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Explaining the development of adolescent violent delinquency

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Abstract

The etiological aspects of a structural dynamic model of delinquent development are analysed with the first five waves (age 13 to 17) of the German prospective panel study Crime in the Modern City, carried out since 2002 in Duisburg. By applying a combined Markov and growth curve model, the developments of structural explanatory factors and self-reported violent delinquency and their reciprocal as well as direct and indirect relations could be examined within one statistical model. Social macro-structure was considered within the notion of a wider social milieu, with social value orientations as the subjective component. The longitudinal analysis confirmed the conceptual distinction between distal and proximate structural factors: distal hedonistic value orientations marked the strongest pathway to violent delinquency via proximate pro-violent peer attachment and pro-violent norms. Although school bonds and parental education style were not of greater importance here, they nevertheless mediated a pathway into conformity with traditional value orientations as the structural background. A latent class growth analysis reproduced a by-now common pattern of six delinquency trajectories.

Keywords

combined Markov and growth curve model, delinquent peers, hedonism, latent class growth analysis, life-course criminology, panel analysis, self-reported violent delinquency, social milieus, structural dynamic analysis, trajectories of delinquency

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Introduction

This contribution presents results from the Crime in the Modern City Study (CrimoC). This ongoing prospective panel study started in 2002 in Duisburg, an industrial city of 500,000 inhabitants in western Germany, with eight annual data waves having been collected. Our analytical conception of the explanation of engagement in violent delinquency follows a sociological-constructivist perspective. This conception can be characterized as *sociological* because (a) social processes are viewed to be more relevant for the explanation of delinquency than individual processes, and (b) it assumes that delinquent developments can best be explained by means of a theoretically based structural model that takes into account direct and indirect effects between distal and proximate theoretical factors,[1] and also considers their development over time (instead of merely analysing them as theoretically unexplained and equally relevant multiple risk or protective factors). The study's conception can be seen as *constructivist* because it also takes into account the independent impact of formal control interventions by the police or the penal justice system (without this it would be a sociological-etiological conception).[2]

Although crime and crime control are regarded here mainly as *faits sociales*, this does not mean that individuals are unimportant; therefore one also needs to pay attention to how individuals cope with structural contexts in their perceptions, attitudes and behaviours.

This article focuses on the etiological aspects of the structural dynamic model. First, major considerations of this model will be outlined briefly. This is followed by a description of the panel design, the data collection process and the methods used. Finally, the results of the analyses with cross-sectional structural equation models, in longitudinal perspective with a combined Markov and growth curve model, as well as an analysis of the development of delinquent trajectories with a growth mixture model, will be presented and discussed.

A structural dynamic model for the analysis of delinquent development

The structural dynamic model consists of three levels of longitudinal analysis. Besides an *individual* level with attitudinal and behavioural components, it distinguishes between the two social levels of *social structure* and (formal) *social control*. The model thus follows one of the constitutive distinctions of modern criminology: the distinction between criminal behaviour and the criminalization of criminal behaviour (Figure 1).

Since such a research design tries to reflect the complexity and rapid change in modern societies for the explanation of conformity and delinquency, one can draw only partly upon traditional criminological theories, such as anomie, learning, control or labelling theory. These classic theories usually reflect only one aspect or one level of the crime causation process.[3] For the consistent observation of certain social styles of action as well as their formal social control, it appears promising to take systems theory into account too (Luhmann, 1995) – in addition to theories of action. And, regarding temporal development, reciprocal as well as self-referential relations between and within these different analytical levels should be considered. The model itself is of course not a theory. It provides a analytical framework that makes it possible to analyse the different

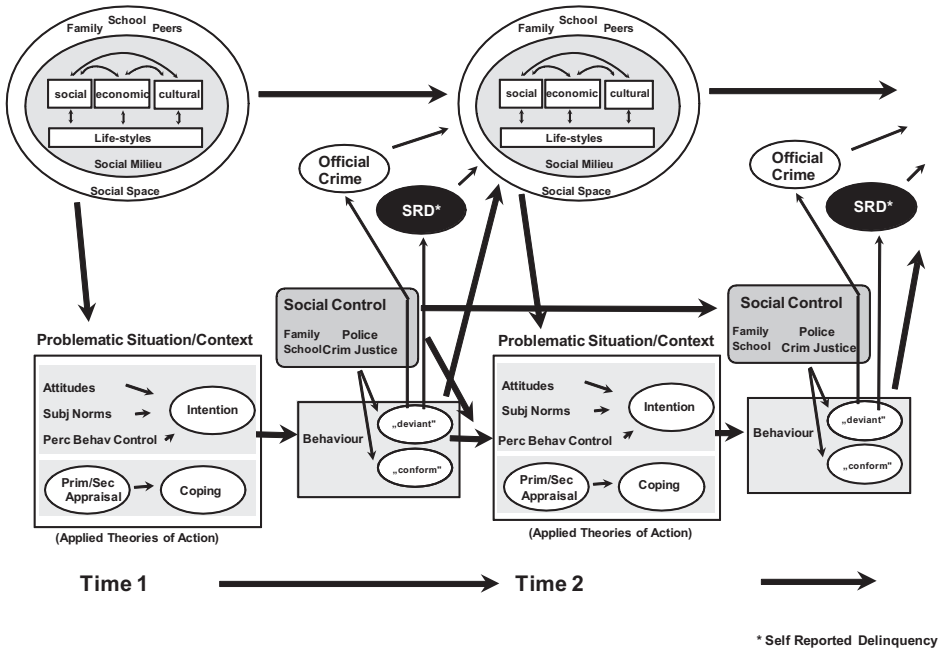

Figure 1. Structural dynamic model for the analysis of delinquent development

aspects and stages of delinquent life courses from different, and also alternative, yet plausible, theoretical perspectives.

On the *individual level* we draw upon assumptions from the theory of planned behaviour (Ajzen, 1991) and coping theory (Lazarus and Folkman, 1984) to explain the psychological regulation of external problem constellations.[4] The impact of formal *social control* is considered not only as direct (self-fulfilling prophecy) or indirect (structural) labelling effects (Becker, 1963; Lemert, 1951), but also with respect to reinforcing or moderating processes through particular control styles and reactions of the immediate social environment (Paternoster and Iovanni, 1989). In addition, the importance of self-referential judicial decision-making processes for delinquent (career) developments may be analysed from the perspective of systems theory. Since the following empirical analysis is focused on the socio-structural impact on delinquency, we will also restrict the theoretical discussion on this socio-etiological aspect of the structural dynamic model (for an explanation of the whole model, see Boers and Reinecke, 2007).

