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EMPIRICAL RESEARCH

Age and the Explanation of Crime, Revisited

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Abstract Age is one of the most robust correlates of criminal behavior. Yet, explanations for this relationship are varied and conflicting. Developmental theories point to a multitude of sociological, psychological, and biological changes that occur during adolescence and adulthood. One prominent criminological perspective outlined by Gottfredson and Hirschi claims that age has a direct effect on crime, inexplicable from sociological and psychological variables. Despite the attention this claim has received, few direct empirical tests of it have been conducted. We use data from Pathways to Desistance, a longitudinal study of over 1,300 serious youthful offenders (85.8 % male, 40.1 % African-American, 34.3 % Hispanic, 21.0 % White), to test this claim. On average, youths were 16.5 years old at the initial interview and were followed for 7 years. We use multilevel longitudinal models to assess the extent to which the direct effects of age are reduced to statistical and substantive non-significance when constructs from a wide range of developmental and criminological theories are controlled. Unlike previous studies, we are able to control for changes across numerous realms emphasized within differing theoretical perspectives including social control (e.g., employment and marriage), procedural justice (e.g., perceptions of the legitimacy and fairness of the legal system), learning (e.g., gang membership and exposure to antisocial peers), strain (e.g., victimization and relationship breakup), psychosocial maturity (e.g., impulse control, self-regulation and moral disengagement), and rational choice (e.g., costs and rewards of crime). Assessed separately, these perspectives explain anywhere from 3 % (procedural justice) to 49 % (social learning) of the age-crime relationship. Together, changes in these constructs explain 69 % of the drop in crime from ages 15 to 25. We conclude that the relationship between age and crime in adolescence and early adulthood is largely explainable, though not entirely, attributable to multiple co-occurring developmental changes.

Keywords Age · Crime · Offending · Multilevel regression · Time-varying covariates

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Introduction

It is well established that antisocial and criminal activity increases during adolescence, peaks around age 17 (with the peak somewhat earlier for property than for violent crime), and declines as individuals enter adulthood. Evidence for this so-called "age-crime curve" has been found across samples that vary in their ethnicity, national origin, and historical era (Farrington 1986; Farrington et al. 2013; Moffitt 1993; Piquero et al. 2003, 2007). Because antisocial behavior is far more common during the late teens than during other periods of development, questions concerning the causes and correlates of delinquent and criminal behavior have occupied a central role in the study of adolescence for as long as scientists have studied this stage

of life. Indeed, adolescents' involvement in crime was a major focus of G. Stanley Hall's (1904) landmark treatise on adolescence, and he specifically noted the curvilinear relationship between age and crime, with offending more common in adolescence than before or after (Arnett 2006). The replication of this relationship across time, social contexts, demographic groups, and crime types led two criminologists, Hirschi and Gottfredson (1983), to conclude that the relationship is invariant and cannot be explained by sociological or psychological variables. Rather, they held that age has a direct effect on crime, attributing the decline to "the inexorable aging of the organism" (Gottfredson and Hirschi 1990, p. 141). Despite the firestorm of critical discussion these assertions generated (Blumstein et al. 1986; Britt 1992; Greenberg 1985; Greenberg 1994; Tittle 1988), no study has provided evidence to refute them.

Only a few studies have directly assessed Hirschi and Gottfredson's claim that sociological and/or psychological factors cannot account for the age/crime relationship (Loeber 2012), which we refer to as the inexplicability hypothesis. Noting this shortcoming, Osgood (2005) highlighted the importance of this issue for criminology and recently observed (2012) that little effort has been put to "determining its source" (p. 5) and that "more research [should be] aimed at determining why crime rates differ with age" (p. 6). Osgood (2005) suggested a specific method to address the age-crime relationship. Specifically, variation in crime can be partitioned into the direct age effect and other time-varying components using a multilevel model with the linear and curvilinear effects of age and time-varying covariates examined simultaneously. If the coefficients for age can be reduced to substantive non-significance with the introduction of theoretically-motivated covariates, the age-related changes that account for the age-crime curve are identified. To date, no research has taken up Osgood's (2005, 2012) suggestion to assess the extent to which time-varying variables can explain the age-crime curve.

The purpose of the present study is to re-engage and re-enter the debate over "one of the most interesting and important challenges of research on crime and the life course…explaining the age-crime curve" (Osgood 2005, p. 209). To undertake this task, we use data from Pathways to Desistance, a longitudinal study of over 1,300 youthful offenders from Philadelphia and Phoenix. Participating youth were at least 14 years old and <18 years old at the time of their study index petition and were found guilty of a serious offense (predominantly felonies, with a few exceptions for some misdemeanor property offenses, sexual assault, or weapons offenses) in either the juvenile or adult system in each locale and were followed for a period of 7 years (Mulvey et al. 2004; Schubert et al. 2004). This dataset provides an important and unique opportunity to examine the longitudinal impact of a wide range of time-varying life events, circumstances, and characteristics that change with age; following Osgood (2012), our objective is to identify "which [of them] account for the dramatic shifts in crime rates over the life course" (p. 8). In the context of previous age-crime curve research, this study provides a strong step forward. Before we present the results of our analysis, we provide a brief overview of the age and crime issue, some of the key ensuing commentary and research, and a more detailed discussion about the four studies that provided more direct investigations of the issue (Osgood et al. 1996; Stolzenberg and D'Alessio 2008; Tittle and Grasmick 1997; Warr 1993).

Age and Crime

Crime bears a robust relationship with age, rapidly peaking in the late teen years, with a decline nearly as rapid soon thereafter, and continued declines throughout adulthood. In the seminal article on this topic in criminology, Hirschi and Gottfredson (1983) made three provocative claims. First, noting the appearance of the age-crime curve across history, cultures, and demographic groups, they asserted that it is invariant across these categories (the *invariance hypothesis*). Second, they asserted that the covariates of crime are the same at all ages (the *non-interactive hypothesis*). This assertion dovetails with their later theoretical position that self-control is a relatively stable trait after childhood and is the major explanation of between-individual variation in crime at all ages (Gottfredson and Hirschi 1990). Finally, perhaps most provocatively, they claimed: "the age distribution of crime cannot be accounted for by any variable or combination of variables currently available to criminology" (p. 554) (the *inexplicability hypothesis*). That is, despite the wealth of criminological theories and empirical research on developmental changes that occur in adolescence and early adulthood, these explanations are not sufficient to explain why crime changes so dramatically before and after late adolescence. Next, we review evidence for Hirschi and Gottfredson's claims with particular emphasis on the inexplicability hypothesis.

