was reduced from 1,161 to 1,037 participants by creating a homogeneous French-speaking sample and eliminating subjects who refused to participate or could not be traced. Boys were assessed between ages 11 and 17 by responding to a self-report questionnaire. We kept 969 participants for the analyses because they had responded to the questionnaires at least for one assessment. From this subsample, 715 participants had data at the seven time points. Participants who left the study or had missing data did not significantly differ on delinquent peer involvement at age 11 compared to those who had complete data. This finding suggests that the delinquent peer involvement variable is missing at random,

which is important because the software used for the trajectory analysis accommodates missing data under the assumption that it is missing at random. When they were first assessed in kindergarten, 67% of the boys lived with both parents and 24% lived with their mothers only. The mean age of parents at birth of the child was 25.4 ($SD = 4.8$) for mothers and 28.4 ($SD = 5.6$) for fathers. The mean number of school years completed by the parents was 10.5 ($SD = 2.8$) for mothers and 10.7 ($SD = 3.2$) for fathers. Parents provided the information about their occupation. The Blishen, Carroll, and Moore (1987) scale for occupational prestige was used to score each parent's occupation on a continuous scale. The score is based on average income and level of education associated with occupations in Canada. The lowest score on this scale is 17.8 and is attributed to families who are on welfare or unemployment insurance. Approximately 13% of the families were in that condition. The mean score on the Canadian socioeconomic index for occupations for the whole sample was 38.87 ($SD = 14.54$). The socioeconomic status of the sample is slightly lower than the average score from a representative sample in the Province of Quebec (42.08; $SD = 12.09$).

Measures

Delinquent group membership. As part of the seven annual assessments from ages 11 to 17 years, participants were asked, "During the past 12 months, were you part of a group or a gang that did reprehensible acts?" Use of such a dichotomous item to measure delinquent group membership has a long tradition in criminological studies of gangs and delinquent peer effects (Howell, Egley, & Gleason 2000; National Youth Gang Center, in press; Spergel, 1990; Thornberry, 1998; Thornberry et al., 1993, Warr, 1993). We use the response to this question to test whether the state of being part of a delinquent group influences the frequency of violent behaviors. In terms of criterion validity, Thornberry (1998), Thornberry et al. (1993), and Warr (1993) found a moderate to strong association between gang membership or delinquent peer association

and measures of delinquency such as person offenses, property offenses, drug sales, and drug use. In data used for this study, participation in a delinquent group at age 11 is significantly correlated ($p < .001$) with self-reported measures of drug use ($r = .23$), theft ($r = .37$), vandalism ($r = .28$), and number of friends being arrested by the police ($r = .37$). It is also correlated with teachers' reports of physical aggression ($r = .18$) and opposition ($r = .18$) and with classmates' report of physical aggression ($r = .21$).

Self-reported violent behaviors. In the present study, we measured violence by creating an index based on the frequency during the past 12 months of seven self-reported behavior items that include threatening to attack someone, fistfighting, attacking someone innocent, gang fighting, throwing objects at people, carrying weapons, and using weapons. These items are all coded on a 4-point Likert scale ($0 = never$; $1 = once\ or\ twice$; $2 = sometimes$; $3 = often$) and were answered every year at ages 11–17. They are part of a more general antisocial behavior questionnaire (Tremblay, Pihl, Vitaro, & Dobkin, 1994). The internal consistency (Cronbach's alpha) for this subscale ranged between .72 and .81 ($M = .77$).

Analysis

The analysis proceeded in three stages. We first identified the best fitting trajectory model. We then examined whether self-reported violence, over time, followed delinquent group trajectories. Finally, we adapted Thornberry et al.'s (1993) initial facilitation test to investigate whether an individual's self-reported violence varied with actual affiliation with delinquent groups while controlling for trajectory group membership. Furthermore, within each trajectory, we investigated the impact of transitions from a delinquent group to a nondelinquent group and vice versa on self-reported violence.

In a first step, we used a group-based method described in work by Nagin and colleagues (Jones, Nagin, & Roeder, 2001; Nagin, 1999; Nagin & Land, 1993; Roeder, Lynch, & Nagin, 1999) to identify the developmental

trajectories of involvement in delinquent groups. By using finite mixtures of suitably defined probability distributions, the group-based approach for modeling developmental trajectories is intended to provide a flexible and easily applied method for identifying distinctive clusters of individual trajectories within the population and profiling the characteristics of individuals within these clusters. Thus, whereas the hierarchical and latent growth curves methodology models population variability in growth with multivariate continuous distribution functions, the group-based approach utilizes a multinomial modeling strategy. Technically, the group-based trajectory model is an example of a finite mixture model. Its parameters are estimated by maximum likelihood.

One valuable feature of the model is that it is easily adapted to accommodate different forms of data (i.e., binary, censored normal, and count data). In this analysis, a Bernoulli model was fitted to the data because the response variable, delinquent group membership or not, is binary. A polynomial relationship is used to link age to behavior.

A key issue in the application of a group-based model is making a determination of how many groups define the best fitting model. We have followed the lead of D'Unger, Land, McCall, and Nagin (1998) and use the Bayesian information criterion (BIC) as a basis for selecting the optimal model. Kass and Raftery (1995) and Raftery (1995) argue that BIC can be used for comparison of both nested and nonnested models under fairly general circumstances. When prior information on the correct model is limited, they recommend selection of the model with the maximum BIC (i.e., closest to zero).