Processes of psychological regulation take place and become structured within certain social contexts, which are more or less influential at different age stages. With respect to the explanation of individual behaviour, the macro-structural social context constitutes *distal* causes of delinquency or conformity. In the structural dynamic model, the conception of the *social macro-structure* does not just follow the classic model of a vertical differentiation of society into different social classes. In line with modern sociological research, the horizontal differentiation of society into so-called *social milieus* through

certain culturally based social value orientations and beliefs (the 'subjective factor') is taken into account as well. For example, the lower level of modern societies is characterized not only by traditional working-class groups but also (and even more so) by groups of people with unconventional value orientations and lifestyles. Members of such non-traditional or hedonistic social milieus are less interested in safeguarding their future, have discontinuous or broken educational or occupational biographies, prefer fun and leisure-oriented lifestyles, and seek current self-fulfilment and satisfaction of their needs (Hradil, 2001: 422–43).

According to this understanding, social milieus represent the macro-structural level of a modern society with, on the one hand, the latent structural resources of social, economic and cultural capital. These capital resources can be transferred, mingled with each other or supplemented by one another (for example, social relations correspond with job or business opportunities; economic resources open the door to higher education and/or relevant social circles). On the other hand, with the lifestyle element, the concept of social milieus encompasses also a manifest, expressive component. So far, the latent and quite abstract capital resource structure receives materialized form in the habits of everyday life: preferences for certain clothing, music styles, literature, media, movies, bars, restaurants, sports, and working and achievement styles (see Pöge, 2007).

This may also be seen as an attempt to modify and differentiate the common macro-structural perspective in criminology expressed by anomie theory (Merton, 1957 [1938]). Anomie theory is based on assumptions of a vertical class structure of society as well as on commonly shared value orientations (aspirations for success and welfare). Its conclusion that crime is rooted in lower-class disadvantages – namely poverty – was not supported by empirical studies of self-reported delinquent behaviour (see Akers and Sellers, 2009: 188–91; Tittle and Meier, 1990), and is at best only a limited theoretical possibility if one considers the results from modern social structural research with its more complex milieu and lifestyle approach.

The characteristics of a specific social milieu are mediated (and also generated) through the socialization institutions in the closer social environment (social meso-level): family, school, peer groups, vocational training, occupational area. From the perspective of classic criminological theories, the social bonds generated in these institutions are generally important for a life course into conformity (Hirschi, 1969), and, for the development of delinquency, peer groups are especially important. They provide the major social context for the learning of delinquent norm orientations (Sutherland, 1947: 5–9). Hence, delinquent peers and delinquent norms constitute proximate causes of delinquent behaviour, with delinquent peer groups transferring the causal context from the social meso-level to the micro-level of individual norms and behaviour. All (together with external reactions by conformity-oriented peers, parents and teachers) may also be seen as components of an interactively self-reinforcing constellation of delinquent communication; that is, delinquent norms learned in delinquent peer groups cause delinquent behaviour, which, in turn, enhances delinquent peer-group attachment and delinquent norms (discussed as interactional theory by Thornberry and Krohn, 2005, or as 'cumulative disadvantage' by Sampson and Laub, 1997).

Finally, the neighbourhood is of importance on the social meso-level. As specific social spaces (working, middle or upper class, gentrified, alternative, or migrant and

ethnic living areas), they translate the abstract social macro-structure into individually relevant and perceivable environmental conditions, and may also be seen as an ecological expression of a certain social milieu structure (see Oberwittler, 2004; Wikström, 2007).

The relations between the socio-structural and individual dimensions of the structural dynamic model are assumed to operate not in a unidirectional but in a reciprocal manner. On the one hand, the macro-structure shapes individual attitudes, beliefs, appraisals, decision-making and behaviour. On the other hand, the social macro-structure is, in turn, also influenced by individual decisions and (problem-coping) behaviour. A particularly relevant reciprocal relation is that the outcome of a chosen coping behaviour may alleviate[5] or (if it 'goes the wrong way') aggravate a problematic situational context (such as violent parental upbringing practices, delinquent peer-group pressure, a perception of economic or social deprivation) and will have an impact on subsequent problem appraisals and coping behaviours.

Such reciprocal relations can be observed only when considering the temporal dimension. A temporal observation is, however, not restricted to the reciprocity between external factors (e.g. between peers, norms and delinquency). Of equal importance are also auto-dynamic (statistically: autoregressive) or, as they are called in systems theory, self-referential processes (Luhmann, 1995).[6] The operations of social, economic, legal or scientific systems or individual acts, attitudes, motivations and beliefs (in systems theory: operations of psychic systems) aim to reproduce and, thus, preserve their own structure or personal identity, respectively. It is assumed that, over time, self-referential stability effects are usually stronger than the impact of external (i.e. also reciprocal) causal effects.

In a simplified way, one may sum up the assumed relations between the etiological components of the structural dynamic model as follows: the delinquency-relevant impact of the distal social macro-structure (social milieus) is initially mediated by (still rather distal) social bonds and eventually through the proximate components of delinquent peers and, in particular, delinquent norm orientations (Figure 2).

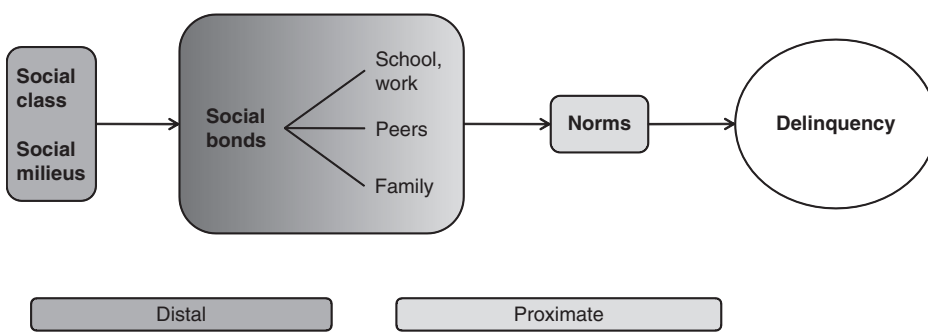

Figure 2. Distal and proximate factors in a socio-structural model of delinquency

Data

Sampling procedure: Cross-sectional and panel samples

The annual survey started in 2002 with 3411 pupils from the 7th grade of all school types. Their mean age was 13. In 2009, the eighth wave of data collection was completed. Questionnaires were completed in school classes. The aim was to examine the total number of all 7th-graders in Duisburg. In the end, 70 percent of the schools (40 out of 57) agreed to participate. From these, 87 percent of the 7th-graders participated in the first year, which represented 61 percent of all 7th-graders in Duisburg. In subsequent years, the rates of participation ranged from 84 percent to 92 percent. Especially after leaving school at the end of the 10th grade, some adolescents had to be contacted by mail or in person at home. After the seventh wave, this became the sole mode of data collection.