The Invariance Hypothesis

The invariance hypothesis has received much criticism (Greenberg 1985; Steffensmeier et al. 1989), but has persisted partly due to ambiguity in its original statement. Hirschi and Gottfredson (1983) acknowledge minor variations in the age-crime curve, but do not take this as evidence against their invariance hypothesis because of the remarkable robustness of the overall pattern. In addition to early evidence on variation in the shape of the age-crime

curve for particular offenses or subpopulations (Greenberg 1985; Steffensmeier et al. 1989), recent analyses of individual offending patterns using group-based trajectories uncover subpopulations of persons who follow markedly different life-course trajectories of crime (see Nagin and Land 1993). For example, Piquero et al.'s (2007) group-based analysis of the Cambridge Study in Delinquent Development identified five distinct trajectories, each with a unique age-crime profile to age 40, and a recent update to age 56 continues to reveal five distinct trajectories (Farrington et al. 2013). Laub and Sampson (2003) estimated the most comprehensive set of trajectory analyses of official arrest records among a group of offenders from childhood to age 70. Their findings showed that, while the aggregate age-crime relationship emerged as Hirschi and Gottfredson described—peaking in the late teens and then gradually decreasing thereafter, there were differences in the shape and level of offending across crime types, as well as different age-crime relationships across offender groups, with some group trajectories peaking in the late teens and others in the early or mid 20s, as well as a high-rate chronic group with a higher overall volume of offending, a peak in the late 30s, and desistance throughout their 40s.

These and related group-based trajectory studies also have permitted the analysis of whether all offenders have the same age-crime profile, and the overall results from these studies indicate that, contrary to Hirschi and Gottfredson's assertion, the relative rankings of criminal behavior across groups is not the same over time. That is, group-based offending patterns do not conform to the same temporal pattern nor do they conform to similar volume of offending and type of offending patterns (Jennings and Reingle 2012; Piquero 2008; Massoglia 2006; Nieuwbeerta et al. 2011; Petras et al. 2010). In his review of this literature, Greenberg (2008) concludes:

> A strict interpretation of Hirschi and Gottfredson's claim that the age-crime distribution is universal cannot be sustained. The distribution varies by time and place, at times substantially. It varies with offense and from one individual to another. There is evidence that increasing levels of self-control contribute to the decline of crime with age, but other factors contribute as well, including social bonds—which constitute a form of social control distinct from self-control. (p. 48)

Anticipating this criticism, Gottfredson and Hirschi (1990) question whether scholars should focus on what by all accounts is a remarkably resilient age-crime relationship or on the minutiae of limited variation in that relationship between people, places, times, and types of crime.

The Non-interactive Hypothesis

The non-interactive hypothesis—that the correlates of crime do not vary with age—also has been subjected to substantial scrutiny from a variety of sources (e.g., Tittle and Ward 1993). Tittle and Grasmick (1997) directly tested the hypothesis using a sample ranging in age from 18 to 90. While they found several correlates of crime that interacted with age, because of the number of interactions tested, they acknowledge these could have arisen by chance. Uggen (2000) found that the effect of employment assistance on recidivism varied with age, directly contradicting the non-interactive hypothesis. From a theoretical perspective, the non-interactive hypothesis implies symmetrical causation: the cause(s) of crime initiation must be the same as the cause(s) of continuing to commit crime and desistance from crime (Uggen and Piliavin 1997). This notion is directly contradicted in Thornbery's (1997) interaction theory, and continues to be called into question by theoretical and empirical work on criminal desistance that identifies processes unique to criminal desistance (Farrall and Bowling 1997; Giordano et al. 2002; Maruna 2001).

The Inexplicability Hypothesis

Most pertinent to the current study, the inexplicability hypothesis has been the subject of considerable controversy and debate within criminology (Osgood et al. 1996; Stolzenberg and D'Alessio 2008; Tittle and Grasmick 1997; Warr 1993). Warr (1993) used five waves of data from the National Youth Survey in order to assess whether differential association theory could explain the age distribution of crime. Among the many findings of his analysis, which were based on a pooled-data approach combining all persons aged 11–21, two results stand out. First, several measures of peer relations, including exposure to delinquent peers, time spent with peers, and loyalty to peers, followed much of the same pattern that the age/crime relationship does as it spans the teenage and early adult years. For example, in early adolescence, there is little exposure to delinquent peers, but in middle to late adolescence, exposure to delinquent peers increases, only to decline in early adulthood. Second, when Warr (1993) controlled for measures of peer influence he found that the effects of age on self-reported delinquency were "largely rendered insignificant" (p. 17). After controlling for differential association variables, the relationship between age and crime was substantially weakened, and for some offenses the relationship disappeared entirely (p. 35). This suggests that delinquent peer exposure is a major part of the explanation of the age-crime curve.

Osgood et al. (1996) used five waves of data from the Monitoring the Future study of more than 1,700 18- to 26-year-olds to examine the longitudinal relationship between routine activities, such as unstructured socializing with peers in the absence of responsible authority figures, and individual offending (such as criminal behavior and substance use), and whether these routine activities were able to account for four key demographic correlates of crime: age, sex, academic performance, and socioeconomic status. Key features of their analyses were the use of longitudinal data, controlling for stable individual differences, and, most relevant to our study, their interest in "the potential of routine activities for explaining the relationship of age to deviant behavior" (p. 641). Two specific issues were examined: the extent to which unsupervised activities and unstructured socializing with peers were related to deviance; and the role of routine activities as a mediator between demographic variables and deviance. After finding that various routine activities were associated with deviance in mainly anticipated ways (i.e., unstructured socialization with peers tended to increase deviance), and that most leisurely routine activities consistently declined as the sample transitioned to early adulthood, the authors asked whether age-related changes in routine activities could explain some portion of the age trends in deviance. Results showed that routine activities explained a substantial portion of the age-related changes in various forms of criminal and deviant behavior, reducing the age trends in those behaviors "by 27 percent [criminal behavior] to 48 percent [marijuana use]" (p. 647). Considered alongside Warr's (1993) earlier work, this study adds an understanding of what type of delinquent peer exposure may account for a portion of the age-crime curve. However, there still remained "substantial portions of some of [the] relationships to be explained" that were unattributable to routine activities (p. 652).