In a second step, the mean frequency of the violent behavior scale for each delinquent group involvement trajectory was plotted at each time point and compared with that group's developmental progression into delinquent groups. Our aim was to examine whether the rate of violent behaviors tracks these trajectories. As previously discussed, we controlled for trajectory group membership to account for persistent unobserved individual differences that might contaminate our esti-

Table 1. *Bayesian information criterion BIC for selection of a Bernoulli model*

Model	K	Order	BIC	Probability
1	1	2	−2758.55	.00
2	2	2, 2	−2517.10	.00
3	3	2, 2, 2	−2522.21	.00
4	3	1, 2, 2	−2506.71	.97
5	4	2, 2, 2, 2	−2510.15	.03

Note: K, the number of groups. The order indicates whether the trajectory was fit with a constant (0), linear (1), or quadratic (2) function.

Table 2. *Average delinquent group affiliation assignment probability, conditional on assignment by maximum probability rule*

Probability Conditional on Group Membership	Assignment Group		
	Never	Adolescence	Childhood
Never	92%	5%	3%
Adolescence	16%	72%	12%
Childhood	6%	8%	86%
Total	100%	100%	100%

mates of the facilitation effect. We also investigated the effect of intraindividual change in delinquent group affiliation within each trajectory. We expected that transition from a nondelinquent group to a delinquent group would lead to an increase in violent behaviors (positive change) and that a transition from a delinquent group to a nondelinquent group would lead to a decrease in violent behaviors (negative change).

Results

In a first step, we identify the number and the shape of the developmental trajectories. Table 1 reports BIC scores for models with varying number of groups and of trajectory shapes within each group. Based on the BIC criterion, a three-group model of delinquent group affiliation was found to be the best fitting model. This model is defined by one trajectory following a simple linear function and two trajectories following quadratic functions of age.

One key output of the model, called the posterior probabilities of group membership, was central to the analyses reported here. For each individual in the sample, these probabilities estimate the probability of belonging to each trajectory group. For example, consider an individual who persistently reports involvement with a delinquent group. For this individual, the posterior probability estimate of his belonging to the "never" trajectory group would be near 0, whereas the estimate of his belonging to a chronic group would be high. Individuals were assigned to the group with the largest posterior probability estimate.

This is the group that best conforms to their observed behavior. Ideally, this probability for each individual should be near 1 for the assigned group and, conversely, near 0 for the rest. Table 2 reports the mean posterior assignment probabilities for the three trajectory groups. The average probabilities for the assigned groups are, respectively, 92, 72, and 86%, indicating a reasonably low classification error.

Figure 1 depicts the trajectories of the best fitting model. The greater majority of adolescents (74.4%) show stable, low probabilities of being part of a delinquent group during their teen years. We call them the "never" affiliation group. A second group, which we call the "adolescence" affiliation group (12.8%), begins with probabilities of affiliation at age 11 that are near zero but thereafter rise quickly to a peak of .67 at age 15. From then on, these probabilities begin declining. By the age of 17, the final period for which we have data, the predicted probability of delinquent group membership declines to .48. Finally, a third group characterized by individuals who affiliate early to delinquent groups was labeled the "childhood" affiliation group. This group begins with high probabilities of affiliation (.61) that slightly increase through age 14 (.70) and abruptly decrease thereafter.