Basic data for the following analyses stem from a five-wave panel data set covering the period from late childhood to late adolescence (age 13–17, Table 1). Included are 1552 adolescents who participated five years in a row and comprise 45.5 percent of the adolescents who were interviewed for the first time in 2002. This indicates a common but nevertheless considerable attrition of the initial population.

The panel attrition led to some differences in the variable distribution (e.g. more girls), somewhat fewer respondents from lower junior high schools and more from grammar schools in the panel data compared with the cross-sectional data. For total and violent delinquency, in the panel data the prevalence rates as well as the offender frequency rates are between 13 percent and 17 percent lower on average for all waves; the prevalence of intensive offenders is almost 30 percent less, yet their offender frequency rates are less than 6 percent lower.[7] The latter smaller difference indicates that the loss of offenders in the panel does not necessarily go along with a similar reduction in intensiveness for the remaining intensive offenders.

Latent variables

According to the structural dynamic model, social value orientations have been measured as characteristics of social milieus. Factor analysis resulted in five dimensions of general value orientations: *traditional*, *religious*, *hedonistic*, *deprived* and *technology* affirmative values (for details, see Pöge, 2007). Criteria to assess classic vertical social

Table 1. Data sets of the Duisburg study

Year	Wave	*n*	Age
2002 (cross-section)	t_1	3411	13
2003 (cross-section)	t_2	3392	14
2004 (cross-section)	t_3	3339	15
2005 (cross-section)	t_4	3243	16
2006 (cross-section)	t_5	4548	17
2002–2006 (panel)	$t_1 - t_5$	1552	13–17

structural indicators (such as parents' socioeconomic status, income, property) were not available owing to data protection law.[8]

The social meso-level was measured by constructs representing the adolescents' bonds to informal institutions of socialization, in particular *parents* (empathetic parenting), *school* (importance of school and relation to teachers) and *violent peer groups* (peer-group activities).[9] Offence-specific norm orientations were operationalized by a scale of ratings on how bad one would find 10 specific offences; ratings for the two kinds of violent behaviour were used in the following analyses as *pro-violent norms*.

Latent constructs were measured by multiple indicators. Delinquent and deviant behaviours were measured by annually self-reported frequencies of offences from different offence categories (property, violent and vandalism offences, drug dealing, drug and alcohol consumption, and computer and Internet-related offences). *Violent delinquency* was calculated as an additive composite of the annually self-reported frequencies of four violent offences (robbery, purse snatching, assault with and assault without a weapon).[10]

Methods of longitudinal data analysis

The longitudinal analyses in this section are based on a combination of a latent autoregressive Markov model (Heise, 1969) and a latent growth curve model (Bollen and Curran, 2006; Meredith and Tisak, 1990).

Following the terminology of Bollen and Curran (2006: 197), the combined model strategy is described as a *conditional time varying covariate latent curve model*. Time-variant as well as time-invariant predictors regarding the development of delinquency can be incorporated into one structural equation model and tested simultaneously. Stability and change in distal and proximal structural variables are analysed via higher-order Markov models, including cross-sectional and cross-lagged relationships between the variables.

The development of delinquent behaviour (incidence rates) over time is analysed with a latent growth curve model as part of the combined model. Growth curve models not only describe a single individual's developmental trajectory, but also capture individual differences in the intercept and slopes of those trajectories. Based on the formative work of Rao and Tucker's basic model (Rao, 1958; Tucker, 1958), Meredith and Tisak (1990) discussed and formalized the model within the structural equation framework.

In a latent growth curve model, the substantive variable under study is specified as a function of time and latent variables (intercept and slope) reflecting intra-individual and inter-individual development. Time-variant covariates can be considered in the model resulting in a combined growth curve and Markov model. In this extended model, the means of the intercept and slope are controlled for the time-variant predictors. Owing to the fact that, in our representative, non-stratified sample of adolescents, the total incidence rate is typically low, the distributions of each panel wave are highly non-normal. This results in high values of skewness and kurtosis. To normalize the distributions, the original incidence rates were transformed with the natural logarithm. The influence of so-called *outliers* can be reduced and values of skewness and kurtosis are significantly lower compared with the original distributions. In addition, the covariance structure of the logarithmized values corresponds to the time order of the panel waves: the larger the

time distance between the panel waves, the lower the correlation between the measurements of delinquency.[11]

The mean values of the incidence rate increase from the first to the second panel wave. After the second wave, the mean values decrease continuously. A simple linear growth curve model will not be sufficient to represent the development of delinquency over time. Therefore, we decided to formalize the age–crime curve with a *piecewise latent trajectory model* (Bollen and Curran, 2006), which contains the intercept (η_1) and two slopes (η_2, η_3). The first slope factor represents the development from t_1 to t_2, the second slope factor the development from t_2 to t_5. The mean of the first slope factor (η_2) is expected to be positive, which indicates an increasing delinquency rate. The mean of the second slope factor (η_3) is expected to be negative, indicating a decreasing delinquency rate.

Migration background, educational level and gender serve as time-invariant variables in the combined model. They are included as predictors of the three growth curve variables. Hedonistic value orientations, peer-group attachment and specific pro-violent normative orientations serve as time-variant predictors of the dependent variable delinquency.

The possibility that the individual trajectories of a dependent variable can vary is one of the main advantages of the growth curve model. This variation is captured by the growth curve factors. The model assumes that all individuals are drawn from the same population. Growth mixture modelling relaxes this assumption and gives information about parameter differences across unobserved subpopulations. Instead of considering individual variation of a single mean of the intercept and slope, the growth mixture model allows different classes of individuals to vary around different intercepts and slopes (Muthén and Shedden, 1999). The classes are introduced by a latent categorical variable where the categories (classes) represent the unobserved heterogeneity of the data.