Tittle and Grasmick (1997) examined Hirschi and Gottfredson's inexplicability hypothesis using cross-sectional data from the Oklahoma City Survey of 394 adults. A key feature of their investigation was the inclusion of subjects between ages 18 and 90, as well as the inclusion of ten correlates, many of which had not been previously investigated with respect to the age-crime curve. They assessed the ability of differences in self-control, opportunity, community integration, interpersonal integration, religiosity, stress, dissatisfaction, and self-esteem to explain the relationship between age and crime. The authors first showed that most of the explanatory variables varied by age such that they had the potential to explain the relationship between age and crime. Next, they tested the inexplicability hypothesis by assessing whether inclusion of a particular variable rendered the association between age and five crime types (cheating on taxes, minor theft, major theft, force, and fraud) insignificant. Three results stood out. First, no variable by itself was able to explain the age effect. Second, controlling for all ten of their covariates reduced the age-crime association minimally, with the largest reduction of 31 % for major theft. Third, three of the age-crime relationships (tax evasion, major theft, and crimes of force) became insignificant when all of the variables were considered simultaneously (p. 336). Tittle and Grasmick (1997) conceded "that age-crime associations do not easily yield to explanation" (p. 341) but their study did show that a broad theoretical approach to identify those changes that account for reduced crime with age is promising.

In an analysis of nearly half a million arrests drawn from the National Incident-Based Reporting System (NIBRS), Stolzenberg and D'Alessio (2008) tested Warr's (1993) assertion that the dynamics of peer relations account for changes in crime with age. Specifically, they tested the notion that co-offending accounts for the rapid increase and decline in crime around late adolescence. Contrary to expectations, they found that solo offending was the dominant form of offending at all ages, and that adolescence was not marked by a greater proportion of co-offending relative to other ages, concluding that co-offending patterns hold little value for explaining the age-crime curve. It is important to note, however, that these analyses were based on arrest data; whether a similar pattern would have emerged for self-reported offending is unknown.

Apart from its sparseness, the literature on explaining the age-crime curve is limited in several ways. First, only two of the four studies discussed above used longitudinal data, and only Osgood et al. (1996) took advantage of the longitudinal nature of their data to rule out unobserved stable heterogeneity. Explaining the age-crime curve using cross-sectional data risks confounding age effects with cohort effects. Second, only Tittle and Grasmick (1997) explored multiple theoretical explanations of the age-crime curve in a single study. The other studies constrained their focus to a single theoretical perspective, limiting the potential to fully explain the age-crime curve.

Although the literature has provided mixed evidence regarding the inexplicability hypothesis, Hirschi and Gottfredson's original position on the relationship between age and has gone unchanged (Gottfredson and Hirschi 1990) and has recently become even more entrenched: "We believe that age affects crime and that attempts to assign its effects to its byproducts or to some as yet unknown variable are a mistake" (Hirschi and Gottfredson 2008, p. 224, emphasis in original). While the debate on the meaning of the age-crime curve has animated criminological discourse for numerous decades, from a developmental psychology perspective this debate appears perplexing, since developmental scientists view an individual's age as necessarily a proxy for some unmeasured

variable with which it is correlated (e.g., some aspect of psychological functioning or some characteristics of the environment). Thus, if we are unable to identify factors that explain the relation between age and crime, it is not likely due to the fact that no such factors exist; instead, it is likely due to an omission in analytic models of the most important factors, which is plausible given how many different phenomena change during the stage of life during which the age-crime curve has been documented, including dramatic changes in biological (e.g., pubertal development), neural (e.g., maturation of the prefrontal cortex), cognitive (e.g., improvements in deductive reasoning), emotional (e.g., gains in impulse control), and interpersonal (e.g., changes in the significance of the peer group) functioning, as well as changes in the realms of education (e.g., completion of formal education), occupation (e.g., entrance into the labor force), finances (e.g., movement toward economic independence), romance (e.g., entrance into serious relationships), and residence (e.g., movement out of one's parents' home) (Steinberg and Morris 2001). Considered alone, as is usually the case in most studies of age and crime, changes in any single domain may not account for the age-crime curve; considered together, as we do in the present article, these changes may explain a great deal.

Current Study

Hirschi and Gottfredson's provocative hypothesis that no theory can explain the age distribution of crime remains an open question. Although there are many plausible and intuitive theoretical explanations for what changes as individuals age and how these changes lead to reductions in crime, because of limitations of prior research, most of these explanations have not been empirically verified. Prior studies on this topic have utilized a limited range of plausible correlates (Osgood et al. 1996; Stolzenberg and D'Alessio 2008; Warr 1993), used general population samples with limited offending rates (Osgood et al. 1996; Tittle and Grasmick 1997; Warr 1993), omitted violent offenses (Warr 1993), used cross-sectional data (Stolzenberg and D'Alessio 2008; Tittle and Grasmick 1997), and/or omitted time-varying covariates (Stolzenberg and D'Alessio 2008; Tittle and Grasmick 1997; Warr 1993). The present study seeks to overcome these limitations in several ways. First, we use a much wider range of variables from various theoretical frameworks. Second, our sampling frame is composed of serious youthful offenders followed for seven consecutive years, spanning the transition from adolescence to early adulthood. This is a population on which there is little data (see Loeber and Farrington 2012). Third, we focus on time-varying covariates such as changes in living situation, education, employment, exposure to antisocial peers, psychosocial traits, and the costs and benefits of crime, that permit analysis of the extent to which within-individual changes in key theoretical correlates account for the age-crime relationship. Fourth, we employ a measure of offending that includes 22 separate offenses, including both serious and non-serious offenses. Importantly, the theoretical models tested as well as the time-varying covariates measured in our analysis are drawn not only from previous research but also grounded in the larger risk/protective factor knowledge base on how these variables relate to offending over the life-course (see Loeber and Farrington 1998; Monahan et al. 2009b).