In a second step, we examine whether trajectories of self-reported violence track trajectories of delinquent group affiliations. To conduct this analysis we assign individuals to the delinquent group trajectory that they most likely belong to and examine whether average
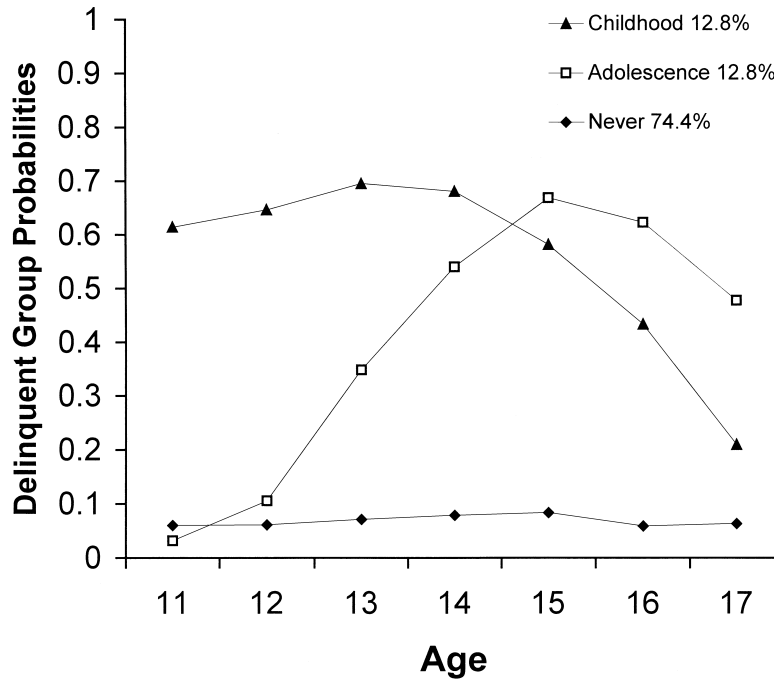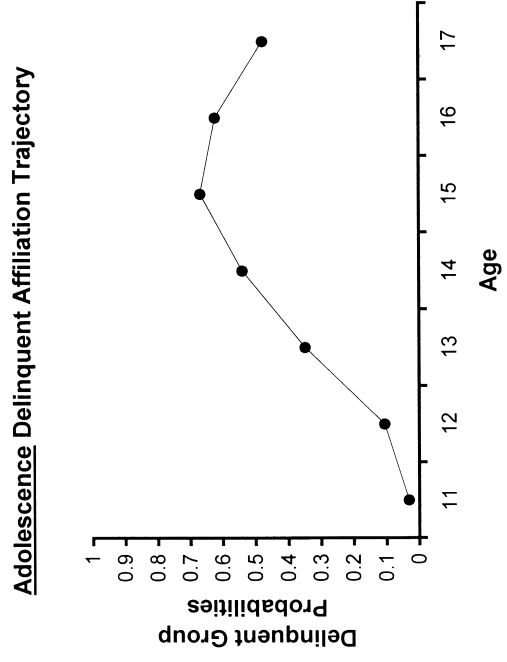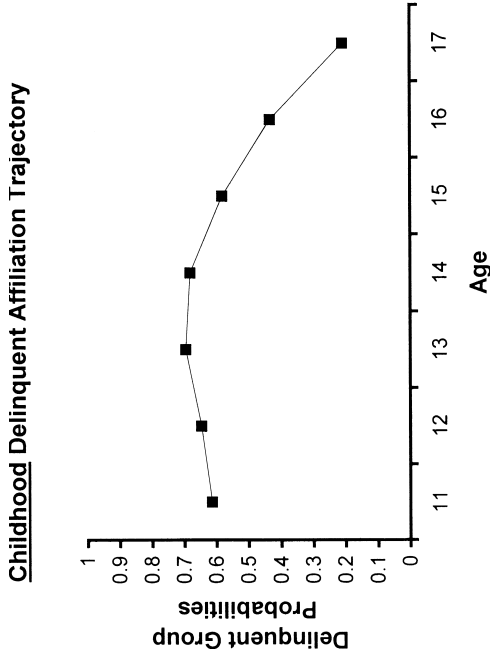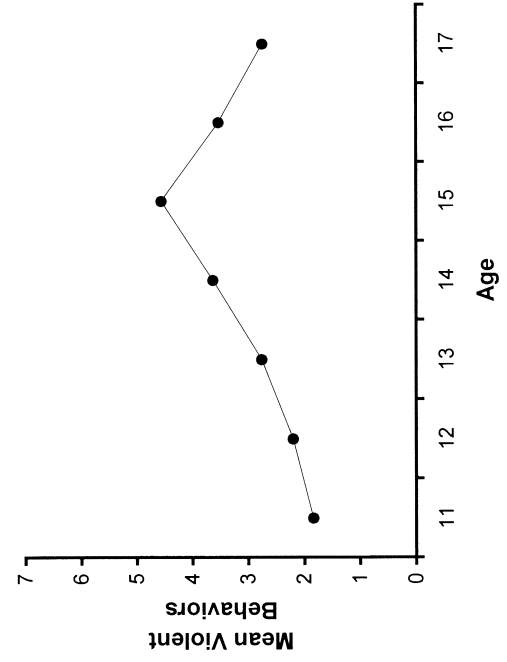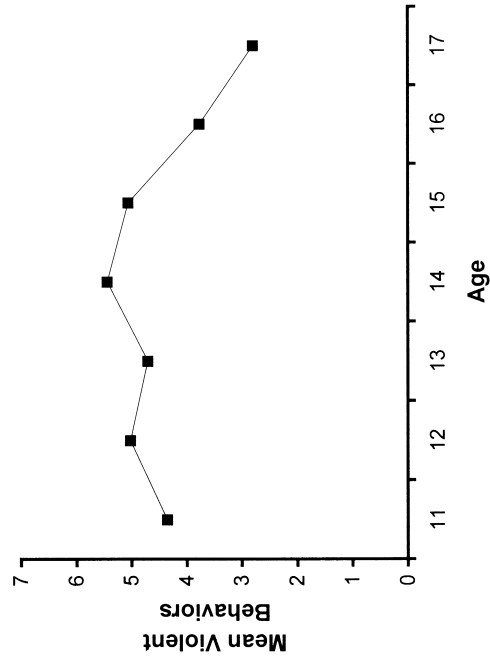
Figure 1. The developmental trajectories of delinquent group affiliation throughout adolescence.

levels of self-reported violence track the trajectories of delinquent group affiliation. Of specific interest is whether the average levels of self-reported violence increases and decreases with the rise and fall of the trajectory group's probability of delinquent group involvement. If a facilitation effect is present we expect that the violence should track delinquent group trajectories. As shown in Figure 2, this is indeed the case. For the childhood affiliation group, as probabilities of association with delinquent groups increase between ages 11 (.61) and 14 (.68) we observe that frequencies of violent behaviors also increase between these ages varying from 4.35 to 5.44. Again, as probabilities of affiliation decrease to .21 at age 17 we observe a similar decline in frequency of violent behaviors to a mean of 2.80. For the adolescence and never affiliation groups, frequency of violent behaviors also closely tracked delinquent group affiliation probabilities.

The prior analysis clearly demonstrates that trajectories of self-reported violence follow trajectories of delinquent group affilia-

tions. This suggests that these two phenomena strongly covary. However, a more demanding demonstration of facilitation is suggested by Thornberry et al. (1993). Specifically, this test builds from the fact that an individual does not always associate with delinquent groups throughout adolescence. Thornberry et al. (1993) examined whether individual rates of violence rise in periods of affiliation with delinquent peers and fall during periods without such associations. As shown in Figure 1, even at ages 14 and 15, the peak ages of involvement for the adolescence and childhood affiliation groups, delinquent affiliations are not certain. We take advantage of this reality by comparing the average rates of violence between those actually involved and those actually not involved with delinquent groups in each trajectory group and at every age.