Following Muthén (2004), a general growth mixture model (GGMM) contains latent continuous variables η (intercept and slopes) and, in addition, a latent categorical variable c. This variable captures so-called latent trajectory classes representing the different subpopulations. Means and variances of the latent continuous variables η can be estimated particularly for each class. In an unconditional growth curve model, the latent variables are then described by their class-specific means (vector α_k) and variances (vector ζ_k).

Within a special case of the GGMM, developed by Nagin and Land (1993), the variances of the growth parameters are fixed to zero so as not to allow individuals to deviate from their class-specific intercept and slopes. This submodel is referred to as the group-based modeling approach (Nagin, 2005) or the latent class growth analysis (Muthén, 2004; see also Reinecke, 2006).

Growth mixture models are estimated by maximizing the log-likelihood function within the admissible range of parameter values, given classes and data. M*plus* (Version 5.2) uses the principle of maximum-likelihood estimation and employs the EM algorithm for maximization (Muthén and Shedden, 1999).

In mixture models, a k-class model is not nested within a k+1 group model. Therefore, conventional mixture tests such as the Akaike information criterion (AIC; Akaike, 1987) and the Bayesian information criterion (BIC; Schwarz, 1978) have to be used for model comparisons. Usually, the model with the smallest AIC or BIC is accepted within model comparisons. If the k-class model contains a redundant class, the k–1-class model with the smaller AIC or BIC value should be chosen. Accepting or rejecting a model on the

basis of the AIC or BIC is, however, more or less descriptive and does not imply any statistical test. Lo et al. (2001) proposed a likelihood ratio based method (the Lo–Mendell–Rubin Likelihood Ratio Test, or LMR-LRT) for testing *k*–1 classes against *k* classes in mixture models. The *p*-value from this test represents the probability that H0 is true, i.e. that the model is sufficient with one class fewer. Therefore, a low *p*-value indicates that the *k*–1 class model has to be rejected and the *k*-class model can be accepted for substantive interpretations. BIC, adjusted BIC and the LMR-LRT test will be used for the model selection in the next section.

Results

The presentation of the results will start with findings from the analysis of cross-sectional data sets. Then the longitudinal analysis of structural factors of violent delinquency will be presented. The third section will discuss trajectories of delinquency derived from latent class growth analyses.

Cross-sectional analysis of violent delinquency

Analyses of cross-sectional data provided some first insights into the fundamental structure of the supposed relations between the different levels of social structure as depicted in Figure 2. Results indicate two distinct developmental pathways, one into conformity and one into violent delinquency. A *pathway into conformity* resulted mainly from an analysis of total delinquency and has been described elsewhere.[12] Here, we focus on the *pathway into violent delinquency*. This developmental pattern is characterized by hedonistic value orientations (HEDO) that foster attachment to violent peer groups (DEL PEER) (β .25 to .32). Peer-group affiliations are directly related to the acceptance both of pro-violent norms (DEL NORM) (β .35 to .43) and of violent behaviour (VIO) (β .28 to .32). Pro-violent norms exert only a moderate effect on violent delinquency (β .19 to .21). Traditional value orientations (TRAD) slightly counteract the attachment to violent peer groups (β –.18 to –.13) and the establishment of pro-violent norms (β –.17 to –.10) but have no direct impact on violent behaviour (Figure 3 for age 15). The three most important latent variables (hedonistic value orientations, violent peer group and offence-specific norms) were selected for further longitudinal analyses of the structural processes influencing the development of violent delinquency.

Longitudinal analysis of violent delinquency

Before testing these exogenous structural components of the longitudinal model, the development of violent delinquency was explored by specifying a piecewise latent trajectory model. The development of the mean rate of violent delinquency during adolescence can be divided into two periods: the first period ranges from age 13 to 14 (early adolescence) and is characterized by an increase in the (arguably) low mean rate of self-reported violent delinquency. After the peak at t_2, the second period from age 14 to 17 (mid-adolescence) displays a constant decrease in the mean rate of self-reported violent delinquency (Table 2).

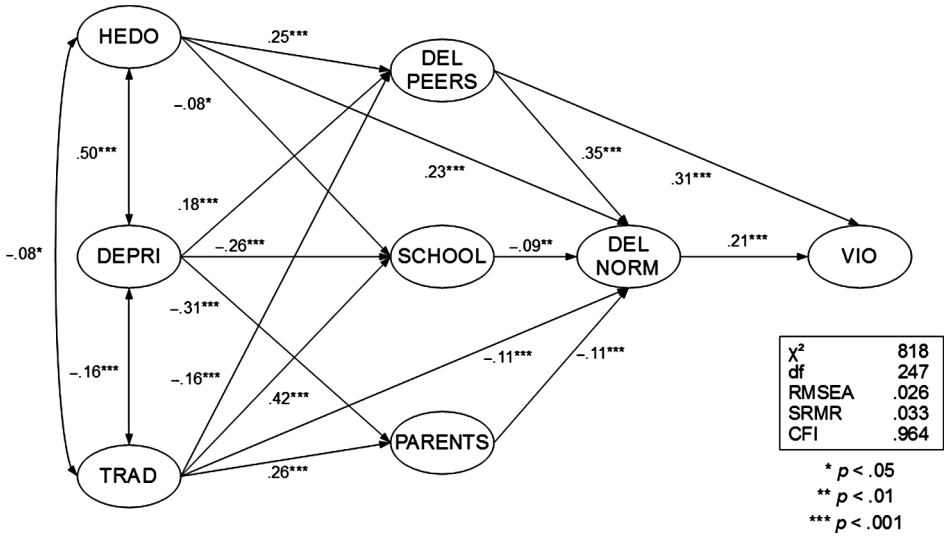

Figure 3. Structural dynamic model of adolescent violent delinquency: Cross-sectional data at age 15, Duisburg 2004 (n = 3.339)

The piecewise parts represent the increase and decrease in the rate of adolescent violent delinquency. Fit statistics (*RMSEA* = .025, *SRMR* = .038, *CFI* = .943) not only reveal good results, but also confirm the piecewise specification to be the most adequate compared with other types of trajectory models (e.g. linear or quadratic growth curve models; see Bollen and Curran, 2006). Means and variances for the intercept and slope factors indicate (1) meaningful change in the rate of violent delinquency and (2) considerable variation around the growth factor means (t-value in brackets), although the parameter values themselves are not very strong: $\alpha_{\eta 1}$ = .183 (10.81), $\alpha_{\eta 2}$ = .058 (2.82), $\alpha_{\eta 3}$ = –.034 (–4.52), $\zeta_{\eta 1}$ = .160 (5.17), $\zeta_{\eta 2}$ = .151 (1.90), $\zeta_{\eta 3}$ = .029 (2.29). However, once the explanatory variables are included, the piecewise trajectory specification fails to replicate significant slope factor means and variances on account of the explanatory part of the time-variant variables and time-invariant covariates (gender, school type and migration background).[13]