Data and Methods

This article uses data from a subset of the participants enrolled in the Pathways to Desistance study, a longitudinal investigation of the transition from adolescence to young adulthood among serious adolescent offenders (Mulvey et al. 2004; Schubert et al. 2004). The enrolled youth were at least 14 years old and <18 years old at the time of their study index petition and were found guilty of a serious offense (predominantly felonies, with a few exceptions for some misdemeanor property offenses, sexual assault, or weapons offenses) in the juvenile or adult court systems in Maricopa County, AZ or Philadelphia County, PA. A total of 1,354 adolescents were enrolled in the study, representing approximately one in three adolescents adjudicated on the enumerated charges in each locale during the recruitment period (November 2000 through January 2003). The baseline interview was conducted an average of 39.2 days (SD = 25.9) after participants' adjudication (for those in the juvenile system) or their decertification (i.e., waiver) hearing in Philadelphia or an adult arraignment in Phoenix (if in the adult system). Youth averaged 16.5 years of age at the time of the baseline interview (SD = 1.1). Follow-up interviews were conducted every 6 months for the first 3 years of the study and annually thereafter through 7 years. For this study, ten waves of information are available, spanning a 7-year period reflecting reports from age 14 through 25. More detail on study design and all variables used in this article can be found at the Pathways to Desistance website: http://www.pathwaysstudy.pitt.edu/.

Although not without shortcomings, these data provide a unique opportunity to investigate how people change from adolescence to adulthood and how these changes explain the relationship between age and crime. Their biggest strength is the breadth of theoretically-relevant sociological and psychological variables that are repeatedly measured in 10 waves across 7 years. Unlike previous studies, we are able to simultaneously assess the strength of constructs

from social control, social learning, strain, psychosocial maturity, rational choice and procedural justice theories of criminal behavior to account for the age-crime relationship. Also, the subjects included in the Pathways study consist of adjudicated youth. Community or school-based samples often have very low base rates of offending, particularly at later ages, and so have little variation to explain (Cernkovich et al. 1985; Weis 1986). The use of such a sample of adjudicated youth should not weaken our test of the inexplicability hypothesis, as Gottfredson and Hirschi (1990) claim that the age-crime curve reveals itself in every context, even within prison walls (p. 129). As most youths in the study are already around age 16 at the beginning of the survey, (and half are already 17), they are not likely to fall on the upward trending part of the age-crime curve. Although this is somewhat limiting, previous studies of the inexplicability hypothesis reviewed earlier have used data sources with individuals who are older than those in the Pathways Study (see in particular: Osgood et al. 1996; Tittle and Grasmick 1997). On balance, while certain elements of the data are not ideal, this study provides a strong advance over prior research in this area and lays the groundwork for future studies.

Dependent Variable

Consistent with the literature on the generality of offending (Gottfredson and Hirschi 1990; Jessor and Jessor 1977), we employ a measure of crime that encompasses a wide range of behaviors. We use a 22-item variety scale of self-reported offending based on the following offense types: destroying/damaging property, fire setting, burglary, shoplifting, trafficking in stolen property, credit card/check fraud, motor vehicle theft, selling marijuana, selling other drugs, carjacking, driving under the influence, paying for sex, rape, murder, shooting at someone (hit), shooting at someone (miss), armed robbery, unarmed robbery, beating someone badly enough they needed a doctor, fighting, beating up someone as part of a gang, and carrying a gun. Hirschi and Gottfredson (1995) stated "the best available operational measure of the propensity to offend is a count of the number of distinct problem behaviors engaged in by a youth (that is, a variety scale)" (p. 134). Because of desirable properties of crime variety as an indicator of antisocial activity, it is the most appropriate dependent variable for understanding the relationship between age and crime. For example, variation in variety scores is not overly driven by less serious items (unlike crime frequency, which is). At the same time, variety scores distinguish between less serious and more serious offenders (unlike dichotomies), and have high validity and reliability (Hindelang et al. 1981; Sweeten 2012).

Time-Varying Theoretical Constructs

Social Control

We include thirteen variables to capture changes in formal and informal controls that may account for changes in crime. We have several measures constructed from self-reports of household composition indicating who the youth is living with, including number of biological parents, spouse, and sexual partner (cohabitation). In addition, also from self-reports, we control for the number of biological children the youth has, regardless of where they live. Because social bonds also form in dating relationships, we include an indicator of romantic relationships during each recall period based on responses to the question "Are you currently involved in a serious romantic relationship?" Social bonds may also reside in institutions external to the family such as work and education. We control for self-reported employment and enrollment in school at each wave, as well as attainment of either a high school degree or GED and any post-high school license or degree. We also include self-reported involvement in *probation* as an indicator of formal social control. Tapping into the attachment component of control theory, we measure social support (Cullen 1994) using an 8-item variety score indicating the number of domains in which the youth can rely on caring adults ($\alpha = .84$). Finally, we include two measures related to commitment to conventional values. First, based on a single question, we control for the importance of avoiding trouble with the law, ranging from "not at all important" (1) to "very important" (5). Second, youths reported on the likelihood of avoiding trouble with the law from "poor" (1) to "excellent" (5).