For each trajectory group, Figure 3 reports the average frequency of violent behaviors at each age conditional upon delinquent group membership or not. We can observe that for each trajectory group, individuals who actually affiliate with delinquent peers have high-
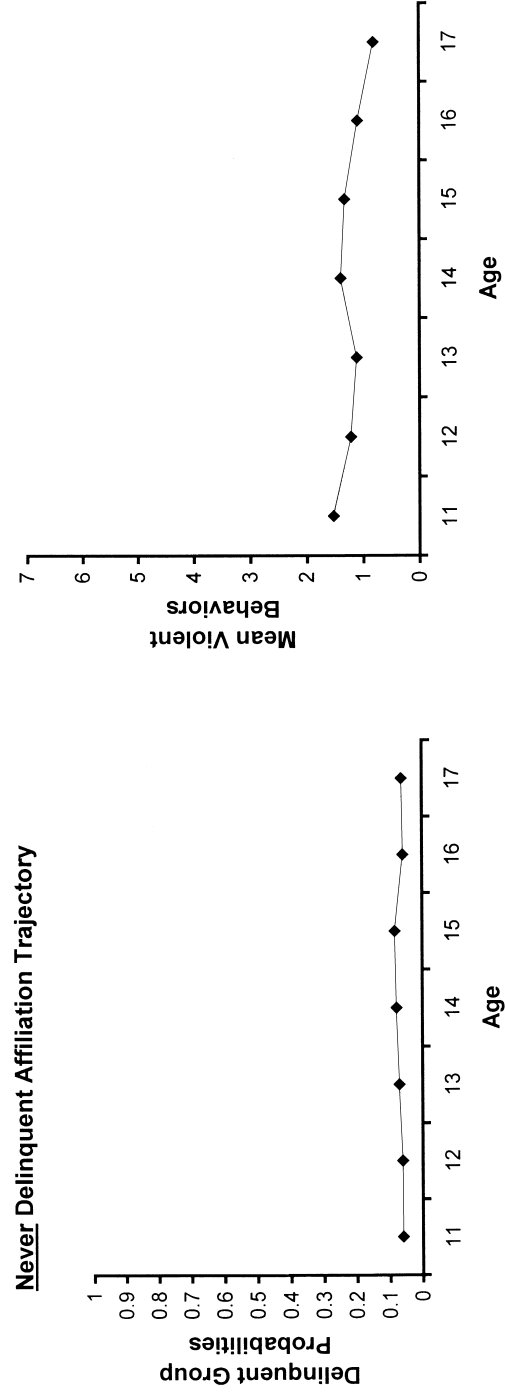
Childhood Delinquent Affiliation Trajectory

Adolescence Delinquent Affiliation Trajectory

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Figure 2. The mean frequency of violent behaviors conditional on developmental trajectories.

Childhood Delinquent Affiliation Trajectory

Adolescence Delinquent Affiliation Trajectory

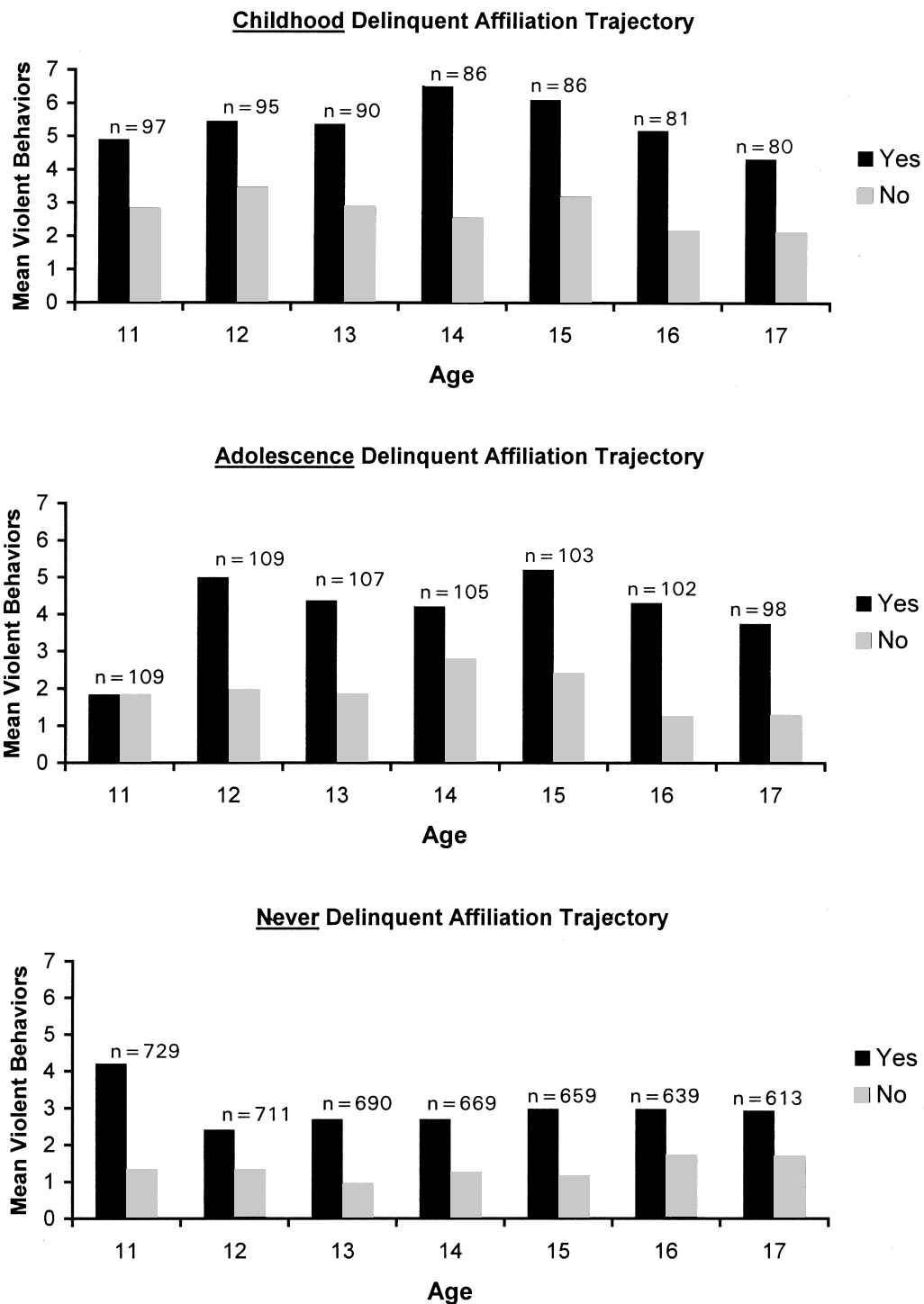## Never Delinquent Affiliation Trajectory