Thus, the specification of the entire model could be reduced to a random intercept model without additional slope factors. Fit statistics for the entire modified model are quite satisfying (*RMSEA* = .024, *SRMR* = .048, *CFI* = .954). With the proposed random intercept model, no meaningful change in the mean rate of violent delinquency is assumed. Thus, the effects of time-invariant covariates (gender, school type and migration background) correspond to the level of violent delinquency at t_1. However, only gender revealed a weak negative effect (β = –.08), indicating that males have a higher rate of delinquency at t_1 than females. The small coefficients for the time-invariant covariates gender, school type and migration mean that females as well as males, respondents with a higher school status as well as respondents with a lower school status, and migrants as well as non-migrants follow the same structural pattern when committing violent acts.[14]

The structural analysis was carried out with hedonistic value orientations (HEDO), attachment to violent peers (PEERS) and pro-violent norms (NORM) as time-variant exogenous variables. Figure 4 illustrates all estimated cross-sectional and only significant cross-lagged standardized parameters as well as correlations between these constructs at t_1. The structural-level effects of the model are presented in three subsections: stabilities of the constructs (Markov processes), effects within the cross-sections and cross-lagged effects.

Stability effects (Markov processes). Overall, the direct stability effects for all three constructs are strong. In particular, the stabilities of the hedonistic value orientations reveal the highest coefficients (β .40 to .55). Generally speaking, the different social structural and normative components remain stable to a remarkable degree during adolescence. It must, however, be kept in mind that these are only first-order Markov processes; that is, the stability at a given time point is mainly reproduced by the directly preceding time point. Long-term stability effects are indirect rather than direct, in particular for (hedonistic) value orientations.

The stability of violent delinquency over time has not been estimated. The interpretation of such autoregressive effects within the latent growth modelling framework is, with respect to the dependent variable, under discussion (see Bollen and Curran, 2004). A tentative investigation of the autoregressive effects of violent delinquency in only a Markov model (that is, without factors accounting for potential growth processes) indicated, however, that the stability coefficients for violent delinquency are much weaker (and partly also not significant) than for the socio-structural and normative components of the model.

Cross-sectional effects. Regarding the findings from cross-sectional analyses, the observed pattern of effects among the theoretical explanatory variables is reproduced in the entire longitudinal model. Moderate to strong coefficients were estimated for the effect of hedonism on peers (β .16 to .28) and peers on norms (β .23 to .36). However, the moderate effect of hedonism on norms is observable only at ages 14 and 15 (β = .25 and β = .17, respectively).

As theoretically expected, pro-violent norms show a significant direct impact on violent behaviour, which decreases remarkably at ages 15, 16 and 17 (β = .11, β = .11, β = .08, respectively), whereas the violent peer-group context influences violent behaviour on a constantly moderate to stronger level from age 14 to 17. Hence, during adolescence – regarding the learning context of violent behaviour – interactions within violent peer groups appear to be more important than processes of norm internalization. Since hedonism had no direct effect on violent behaviour in the cross-sectional analyses, this particular structural path was not further examined for reasons of parsimony. Indirect cross-sectional effects are mostly significant but weak.

Cross-lagged effects. In longitudinal perspective, cross-lagged effects in terms of a self-reinforcing constellation of delinquent communication could be expected theoretically. For example, violent delinquency at time_1 leads to the reinforcement of delinquent peer-group association and pro-violent norms at time_2, which, in turn, reinforces violent

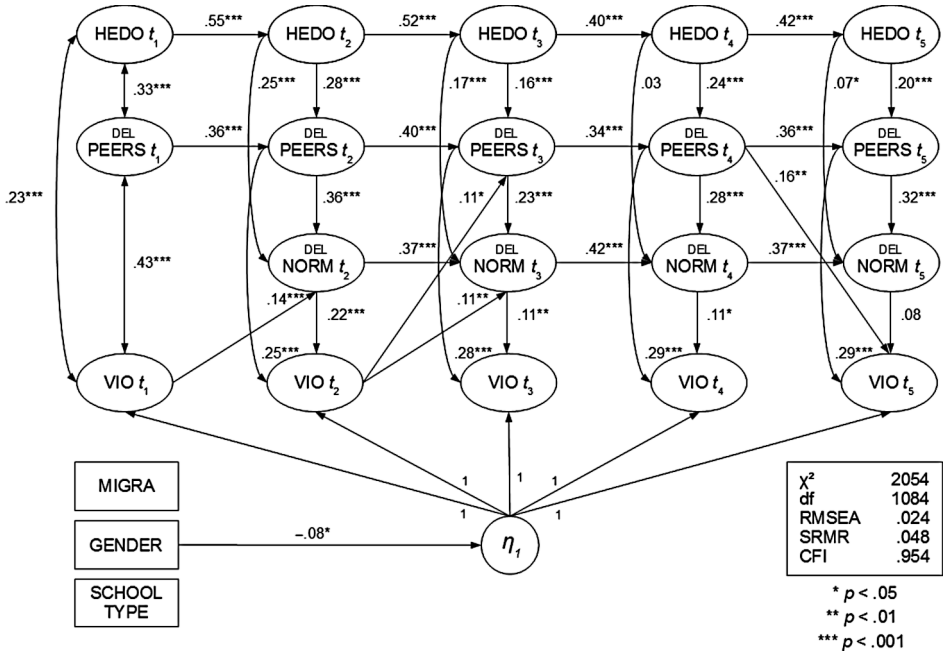

Figure 4. Combined Markov and latent growth model: Duisburg 2002 to 2006, five-wave panel data, age 13 to 17 (n = 1552)

behaviour at t_3. However, such (reciprocal) effects only partly emerge in this longitudinal analysis of violent delinquency, although they were more pronounced in former analyses for total delinquency (with tradition as the most influential value orientation; Boers et al., 2009b: 281–4). Thus, violent delinquency at ages 13 and 14 enhances pro-violent norms at age 14 or 15, respectively (β = .14 and β = .11); in addition, attachment to violent peers at age 15 is affected by violent delinquency at age 14 (β = .11). However, this does not have an impact on violent delinquency at age 15 or 16, respectively. A 'peer on violence' cross-lagged effect exists only between ages 16 and 17 (β = .16). Also, the specific indirect paths from $PEERS_{t-1}$ to VIO_t via $PEERS_t$ may support the assumption of a self-reinforcing constellation of delinquent communication. These indirect effects are, however, not reciprocal and range from β = .09 to β = .11 (not displayed in Figure 4). All reported cross-lagged coefficients are significant but weak, which is not unexpected for longitudinal inter-variable effects in a complex multivariate model.