Social Learning and Social Networks

We use an antisocial peers scale that averages responses to twelve 5-point Likert-scale questions on peer delinquency, indicating the proportion of one's peers who engage in delinquency, from "none of them" to "all of them" ($\alpha = .92$). Although this indirect measure of peer delinquency is widely used in criminology, it may not be as ideal as other, direct measures (asking peers directly) as youths may project their own behavior onto their peers (Young et al. 2011; Zhang and Messner 2000). We employ it because it is the best available measure in these data, but must caution that its strength as a predictor may be overstated in the results. We also control for antisocial peer pressure using a scale of seven questions indicating the proportion of friends who encourage the youth to engage in delinquency ($\alpha = .89$). Based on a separate set of ten questions, we include a resistance to peer influence scale (Steinberg and Monahan 2007) that captures the

willingness of youths to act independently of their friends ($\alpha = .75$). Although this is a measure of psychosocial maturity, we include it here to contrast it with the influence of reported peer pressure to commit delinquent acts. We include an indicator of gang membership, which may indicate participation in deviant social networks over and above measures of antisocial peers and their influence. Finally, we control for number of close friends, tapping into network size and potentially, network density. Youth responses to ten 4-point Likert-scale questions on the extent to which they receive interpersonal support from their five closest friends were averaged to create a friendship quality scale ($\alpha = .80$).

Strain

Our first indicator of strain—mobility—is a count of the number of places the youth has lived during the recall period, a simple indicator of disruption or potential stress. Youths also report on spells of homelessness, defined as "living in the streets or moving around place to place, staying with different people." *Direct* victimization variety includes six items: chased and thought might be seriously hurt; beaten up, mugged or seriously threatened by another person; raped or victim of attempted rape or other sexual attack; attacked with a weapon; shot at; and shot. The 7-item witnessing victimization variety scale includes the above items plus whether the youth had seen someone killed as a result of violence. We also include a self-report indicator of relationship breakup. Although this has been shown to be a predictor of delinquency (Larson and Sweeten 2012), the causal mechanisms are not established. It may operate via strain, social control or social learning mechanisms. We group it with strain indicators provisionally.

Psychosocial Functioning

We use three variables from the Weinberger Adjustment Inventory (Weinberger and Schwartz 1990): impulse control ($\alpha = .78$), suppression of aggression ($\alpha = .79$), and consideration of others ($\alpha = .76$). Each of these is an average of 5-point Likert scale items. Emotional self-regulation was measured using a modified version of Walden et al.'s (2003) Children's Emotion Regulation scale, an average of nine Likert items ($\alpha = .90$). An average of thirty-two 3-point Likert items was used as a scale of moral disengagement (Bandura et al. 1996). We measure future outlook using Cauffman and Woolard's (1999) Future Outlook Inventory, an average of eight items indicating the degree to which the youth considers future outcomes ($\alpha = .73$). Finally, psychosocial maturity is the mean of thirty 4-point Likert items from the personal responsibility subscale of the Psychosocial Maturity Inventory (Greenberger et al. 1975) ($\alpha = .91$). Taken together, these items present a nuanced developmental counterpart to Gottfredson and Hirschi's (1990) self-control construct, and it has been argued that improvements in psychosocial maturity can account for much of the decline in offending in the transition to adulthood (Monahan et al. 2009a, b; Steinberg and Cauffman 1996).

Rational Choice

Perceptions of the certainty of punishment for others are measured using the average response to questions concerning the perceived likelihood (from 0 to 10) of individuals in the youth's neighborhood getting caught and arrested for the following crimes: fighting, robbery with a gun, stabbing someone, breaking into store/home, shoplifting clothes, vandalism, and auto theft ($\alpha = .85$). The same items were used for the youth's perception of the certainty of punishment for self ($\alpha = .90$). The social costs of crime scale averages six 5-point Likert items indicating the youth's expectations of the social consequences of getting arrested ($\alpha = .74$). Social rewards of crime were measured by summing fifteen 4-point Likert items. For stealing ($\alpha = .80$), fighting ($\alpha = .83$), and robbery ($\alpha = .86$), five questions were asked about the potential social benefit of crime commission. These scales were combined because they were highly intercorrelated. Finally, personal rewards for crime were assessed using the average of seven crime-specific items that asked about the degree of "thrill" or "rush" derived from crime commission, ranging from 0 for "no fun or kick at all" to 10 for "a great deal of fun or kick" ($\alpha = .90$).

Procedural Justice

We include several constructs related to perceptions of procedural justice (Tyler 1997; Piquero et al. 2005). The procedural justice of police scale is an average of nineteen 5-point Likert items ($\alpha = .77$), as is the procedural justice of judges scale ($\alpha = .78$). These were based on both direct and vicarious experiences and associated perceptions of either police or judicial fairness and equity. Legitimacy is an average of eleven 4-point Likert items on police, courts, and criminal justice in general ($\alpha = .80$). For this scale, respondents indicated their level of agreement with statements such as "I have a great deal of respect for the police." and "The courts generally guarantee everyone a fair hearing." Finally, legal cynicism is based on five 4-point Likert items ($\alpha = .60$) about law and justice in general, assessing agreement with statements such as "Laws are meant to be broken." and "There are no right or wrong ways to make money."

Control Variables

In addition to these theoretically-motivated time-varying covariates, we include several control variables. First, we include exposure time in months (i.e. time between interviews), as well as exposure time squared (see Piquero et al. 2001). This allows a flexible specification of the relationship between the variety score and months in the recall period because a variety score does not exhibit a uniform rate of increase with time. Second, we include a variable indicating the proportion of the recall period spent out of secure facilities. While time in secure facilities decreases opportunities to commit crime, it does not eliminate it. Indeed, even those youths who spend the entire recall period in confinement report offending.

Analytic Strategy

Our analysis follows the recommendations of Osgood (2005). First, we estimate a random effects negative binomial model (Cameron and Trivedi 1998) of the following form:

$$Y_{it} = \beta_0 + \beta_1 Age_{it} + \beta_2 Age_{it}^2 + v_i + e_{it} \quad (1)$$

Where the dependent variable is crime variety and the error term is partitioned into a standard error term and an individual-specific component (v_i): the random effect is assumed to follow a beta distribution with two estimated parameters. Our aim with this first regression model is to obtain estimates of the age-crime curve, as reflected in the three regression coefficients. Next, we introduce time-varying covariates:

$$Y_{it} = \beta_0 + \beta_1 Age_{it} + \beta_2 Age_{it}^2 + \delta_1 x_{1it} + \delta_2 x_{2it} + \cdots + \delta_j x_{jit} + v_i + e_{it} \quad (2)$$

We enter j covariates one set at a time and examine the change in the age and age-squared coefficients. If these coefficients are close to zero and not statistically significant, the covariates have effectively "explained" the age-crime curve. However, if the age coefficients remain large and statistically significant, then the age-crime relationship has not yet been explained. We do not control for time-stable characteristics, as these by definition cannot explain change.