Figure 3. The mean frequency of violent behaviors conditional on time-specific delinquent group affiliation within developmental trajectories.
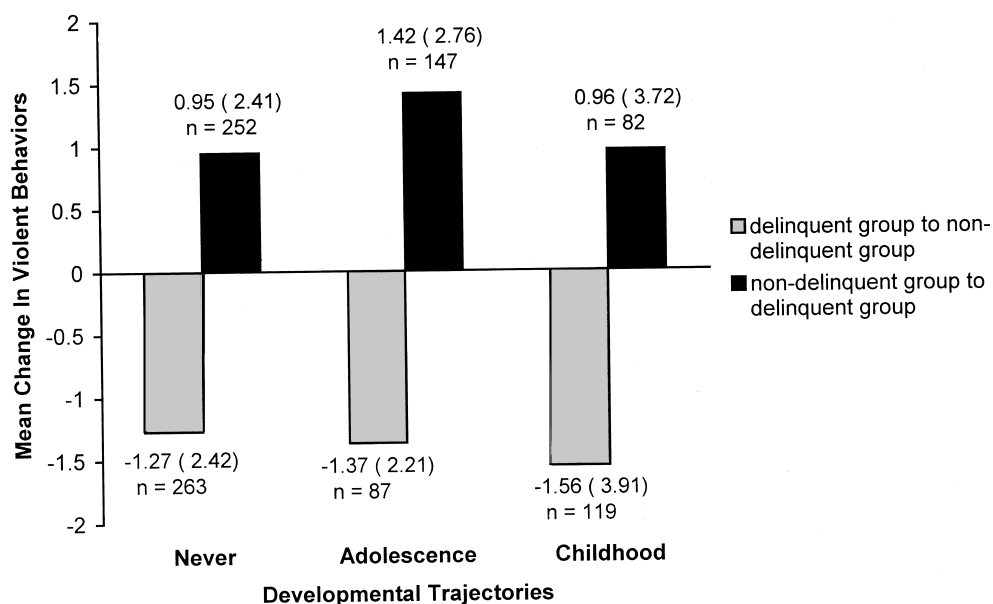
Figure 4. The mean change in violent behaviors across age due to transitions from different states of affiliation within developmental trajectories.

er rates of violence then their counterpart trajectory group members who are not so affiliated. For example, at age 14, adolescents in the childhood trajectory who are involved in a delinquent group have double the rates of violence of adolescents in the same trajectory who are not associated with delinquent groups at that age. This same pattern holds at every age in all three trajectories, and in all cases the difference in the mean rate of violence between active members and nonactive members is significant at $p < .05$.

As a further test of a facilitation effect, we also computed for each trajectory group the average change in the self-reported violence index in periods when an individual moved from a state of no affiliation to active affiliation. We also computed a companion statistic for periods of movement from active involvement to noninvolvement. We expected the former change to be positive and the latter change to be negative. The results, which are reported in Figure 4, conform to this prediction. Transitions into a delinquent group are associated with increased violent behaviors, and transition out of a delinquent group is associated with decreased violent behaviors.

In conclusion, the results clearly point to a facilitation or enhancement effect of delinquent groups on violent behaviors conditional upon developmental trajectories. Furthermore, we can attest that these results hold for the multiple violent behaviors included in the scale.

Discussion

The first goal of our study was to identify different trajectories of affiliation with delinquent groups. The results demonstrate notable differences in developmental trajectories. A quarter of the participants followed a trajectory of affiliation with delinquent groups that peaked around the ages of 14 and 15. Half of these individuals followed a trajectory that was already high at age 11, thus suggesting they probably had been involved with a delinquent group well before that age. In contrast, the other groups' probability of membership increased between the ages of 12 and 15. These results, in contrast to prior research (Elliott et al., 1996; Warr, 1993), illustrate that adolescents will not homogeneously experience increasing probabilities of joining a de-

linquent group through their midadolescence. It further suggests that there is a mixture of age dependent pathways of delinquent group affiliation. These findings are similar to theoretical descriptions of early and late onset pathways of problem behaviors suggested by Moffitt (1993) and Patterson et al. (1997).

In the present study, individuals who affiliate with delinquent groups during preadolescence (i.e., childhood affiliation) or later during adolescence (i.e., adolescence affiliation) commit, as a group, more violent acts than those who never or who temporarily develop this kind of affiliation. The childhood affiliation group, having an earlier and more prolonged involvement with delinquents, clearly shows the highest rates. These results imply that early affiliation to delinquent groups is an important factor in understanding the frequency and stability of violent offending during adolescence and maybe through adulthood (Fergusson, Lynskey, & Horwood, 1996). This same pattern has been observed in other longitudinal studies that examined the developmental aspects of problem behaviors. For example, early aggressive behaviors in children will unfold in more violent delinquent behaviors throughout adolescence (Brame, Nagin, & Tremblay, 2001; Loeber & Hay, 1996; Moffitt, 1993; Nagin & Tremblay, 1999; Patterson et al., 1997). Our results also reflect Patterson et al. (1997) and Moffitt's (1993) theories on late onset or adolescent-limited individuals, which suggest that adolescents who affiliate with delinquent groups will also show some increase in violent behaviors. In our study, their rate of violent behaviors during late adolescence becomes very similar to that displayed by the childhood affiliation group.