Trajectories of delinquency

The analysis of unobserved heterogeneity in the development of self-reported delinquency was carried out with the entire panel sample (males and females) by means of latent class growth analysis (LCGA). Delinquency was operationalised using the total offence rate, an additive index of 16 offences.[15]

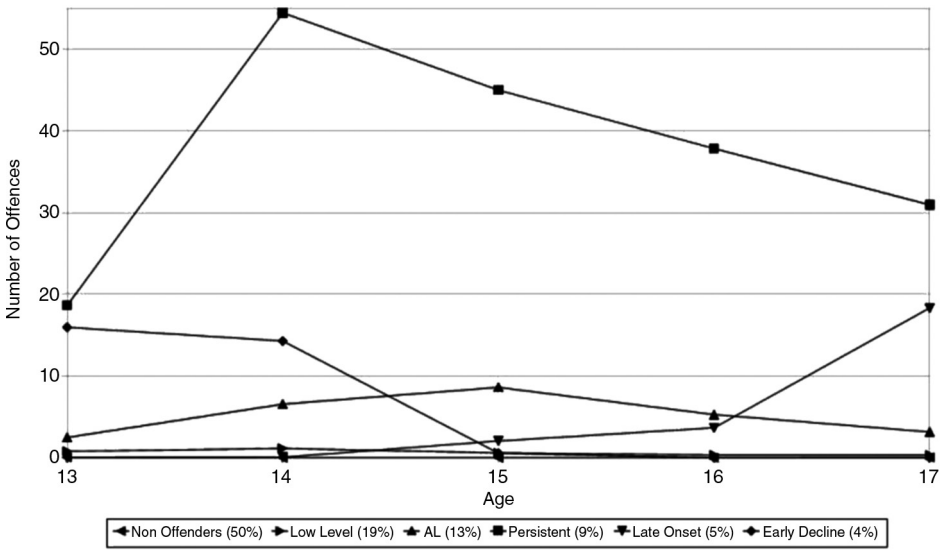

Figure 5. Offender trajectories (LCGA), observed data: Duisburg 2002 to 2006, five-wave panel data, age 13 to 17 (n = 1552)

The mean frequency values across the five measurement points, from age 13 to 17, showed a clear curvilinear development, which peaked at age 15 and decreased constantly thereafter. A cubic term was deemed necessary in the developmental pattern of the LCGA. The distributions of self-reported delinquency showed a high percentage of 'zeros' as well as significant overdispersion. For this reason, annual delinquency measures were treated as zero inflated negative binomial distributed count variables (Hilbe, 2007). The resulting best model was a six-class cubic LCGA that was selected on the basis of model fit indices (AIC = 20255.232; BIC = 20458.430; adjusted BIC = 20337.713; LMR-LRT = 28.127, $p < .750$; entropy = 0.667) and a substantive interpretation of the classes. Note that the LMR-LRT indicates rejection of the six-class solution in favour of a solution with one class fewer. Contrary to this single statistical indicator, however, the appearance of a sixth class was expected and can be substantially interpreted. The resulting curves for the six classes are clearly distinguishable in their developmental trajectories (Figure 5).

The largest class consists of *non-offenders*: 50 percent of *all* panel respondents (n = 772) show almost no delinquent behaviour between ages 13 and 17. *Low-level offenders* (19 percent, n = 303) remain constantly on a low rate of delinquency, whereas *adolescence-limited offenders* (AL; 13 percent, n = 203) follow a curvilinear trajectory at an all in all moderate level of delinquent activity that peaks at age 15 and decreases thereafter. *Late-onset offenders* (5 percent, n = 83) are characterized by a low offending rate till age 16 and a remarkable increase thereafter. On the other hand, *early declining offenders* (4 percent, n = 59) show a somewhat higher level of offending, in particular for violence and vandalism, at ages 13 and 14 which then declines rapidly, approaching a

Table 2. Offence-specific incidence rates for different offender trajectories: Duisburg 2002–2006, five-wave panel data, age 13 to 17

Offence[a]	Age				
	13	14	15	16	17
Non-offenders (*n* = 772)					
Property	0.03 (0.16)	V0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.01 (0.10)
Violence	0.01 (0.09)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.01 (0.09)
Vandalism	0. 01 (0.08)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.01 (0.09)
Low-level offenders (*n* = 303)					
Property	0.29 (0.84)	0.45 (0.97)	0.29 (0.68)	0.14 (0.42)	0.17 (0.64)
Violence	0.21 (0.65)	0.30 (0.80)	0.13 (0.48)	0.11 (0.38)	0.07 (0.38)
Vandalism	0.28 (0.85)	0.39 (0.98)	0.17 (0.55)	0.09 (0.34)	0.07 (0.40)
Adolescence limited (*n* = 203)					
Property	0.91 (2.00)	2.65 (4.71)	3.35 (6.16)	2.20 (4.56)	1.05 (3.15)
Violence	0.58 (1.59)	1.11 (2.24)	1.34 (3.71)	1.00 (3.14)	0.62 (2.68)
Vandalism	0.99 (2.52)	2.72 (5.32)	3.65 (8.28)	1.71 (5.57)	1.28 (4.35)
Early decliners (*n* = 59)					
Property	2.86 (5.83)	4.42 (9.92)	0.24 (0.57)	0.00 (0.00)	0.00 (0.00)
Violence	4.44 (11.22)	2.75 (6.04)	0.08 (0.34)	0.00 (0.00)	0.00 (0.00)
Vandalism	8.46 (25.03)	6.41 (10.39)	0.24 (0.62)	0.00 (0.00)	0.00 (0.00)
Late starters (*n* = 83)					
Property	0.00 (0.00)	0.01 (0.11)	0.99 (2.19)	1.28 (4.05)	3.47 (9.17)
Violence	0.00 (0.00)	0.01 (0.11)	0.27 (0.92)	0.52 (1.44)	2.13 (11.34)
Vandalism	0.00 (0.00)	0.04 (0.19)	0.78 (1.75)	1.86 (4.26)	7.48 (26.94)
Persistent offenders (*n* = 132)					
Property	6.27 (12.93)	11.28 (22.72)	15.80 (32.45)	8.95 (21.35)	6.35 (17.85)
Violence	4.11 (8.64)	6.56 (16.81)	6.92 (21.68)	7.04 (14.91)	5.14 (15.43)
Vandalism	8.04 (17.50)	19.41 (34.41)	18.10 (35.22)	16.73 (36.88)	13.72 (37.38)

Notes: *n* = 1552. Standard deviations in brackets.