In order to obtain consistent estimates across models, we center exposure time at 12 months and street time at 100 %. Time varying covariates are all grand-mean centered. This ensures that the intercept, linear and squared terms on age reflect the age-crime curve for an individual with 12 months of street time, and an average unchanging level of included time-varying covariates throughout all ten waves. For ease of estimation, age is centered at 18 and divided by 5. In order to assess the relative strength of theoretical explanations for the age-crime curve, we first estimate theory-specific models. Finally, we estimate the full model that includes all time-varying covariates in an attempt to fully explain the relationship between age and crime.

Of the full sample of 1,354, we retain 1,336 individuals who are interviewed 12,146 times in ten waves. Less than 1 % (.6 %) of the time-varying covariate measurements are missing in waves where delinquency variety is measured. We impute data on these missing observations using chained equations (Raghunathan et al. 2001) with 50 replications. Estimates from these 50 models are combined to generate correct standard errors.

Results

Descriptive Statistics

In Table 1, in addition to the mean and standard deviation of each variable, we provide several estimates that help us to assess the potential of each variable to explain the age-crime curve. To account for the relationship between age and crime, a variable must have a strong relationship with both age and crime, it must have a similarly shaped age trend as crime, and within-individual change in the covariate must correlate with crime (Osgood et al. 1996). Evidence for these conditions is provided in Table 1. First, in order to assess the strength of the relationship between age and each covariate we present the within-individual variance that is explained by age and age-squared (i.e., the quadratic term). Second, we estimate three age-specific correlations between the covariate and crime. Besides demonstrating the strength of the covariate-crime relationships, this provides some evidence for concordant trends in both the covariate and crime. Consistently high correlations would indicate a strong relationship as well as a similar age trend. Increasing, decreasing, or inconsistent correlations would indicate inconsistent age trends, decreasing the ability of the covariate to explain the age-crime curve. Finally, we estimate the correlation between within-individual variation in the covariate and crime. This shows how responsive crime is to changes in each covariate. These estimates are provided in order to assess the potential for each time-varying covariate to explain the relationship between age and crime, and to pinpoint reasons why certain correlates might be unable to explain this relationship.

The descriptive statistics in Table 1 show that while most of the potential predictors of crime have a good deal of variation, some, like marriage, are limited. Consistent

Table 1 Descriptive statistics (N = 1336, NT = 12146)

Variable	Mean (SD)	Range	Within variance explained by age	Correlation with crime at age			Within corr, with crime
				16	19	22	
Crime variety	1.33 (2.34)	0–19	.025				
Age	18.34 (.47)	14.5–26.7					
Social control							
Bio. parents	.46 (.63)	0–2	.032	.03	−.02	−.10	.03
Married	.03 (.17)	0–1	.041	n/a	−.01	−.01	−.02
Cohabitation	.13 (.33)	0–1	.041	.02	.00	−.01	.00
Children	.44 (.79)	0–6	.261	.04	.00	.01	−.03
Romance	.43 (.50)	0–1	.015	.08	.05	−.02	.02
Employed	.58 (.49)	0–1	.016	.02	−.05	−.08	−.02
Enrolled	.48 (.50)	0–1	.286	−.03	−.07	−.01	.03
Hs grad/GED	.38 (.49)	0–1	.310	.00	−.04	−.02	−.06
Post hs	.09 (.28)	0–1	.100	−.01	−.01	−.03	−.03
Probation	.41 (.49)	0–1	.157	.06	.11	.18	.08
Social support domains	5.39 (2.78)	0–8	.040	.01	−.05	−.03	.04
Avoid law trouble, imp.	4.77 (.63)	1–5	.013	−.15	−.17	−.15	−.09
Avoid law trouble, prob.	3.84 (1.18)	1–5	.004	−.27	−.31	−.25	−.15
Learning							
Gang	.09 (.28)	0–1	.019	.30	.24	.19	.10
No. of friends	2.86 (4.83)	0–95	.032	.02	.05	.01	.03
Friend quality	2.95 (.97)	1–4	.087	−.10	−.02	.02	.04
Antisocial peers	1.72 (.79)	1–5	.015	.45	.52	.49	.31
Anti. peer pressure	1.45 (.68)	1–5	.002	.43	.46	.46	.29
Resistant to peers	3.27 (.56)	1–4	.101	−.09	−.07	−.09	−.06
Strain							
Mobility	1.75 (.92)	1–8	.005	.30	.30	.29	.15
Homeless	.03 (.17)	0–1	.002	.21	.20	.21	.12
Victimization	.20 (.59)	0–5	.007	.54	.45	.40	.29
Victim witness	.96 (1.43)	0–7	.009	.54	.51	.48	.30
Breakup	.12 (.33)	0–1	.003	.13	.10	.12	.07
Psychosocial traits							
Impulse control	3.22 (.97)	1–5	.018	−.34	−.28	−.29	−.13
Supp. aggression	3.00 (.97)	1–5	.029	−.33	−.35	−.29	−.15
Consid. others	3.66 (.82)	1–5	.031	−.19	−.17	−.16	−.06
Self-regulation	2.82 (.68)	1–4	.002	−.08	−.09	−.11	−.04
Moral dis.	1.46 (.36)	1–3	.058	.25	.33	.30	.14
Future outlook	2.62 (.56)	1–4	.033	−.12	−.17	−.15	−.08
Psychosocial maturity	3.19 (.47)	1–4	.055	−.14	−.17	−.10	−.08
Rational choice							
Punishment, others	5.56 (2.34)	0–10	.001	−.19	−.14	−.14	−.05
Punishment, self	5.61 (2.97)	0–10	.007	−.18	−.21	−.21	−.09
Social costs of crime	3.15 (.93)	1–5	.030	−.05	−.08	−.07	−.02
Social rewards of crime	1.88 (.52)	1–4	.004	.22	.26	.24	.10
Pers. rewards of crime	1.79 (2.33)	0–10	.031	.33	.31	.24	.13
Procedural justice							
Proc. justice, cops	2.83 (.59)	1–5	.001	−.09	−.11	−.11	−.03
Proc. justice, courts	3.10 (.59)	1–5	.001	−.03	−.07	−.03	.00
Police legitimacy	2.35 (.61)	1–4	.004	−.12	−.21	−.19	−.06