Our findings do not support Gottfredson and Hirschi's (1990) prediction that the relationship between delinquency and affiliation with delinquent peers is spurious. Rather, the results strongly suggest that recency of affiliation and transitions into and out of these groups influence the rate of violent behaviors throughout adolescence. This effect supports social interactional theories and recent findings (Brengden et al., 2000; Matsueda & Heimer, 1997; Patterson et al., 1997; Thorn-

berry et al., 1993) stipulating that having deviant friends will modify individuals' behaviors. The enhancement effect in Thornberry's interactional theory (Thornberry, 1987, 1998; Thornberry et al., 1993) seems to best describe the childhood affiliation group's profile. In this model, children who are already aggressive will self-select peers that are similar to them at an early age. Moreover, when they are actively involved in a delinquent group, a facilitation effect is observed. For this specific group, the presence of both selection and facilitation effects support the enhancement effect noted by Thornberry et al. (1993). As for the adolescence affiliation group, because they do not report more aggressive behaviors at 11, a facilitation effect seems to predominate and influence their behaviors when they are part of delinquent groups.

The occurrence of a facilitation effect within the adolescence affiliation group also supports Moffitt's (1993) and Patterson and Yoerger's (1997) theories. However, the presence of a facilitation effect in the childhood affiliation group is at odds with Moffitt's perspective. From her point of view, early-onset individuals are generally more impulsive and will be less susceptible to friends' influences, as neurological deficits mostly influence their behaviors. However, overall, our results suggest that involvement in delinquent groups can facilitate violent behaviors and that this facilitation effect can be generalized to every developmental trajectory found in our study. Interpreting the facilitation effect as a form of conformity to peers, we can conclude that this effect on violence appears stable throughout adolescence and does not follow the inverted U shape curve described by Brown, Clasen, and Eicher (1986). As argued by Thornberry et al. (1997), the facilitation effect of delinquent peers on antisocial behavior appears to be relatively stable through late adolescence and possibly extends well into adulthood (i.e., biker gangs, soldiers at war, etc.).

Three limitations inherent to this study need to be mentioned. First, although seven time points were used to assess trajectories of affiliation with deviant peers, it is clear that this phenomenon starts prior to age 11 (Dodge, 1983; Snyder, Horsch, & Childe, 1997). Hav-

ing access to data during childhood on this matter could have influenced the shape and number of trajectories. Nevertheless, trajectories we have identified are theoretically meaningful have also been described by other researchers (Moffitt, 1993; Patterson et al., 1997). Second, the use of a general one-item measure of delinquent group affiliation from a single informant is not ideal. Although self-reported measures of violent delinquency are generally considered more valid and reliable than official records (Blumstein et al., 1986; Hindelang, Hirschi, & Weiss, 1981; Rutter et al., 1998), the fact that the study child was the informant on both dependent and independent variables may have accentuated the size of effects in the mean difference tests. Unfortunately we did not have access to information from another informant on each adolescent at the seven time points. To ensure that our findings are reliable and consistent, we did some analyses using physical aggression data as described by classmates at ages 10, 11, and 12. Based only on these time points, results appear to confirm the trend found using self-reports. In future studies, these findings should be replicated by simultaneously using multiple informants and multiple time points, as in other studies on peer delinquency (Brengden et al., 2000; Patterson, 1993; Patterson et al., 1997; Simons et al., 1994; Vitaro et al., 2000). Also, our delinquent group membership measure does not specifically take into account heterogeneity of delinquent groups within the adolescent population. For example, the facilitation effect of delinquent peers on violent behaviors may be stronger in more structured violent gangs than within groups of marijuana users, although both groups will be described as deviant by adolescents in our sample. The use of more specific items such as "Do you have friends involved in gang fights?" versus "Do you have friends who smoke marijuana?" could help us understand

the extent to which different types of peers influence violent behaviors. Third, because our sample was restricted to French Canadian, Caucasian boys from poor neighborhoods in Montreal, the results might not extend to populations from other socioeconomic backgrounds. A replication of this study should include samples from the United States where the gang phenomenon is more prevalent. The trajectory procedure we used may also identify different trajectories for Caucasians, Hispanic, and African American adolescents raised in different neighborhoods. On the other hand, findings from the Montreal Longitudinal Study are consistent with most recent studies done in various cities within North America (Brengden et al., 2000; Elliott & Menard, 1996; Thornberry et al., 1993; Warr, 1993). Although this study delineates a facilitation effect while controlling for population heterogeneity in affiliation with delinquent groups, future studies should add other variables to test the specific effect of delinquent groups on violence. For example, these studies could include other time-varying covariates, such as parental supervision, coercive parental practices, and quality of friendships (Poulin, Dishion, & Haas, 1999), that are generally correlated with delinquent affiliations and could be introduced as moderators.

Because preadolescence and adolescence affiliation with delinquent groups may play a significant role in the development of violent behaviors, more studies should focus on risk factors that predict these different pathways. This could give a broader understanding of early childhood characteristics that could lead an individual to affiliate with deviant friends early or later in his development. This step is necessary to develop prevention programs that are better adapted to specific subgroups in the population (Cairns, Cadwallader, Estell, & Neckerman, 1997).