[a] *Property:* theft of and out of cars, out of a vending machine, of bicycles, other theft, burglary, shoplifting, fencing. *Violence:* robbery, purse snatching, assault with and assault without a weapon. *Vandalism:* graffiti, scratching, damage to property.

near zero level at age 16. Finally, *persistent offenders* (9 percent, *n* = 132) share a similar starting level with *early decliners* at age 13, but exhibit a different developmental pattern: after rapidly increasing to a peak at age 14, their offending rate steadily declines by almost half, but remains up to two and a half times higher over all observed ages than for all other trajectories. In an analysis carried out for males only, the three trajectories of early declining, adolescent-limited and late-onset offenders showed the same developmental pattern, but on a somewhat higher level of offending.

For purpose of further interpretation, the delinquency structure of each class is described by offence-specific incidence rates[16] aggregated for property, violent and vandalism offences (Table 2). Although our analysis covers only the period of adolescence and the sample was not stratified towards more delinquency-prone subpopulations (such

as a disproportionate number of offenders or of respondents from disadvantaged neighbourhoods, or males only), the progression of the self-reported delinquency trajectories is, in general, quite similar to results found in other studies (see Lacourse et al., 2008: 236–41; Odgers et al., 2007: 479; Thornberry, 2005: 164;). First, even for persistent offenders, the frequency rates for all offences are already decreasing remarkably during adolescence. Second, early-onset offenders obviously do not consist only of persisters but, to a significant extent, include early decliners as well (one-third in our study, more than two-thirds in other studies that cover an age period up to the mid-twenties – Odgers et al., 2007: 479; Lacourse et al. 2008: 236–8). Third, from the end of adolescence onwards, late-onset offenders too approach the offending level of persisters (see also Odgers et al., 2007: 479; Thornberry, 2005: 170–72).[17] Thus, it appears that, at different age stages, high-rate offenders do not constitute a homogeneous offender group. Finally, there seems to exist no specialization for certain offence types. Through all stages of high-rate offending, higher levels of offending are performed for all offence types. For violent offenders, in particular, this means that they are violent offenders in the sense that they commit the violent offences; however, looking at their entire offending pattern, they are versatile offenders.

Discussion

The conceptual distinction between distal and proximal explanatory factors turned out to be useful in analysing the differential impact of structural and normative components on violent delinquency during adolescence. Cross-sectional analyses of single age stages from 14 to 17 years have already shown the underlying importance of social structural components, which were understood as value-differentiated social milieus. They had a structuring impact on the immediate socializing environment of families, schools and peer groups, which, subsequently, had an influence on whether peer-group attachment or offence-specific norm orientations develop into pro-violent or conforming peer-group activities or into pro-violent or conforming norm orientations, respectively. This structuring impact is a *differential* structuring impact: different social value orientations open different developmental pathways – into conformity or into delinquency.

Traditional value orientations marked a pathway into conformity. They led to strong affirmative school and family bonds as well as to non-violent peer attachment, which corresponds with results already observed in an analysis of total delinquency (Boers et al., 2009b). Within different social bonds, a positive school affiliation (school climate, relation to and supervision by teachers) appears to be the primary factor for successful normative socialization during adolescence. The impact of deprived value orientations (dissatisfaction with life chances, withdrawal from conventional society) was restricted mainly to an erosion of school and family bonds, with no stronger relations to pro-violent norms or violent delinquency.

Only hedonistic value orientations structured a stronger pathway into violent delinquency through an affiliation to a violent peer group and the acceptance of delinquent norms. Neither school bonding nor parental attachment was substantially connected with hedonistic orientations. For hedonistic adolescents, violent peers appear to provide the major learning context for pro-violent norms and violent delinquency. Whether this is a

reciprocally interacting context of delinquent communication, as suggested in Thornberry's interactional theory (Thornberry and Krohn, 2005) and Sampson and Laub's (1997) assumption of cumulative disadvantage, can be examined only in a longitudinal analysis. On the basis of the cross-sectional findings, the longitudinal analysis (based on a combined Markov and growth curve model) focused for the explanation of violent delinquency only on hedonism, pro-violent peers and delinquency-specific norms as the so far most important components of the structural dynamic model.

Longitudinal results showed strong stability effects (first-order Markov processes) for all analysed constructs, with the strongest for hedonism. This indicates that social dispositions and normative orientations do not change significantly during adolescence. This is quite remarkable since one might expect that general values and delinquency-specific norm orientations would undergo more change and discontinuity during adolescence.

The analysis of a Markov model revealed only that autoregressive effects were much weaker for delinquency than for the structural and normative components. This would correspond with the common knowledge that self-reported delinquency, even in cases of violence, is an episodic phenomenon, to a certain degree normal but eventually atypical, in the course of socializing processes. Some degree of continuity has, however, usually been observed in official crime developments (e.g. Hermann and Kerner, 1988; Höfer, 2003: 131–47; Piquero et al., 2007: 46–57, 142–57). This may lead to the assumption that continuity within official crime data is less the result of individual delinquent behaviour, but also reflects selective and self-referent decision-making processes within the criminal justice system, i.e. an increase in detection and conviction risks for already registered offenders. This assumption will be tested in future when official crime data have finally been collected for the panel participants.

The hypothesized reciprocal relations between pro-violent peers, norms and violent delinquency were not comprehensively confirmed in the longitudinal analysis. Nevertheless, there were reinforcing effects from prior violent delinquency to violent peer-group attachment and pro-violent norms between ages 13 and 14 and ages 14 and 15, but here peers and norms did not significantly affect the subsequent violent delinquency. Only violent peer attachment at age 16 reinforced violent delinquency at age 17, and it was not strengthened by prior violent delinquency. In contrast to the cross-sectional analyses, the longitudinal analysis revealed that the direct impact of pro-violent peer attachment on violent delinquency turned out to be notably stronger than that of pro-violent norms. It appears that, for adolescents who are involved in a delinquent peer group, the activity dynamics of the peer group are more important – during this developmental stage – than normative self-reflection of violent behaviour ('we don't really think about what we are doing, it just happens out of the group').