Table 1 continued

Variable	Mean (SD)	Range	Within variance explained by age	Correlation with crime at age			Within corr, with crime
				16	19	22	
Legal cynicism	2.00 (.62)	1–4	.007	.20	.27	.22	.10
Controls							
Exposure	8.30 (3.09)	2–14					
Street prop.	.67 (.42)	0–1					

with decreasing marriage rates in recent decades, and later ages of first marriage (Cherlin 2009), particularly among criminally-active populations (King and South 2011), marriage only occurs 3 % of the time in this sample. Thus, despite the prominent role marriage plays in theoretical accounts of desistance from crime (Laub and Sampson 2003), it may be of less importance, ironically, among more criminally-active youthful populations. Of course, control mechanisms may operate through cohabitation, which is over four times as likely as marriage in this sample, but it too is only reported 13 % of the time. Homelessness, a crime-inducing life state of extreme strain (Hagan and McCarthy 1997), is also quite rare, experienced only 3 % of the time. Likewise, gang membership, although one of the most robust correlates of youth crime (Klein and Maxson 2006), is only reported 9 % of the time. Such rare life states may be strongly related to crime, but it is unlikely that they would account for much of its age trend. On the other hand, most covariates vary quite a bit, and so at least have the potential to account for age-related changes in crime.

Covariates must meaningfully vary with age in order have potential as an explanation for the age-crime curve. To assess this, we estimate random effects models that regress within-individual variation on age and age-squared, reporting the portion of the within-individual variation in each covariates explained by age. Where exposure time matters, such as with crime variety, we report the increase in explained within-individual variance when age and age-squared are added, compared to a model with exposure time only. As a benchmark, just 2.5 % of the within-individual variance in crime variety is explained by age. Although crime variety has a strong age trend in these data, there is quite a bit of within-individual variance that age does not capture. Not surprisingly, social control variables associated with normative transitions in late adolescence and young adulthood are strongly related to age. Within-individual variation in having children, school enrollment, and completion of a high school degree (or equivalent) are moderately associated with age, with around 30 % of the variance of each explained by age alone. Friendship quality (.087) and resistance to peer influence (.101) also have a markedly stronger relationship with age than other variables. Notably, age only accounts for 1.5 % of the within-individual variance in antisocial peers, one of the strongest correlates of crime. Overall, of 40 covariates, nearly half (19) are as strongly related to age as crime variety is.

The next three columns in Table 1 show the correlation between each variable and crime at three ages: 16, 19 and 22. To calculate these, correlations between the two variables were estimated for a restricted portion of the sample, within 1 year of the focal age. A variable that accounts for the relationship between age and crime would be strongly correlated with crime at all ages. Of the social control variables, the importance and probability of avoiding trouble with the law is consistently negative correlated with crime. Probation shows a consistent relationship with crime but its positive correlation suggests this variable does not operate through control mechanisms. Variables related to antisocial peer influence are some of the most consistently and strongly related to crime. Having antisocial peers, for example, is correlated with crime at around .50 across all three ages. Likewise, several strain, psychosocial and rational choice variables are consistently strongly associated with crime across all ages.

The final column of Table 1 shows the correlation between within-individual variation in the covariate and crime. This shows how responsive crime is to changes in each covariate. Once again, social control variables fare poorly, with no correlation exceeding .10 in magnitude. Changes in antisocial peer exposure ($r = .31$) and antisocial peer pressure ($r = .29$), however, are moderately correlated with crime, as are victimization ($r = .29$) and witnessing victimization ($r = .30$), suggesting that learning and strain theories should be able to explain a good deal of the age effect on crime. Changes in variables from psychosocial and rational choice theories are less strongly associated with crime.

Overall, evidence for the potential of these variables to explain the age-crime curve is mixed. Few variables strongly meet all three conditions needed to explain the age-crime curve. Those variables with the strongest age trends are not consistently correlated with crime across age and within-individual variation in these variables is not strongly correlated with crime. On the other hand, variables

with strong correlations with crime across age tend to fall flat on other measures. At the same time, several variables weakly meet all three conditions. Suppression of aggression, for example, is moderately correlated with crime at all ages, is as strongly related to age as crime (2.9 % of within-individual variance explained by age), and within-individual variation on this trait is weakly to moderately correlated with crime. Considered as a whole, there is much meaningful variation with age, numerous variables are consistently correlated with crime across age, and much within-individual change is correlated crime. This suggests that when considered together, we should be able to explain much of the relationship between age and crime by pointing to specific age-related changes.

Explaining the Age-Crime Curve

Model 1 in Table 2 estimates the unconditional age-crime curve in this sample. This curve is shown in Fig. 1 as well. Since the Pathways sample is selected based on involvement with the criminal justice system, their peak in offending comes earlier than we would expect to see in a general population sample. This sample is declining in crime variety throughout the observed age range (14–25). Expected crime variety per 12 months of street time drops significantly from 4.2 at age 15 to .8 at age 25. We assess the ability of subsequent models to explain the age-crime curve in two ways. First, as recommended by Osgood (2005), we measure the extent to which the age coefficients approach zero. We assess this by means of statistical significance of the age coefficients and by the drop in magnitude of the age coefficients. Second, we compare the estimated drop in delinquency variety from ages 15 to 25 holding all included time-varying covariates constant, to the crime drop in the unconditional model. If the estimated curve is flat, the age-crime curve is fully explained by changes in time-varying covariates. These measures are summarized later in Table 3.