References

Battin, S. R., Hill, K. G., Abbott, R. D., Catalano, R. F., & Hawkins, J. D. (1998). The contribution of gang membership to delinquency beyond delinquent friends. *Criminology, 36,* 93–115.

Bjerregaard, B., & Lizotte, A. J. (1995). Gun ownership and gang membership. *Journal of Criminal Law and Criminology, 86,* 37–58.

Blishen, B. R., Carroll, W. K., & Moore, C. (1987). The

1981 socioeconomic index for occupations in Canada. *Canadian Review of Sociology and Anthropology, 24,* 465–488.

Blumstein, A., Cohen, J., Roth, J. A., & Visher, C. A. (Eds.). (1986). *Criminal careers and career criminals*. Washington, DC: National Academy Press.

Brame, B., Nagin, D. S., & Tremblay, R. (2001). Developmental trajectories of physical aggression from school entry to late adolescence. *Journal of Child Psychology and Psychiatry, 42,* 503–512.

Brengden, M., Vitaro, F., & Bukowski, W. M. (2000). Stability and variability of adolescents' affiliation with delinquent friends: Predictors and consequences. *Social Development, 9,* 205–225.

Brown, B. B., Clasen, D. R., & Eicher, S. A. (1986). Perceptions of peer pressure, peer conformity dispositions, and self-reported behavior among adolescents. *Developmental Psychology, 22,* 521–530.

Buehler, R. E., Patterson, G. R., & Furniss, J. M. (1966). The reinforcement of behavior in institutional settings. *Behaviour Research and Therapy, 4,* 157–167.

Cairns, R. B., Cadwallader, T. W., Estell, D., & Neckerman, H. J. (1997). Groups to gangs: Developmental and criminological perspectives and relevance for prevention. In D. Stoff, J. Breiling, & J. Maser (Eds.), *Handbook of antisocial behavior* (pp. 194–205). New York: Wiley.

Chamberlein, P., & Reid, J. B. (1998). Comparison of two community alternatives to incarceration for chronic juvenile offenders. *Journal of Consulting and Clinical Psychology, 66,* 624–633.

Dishion, T. J., Patterson, G. R., & Griesler, P. C. (1994). Peer adaptation in the development of antisocial behavior: A confluence model. In L. R. Huesmann (Ed.), *Current perspectives on aggressive behavior* (pp. 61–95). New York: Plenum Press.

Dishion, T. J., Patterson, G. R., Stoolmiller, M., & Skinner, M. L. (1991). Family, school, and behavioral antecedents to early adolescent involvement with antisocial peers. *Developmental Psychology, 27,* 172–180.

Dodge, K. A. (1983). Behavioral antecedents of peer social status. *Child Development, 54,* 1386–1399.

D'Unger, A. V., Land, K. C., McCall, P. L., & Nagin, D. S. (1998). How many latent classes of delinquent/criminal careers? Results from mixed Poisson regression analyses of the London, Philadelphia, and Racine cohorts studies. *American Journal of Sociology, 103,* 1593–1630.

Elliott, D. S., & Menard, S. (1996). Delinquent friends and delinquent behavior: Temporal and developmental patterns. In J. D. Hawkins (Ed.), *Delinquency and crime: Current theories* (pp. 28–67). Cambridge: Cambridge University Press.

Farrington, D. P. (1986). Age and crime. In M. Tonry, & N. Morris (Eds.), *Crime and Justice* (Vol. 7, pp. 189–250). Chicago: University of Chicago Press.

Farrington, D. P., & Hawkins, J. D. (1991). Predicting participation, early onset and later persistence in officially recorded offending. *Criminal Behaviour and Mental Health, 1,* 1–33.

Fergusson, D. M., Lynskey, M. T., & Horwood, L. J. (1996). Factors associated with continuity and changes in disruptive behavior patterns between childhood and adolescence. *Journal of Abnormal Child Psychology, 24,* 533–553.

Glueck, S., & Glueck, E. T. (1950). *Unraveling juvenile delinquency*. New York: Commonwealth Fund.

Gottefredson, M., & Hirschi, T. (1990). *A general theory of crime*. Stanford, CA: Stanford University Press.

Hartup, W. W. (1999). Constraints on peer socialization: Let me count the ways. *Merrill–Palmer Quarterly, 45,* 172–183.

Hindelang, M. J., Hirschi, T, & Weiss, J. (1981). *Measuring delinquency*. Beverly Hills, CA: Sage.

Howell, J. C. (1999). Youth gang homicides: A literature review. *Crime and Delinquency, 45,* 208–241.

Howell, J. C., Egley, A., & Gleason, D. K. (2000, November). *Youth gangs: Definitions and the age-old issue*. Paper presented at the meeting of the American Society of Criminology, San Francisco, CA.

Jones, B., Nagin, D., & Roeder, K. (2001). A SAS procedure based on mixture models for estimating developmental trajectories. *Sociological Methods and Research, 29,* 374–393.

Kass, R. E., & Raftery, A. E. (1995). Bayes factor. *Journal of the American Statistical Association, 90,* 773–795.

Loeber, R., & Hay, D. F. (1996). Key issues in the development of aggression and violence from childhood to early adulthood. *Annual Review of Psychology, 48,* 371–410.

Matsueda, R. L., & Heimer, K. (1997). A symbolic interactionist theory of role transitions, role commitments and delinquency. In T. P. Thornberry (Ed.), *Developmental theories of crime and delinquency: Advances in criminological theory* (Vol. 7, pp. 163–174). New Brunswick, NJ: Transaction.

Moffitt, T. E. (1993). "Life-course persistent" and "adolescent-limited" antisocial behavior: A developmental taxonomy. *Psychological Review, 100,* 674–701.