Finally, a trajectory analysis (based on latent class growth analysis) revealed six latent classes of adolescent delinquent and non-delinquent pathways: non-offenders, low-rate offenders, adolescence-limited offenders, early decliners, late-onset offenders and persistent offenders. Although persistent offenders – during adolescence – performed by far the highest and most continuous level of, in particular, violent offending, the progression of trajectories in this and other studies on self-reported delinquency (see Lacourse et al., 2008; Odgers et al., 2007; Thornberry, 2005) may put still-common assumptions about the typology, long-term continuity and predictability of persistent offenders (see Blumstein

et al., 1986; Moffitt, 1993) in a somewhat different perspective (see Boers, 2009: 581–91; Capaldi and Wiesner, 2009; Sampson and Laub, 2009: 235–7; Wikström and Treiber, 2009). Even for persistent offenders, the frequency rate of all offences is already decreasing during adolescence. Although persistent offenders committed most of the violent offences, they were not specialised violent offenders. Besides persistent offenders, early-onset offenders consist also of early decliners, which questions the assumption that early onset is 'one of the best predictors of a future criminal career' (Farrington et al., 1990: 329; see, recently, Ezell and Cohen, 2005: 6; Odgers et al., 2007: 476). However, to a remarkable extent, not only early but also later high-rate offenders do not consist only of persistent offenders. Rather, late-onset offenders join in by the end of adolescence. Over the years, high-rate (or intensive) offenders are thus characterized by a certain amount of heterogeneity, which makes their prediction harder.

Notes

1 See also Elliott (1985: 133) and Akers (1998: 322) for the conceptual distinction between distal and proximate structural factors. Essentially, distal factors are those factors that lie in the background, whereas proximate factors refer to those factors that rather more immediately influence behaviours.

2 In criminology, theoretical conceptions that consider the impact of formal social control interventions are usually called *interactionist* (i.e. mainly the labelling approach). Although not questioning the interactive character of such a control process, we prefer the term *constructivist* here because it emphasizes explicitly that the public or official perception of a behaviour as 'criminal behaviour' or of delinquent development as a 'criminal career' is based on social constructions. For the distinction between different perspectives in criminological life-course research, see Boers (2009); for major studies in criminological life-course research, see Boers et al. (2009a); Farrington (2005); Liberman (2008); Sampson and Laub (2005); Thornberry and Krohn (2003). Further information about the CrimoC study can be found at www.crimoc.org.

3 For a recent development of a criminological theory with different explanatory levels, see Wikström's (2005) situational action theory, which takes an individual, ecological and developmental level into account.

4 For analyses of these aspects, see Pollich (2007) and Wittenberg (2007).

5 'Problem alleviation' can in principle also be achieved by a delinquent coping strategy – as long as delinquency turns out to be a successful strategy (in terms of, for example, financial, emotional or social advantages), and as long as one can deal successfully with detection and detention risks. This will, however, be more likely the case in economic than in juvenile crime.

6 See Boers (1997) for more details, and Le Blanc (2005) for an attempt to utilize chaos theory for a longitudinal analysis of delinquency.

7 As the average number of offences per offender, the offender frequency rate λ represents the individual intensiveness of offending. Persons reporting more than half of all offences and more than three-quarters of all violent offences are defined as intensive offenders (Boers, 2008: 346–50).

8 The request for information about third parties was not permitted. Meanwhile the participants are asked about such information themselves.

9 To ask what activities one undertakes when together with one's peers is different from the usual operationalization of delinquent peer-group attachment. Usually, respondents are asked for the number of friends who have engaged in certain delinquent acts (e.g. Elliott et al., 1989: 143). Whereas the latter focuses more on the number of single delinquent friends, the former puts more emphasis on the group activities and may be a bit closer to the concept of a 'delinquent peer group'.

10 In contrast to the offender frequency rate (λ), the additive composite used here refers to the frequency of offences in the entire population (incidence rate) in order to include information of non-offenders. In the panel data, this incidence rate for violent offending was 35 percent lower on average than in the cross-sectional data.

11 All reported structural models were estimated using full information maximum likelihood (FIML) estimation. A simulation study by Enders (2001) showed no considerable bias for FIML parameter estimates even under conditions of extreme skewness and kurtosis in structural equation models with missing data. Nevertheless, Enders recommends correctional procedures (e.g. adjusted, robust standard errors). A robust FIML estimator was used for all reported structural models.

12 This conforming pattern was characterized by strong positive effects of traditional value orientations on bonds to school. A positive school climate, in turn, served as a learning environment for conforming general normative orientations. This normative setting proved to be the only significant and direct predictor of total delinquency (Boers et al., 2009b).

13 A combined Markov and growth curve model with a piecewise trajectory specification of total delinquency is discussed in Boers et al. (2009b: 280–4). Here, growth factor means and variances (*t*-values in brackets) continued to be significant after considering time-variant and time-invariant predictors: $\alpha_{\eta 1}$ = .43 (18.63), $\alpha_{\eta 2}$ = .022 (8.35), $\alpha_{\eta 3}$ = –.009 (–9.13), $\zeta_{\eta 1}$ = .35 (10.43), $\zeta_{\eta 2}$ = .23 (4.05), $\zeta_{\eta 3}$ = .05 (4.03).

14 For the basic distributions there are, of course, considerable differences: boys or respondents with a lower school status reported more violent offences than girls or respondents with a higher school status, respectively. However, for migrants, higher prevalence rates were found only in the case of violent male intensive offenders (Boers et al., 2006).

15 The offences are listed in the notes to Table 2; the total delinquency index in the LCGA analysis also included drug dealing. For the LCGA analysis, offences were not logarithmized.

16 Offence-specific incidence rate = the number of specific offences divided by the number of class members.

17 Late-onset offenders could up to now be observed only in latent class analyses of self-reported delinquency. They constitute a rather new phenomenon for life-course criminology, whose explanation has just started (see Farrington et al., 2006: 51–62; Lacourse et al., 2008: 236–68; Odgers et al., 2007: 479–81; Thornberry, 2005: 170–6).

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