Nagin, D. S. (1999). Analyzing developmental trajectories: A semiparametric, group-based approach. *Psychological Methods, 4,* 139–157.

Nagin, D. S., & Land, K. C. (1993). Age, criminal careers and population heterogeneity: Specification and estimation of a nonparametric, mixed Poisson model. *Criminology, 31,* 327–362.

Nagin, D., & Paternoster, R. (1991). On the relationship of past to future participation in crime. *Criminology, 29,* 163–190.

Nagin, D., & Paternoster, R. (2000). Population heterogeneity and state dependence: State of the evidence and directions for future research. *Journal of Quantitative Criminology, 16,* 117–141.

Nagin, D., & Tremblay, R. E. (1999). Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and non-violent delinquency. *Child Development, 70,* 1181–1196.

National Youth Gang Center. (in press). *1998 national youth gang survey. Summary*. Washington, DC: U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.

Patterson, G. R. (1993). Orderly change in a stable world: The antisocial trait as a chimera. *Journal of Consulting and Clinical Psychology, 61,* 911–919.

Patterson, G. R., DeBaryshe, B. D., & Ramsey, E. (1989). A developmental perspective on antisocial behavior. *American Psychologist, 44,* 329–335.

Patterson, G. R., Dishion, T. J., & Yoerger, K. (2000). Adolescent growth in new forms of problem behavior: Macro- and micro-peer dynamics. *Prevention Science, 1,* 3–13.

Patterson, G. R., & Yoerger, K. (1997). A developmental model for late onset delinquency. In R. Dienstbier &

D. W. Osgood (Eds.), *The Nebraska Symposium on Motivation: Vol. 44. Motivation and delinquency* (pp. 119–177). Lincoln, NE: University of Nebraska Press.

Poulin, F., Dishion, T. J., & Haas, E. (1999). The peer influence paradox: Friendship quality and deviancy training within male adolescent friendships. *Merrill–Palmer Quarterly, 45,* 42–61.

Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology, 25,* 111–164.

Roeder, K., Lynch, K. G., & Nagin, D. S. (1999). Modeling uncertainty in latent class membership: A case study in criminology. *Journal of the American Statistical Association, 94,* 766–776.

Rutter, M., Giller, H., & Hagell A. (1998). *Antisocial behavior by young people*. Cambridge: Cambridge University Press.

Shaw, C. R., & McKay, H. D. (1931). *Report on the causes of crime: Volume II. Social factors in juvenile delinquency*. Washington, DC: National Commission on Law Observance and Enforcement.

Short, J. F., Jr. (1957). Differential association and delinquency. *Social Problems, 4,* 233–239.

Simons, R. L., Wu, C., Conger, R. D., & Lorenz, F. O. (1994). Two routes to delinquency: Differences between early starters and late starters in the impact of parenting and deviant peers. *Criminology, 32,* 247–275.

Snyder, J., Horsch, E., & Childe, J. (1997). Peer relationships of young children: Affiliative choices and the shaping of aggressive behavior. *Journal of Clinical Child Psychology, 26,* 145–156.

Spergel, I. A. (1990). Youth gangs: Continuity and change. In N. Tonry & N. Morris (Eds.), *Crime and justice: A review of research*. Chicago: University of Chicago Press.

Sutherland, E. H. (1939). *Principles of criminology* (3rd ed.). Philadelphia, PA: Lippincott.

Thornberry, T. P. (1987). Toward an interactional model of delinquency. *Criminology, 25,* 863–891.

Thornberry, T. P. (1997). Introduction: Some advantages of developmental and life-course perspectives for the study of crime and delinquency. In T. P. Thornberry (Ed.), *Developmental theories of crime and delinquency: Advances in criminological theory* (Vol. 7, pp. 1–10). New Brunswick, NJ: Transaction.

Thornberry, T. P. (1998). Membership in youth gangs and involvement in serious and violent offending. In R. Loeber, & D. P. Farrington, (Eds.), *Serious and violent juvenile offenders: Risk factors and successful interventions* (pp. 147–166). Thousand Oaks, CA: Sage.

Thornberry, T. P., & Krohn, M. D. (1997). Peers, drug use, and delinquency. In D. Stoff, J. Breiling, & J. D. Maser (Eds.), *Handbook of antisocial behavior* (pp. 218–233). New York: Wiley.

Thornberry, T. P., & Krohn, M. D., Lizotte, A. J., Chard–Wierschem, D. (1993). The role of juvenile gangs in facilitating delinquent behavior. *Journal of Research in Crime and Delinquency, 30,* 55–87.

Trasher, F. M. (1927). *The gang*. Chicago: University of Chicago Press.

Tremblay, R. E., Pihl, R. O., Vitaro, F., & Dobkin, P. L. (1994). Predicting early onset of male antisocial behavior from preschool behavior. *Archives of General Psychiatry, 51,* 732–739.

Vitaro, F., Brengden, M., Tremblay, R. E. (2000). Influence of deviant friends on delinquency: Searching for moderator variables. *Journal of Abnormal Child Psychology, 28,* 313–325.

Vitaro, F., Brendgen, M., & Tremblay, R. E. (2001). Preventive intervention: Assessing its effects on the trajectories of delinquency and testing for mediational processes. *Applied Developmental Science, 5,* 201–213.

Vitaro, F. Tremblay, R. E., Kerr, M., Pagani, L., & Bukowski, W. M. (1997). Disruptiveness, friends' characteristics, and delinquency in early adolescence: A test of two competing models of development. *Child Development, 68,* 676–689.

Warr, M. (1993). Age, peers, and delinquency. *Criminology, 31,* 17–40.

Warr, M. (2002). *Companions in crime: The social aspects of criminal conduct.* New York: Cambridge University Press.