Each theory is considered in turn in Table 2 in order to assess its strength in accounting for the age-crime relationship. To account for multiple statistical tests, we adjust all p value thresholds using a Bonferroni correction with 40 comparisons. When considered separately, each theory-specific model uncovers at a minimum three statistically significant covariates, many of which appear to be quite strong predictors of crime. Of the thirteen social control variables, for example, six are statistically significant predictors of crime. The linear age coefficient decreases in magnitude by 27.4 % when controlling for control theory variables, and the age squared term drops to practically zero and is not statistically significant. What is striking from Fig. 1 is how closely the age-crime curve from the social control model follows the unconditional age-crime curve, despite holding all social control variables constant at their means. While much of the drop in crime variety from ages 15 to 25 is explained by this model, nearly three-fourths remains unexplained.

We are able to explain more of the age-crime curve using social learning variables (model 3). The coefficient for antisocial peers is by far the largest in this model, with a one point change in the antisocial peers scale associated with 67 % higher crime variety. Gang membership is criminogenic over and above the effect of antisocial peers, with 38 % higher crime variety in periods of gang membership than non-gang membership. Two other peer-related variables are statistically significant predictors of crime as well, and the magnitude of the linear age coefficient drops by 46.8 % while the age squared term is close to zero. As shown in Fig. 1, when social learning-related variables are held at their means, the age-crime relationship is much less pronounced; 49.2 % of the crime drop from age 15 to 25 is explained by changes in social learning variables.

All five covariates associated with strain theory are statistically significant predictors of crime, and all in the expected direction. In terms of reduction in the magnitude of the linear age effect, this is the second strongest model, with a 36.6 % reduction in magnitude. Although not shown in Fig. 1 (to avoid clutter), the predicted age-crime curve is flattened quite a bit when these strain variables are held at their means; 40.5 % of the crime drop from age 15 to 25 is explained by changes in strain variables .

Gottfredson and Hirschi (1990) claim that self-control accounts for persistent between-individual differences in crime but cannot explain the overall age-crime curve since it is essentially—and relatively—fixed (between persons) after childhood. We have shown in Table 1 that several constructs related to self-control display a considerable degree of within-individual variation. Whether these changes can account for the age-crime curve is tested in model 5. Of seven psychosocial traits considered, five are statistically significant in the expected direction. A one point increase in impulse control, for example, is associated with an 18 % drop in crime variety. Taken together, changes in these psychosocial traits decrease the magnitude of the linear age coefficient by 28 % and account for 33.7 % of the drop in crime from age 15 to 25.

By both the drop in magnitude of the linear age coefficient and the proportion of the drop in crime explained by the models, social learning ranks the highest, followed by strain and psychosocial traits. The rational choice model is the second weakest model, explaining 18.1 % of the age 15–25 crime drop. The procedural justice model explains only 3.3 % of the drop. These results are somewhat surprising since both models contain robust predictors of crime (see Weisburd and Piquero 2008). Despite these findings, in each of the theory-specific models there

Table 2 Hierarchical negative binomial models explaining delinquency variety from ages 14 to 25 (N = 1336, NT = 12146)

	(1) no controls	(2) social control	(3) social learning	(4) strain	(5) psychosocial	(6) rat. choice	(7) proc. justice	(8) full model
Age	−.89** (.06)	−.64** (.07)	−.47** (.06)	−.57** (.06)	−.64** (.06)	−.74** (.06)	−.88** (.06)	−.21* (.07)
Age squared	.11 (.05)	−.01 (.05)	.02 (.05)	.08 (.05)	.05 (.05)	.04 (.05)	.12 (.05)	−.07 (.05)
Social control								
Bio. parents		−.09 (.03)						−.03 (.02)
Married		−.33* (.10)						−.16 (.08)
Cohabitation		−.15 (.05)						−.11 (.04)
Children		.03 (.02)						.03 (.02)
Romance		.12** (.03)						.13** (.03)
Employed		−.03 (.03)						−.02 (.02)
Enrolled		−.03 (.03)						.01 (.03)
Hs grad/GED		−.07 (.04)						.02 (.03)
Post hs		−.01 (.07)						.01 (.05)
Probation		.22** (.03)						.10** (.02)
Social support domains		.02** (.01)						.01 (.00)
Avoid law trouble, imp.		−.06** (.02)						−.02 (.01)
Avoid law trouble, prob.		−.27** (.01)						−.09** (.01)
Learning								
Gang			.32** (.04)					.07 (.04)
No. of friends			.00 (.00)					.00 (.00)
Friend quality			.03 (.01)					.02 (.01)
Antisocial peers			.51** (.02)					.26** (.02)
Anti. peer pressure			.18** (.02)					.08** (.02)
Resistant to peers			−.11** (.03)					−.04 (.02)
Strain								
Mobility				.19** (.01)				.13** (.01)
Homeless				.26** (.05)				.20** (.04)
Victimization				.19** (.01)				.12** (.01)
Victim witness				.26** (.01)				.16** (.01)
Breakup				.19** (.03)				.21** (.03)
Psychosocial								
Impulse control					−.20** (.02)			−.12** (.02)
Suppr. of aggression					−.28** (.02)			−.12** (.02)
Consideration of others					−.08** (.02)			−.04 (.02)
Self-regulation					−.05 (.02)			−.05 (.02)
Moral disengagement					.55** (.04)			.20** (.04)
Future outlook					−.12** (.03)			−.06 (.02)
Psychosocial maturity					−.01 (.03)			.07 (.03)
Rational choice								
Punishment, others						−.02 (.01)		−.01 (.01)
Punishment, self						−.06** (.01)		−.02* (.01)
Social costs of crime						−.03 (.02)		−.01 (.01)

Table 2 continued

	(1) no controls	(2) social control	(3) social learning	(4) strain	(5) psychosocial	(6) rat. choice	(7) proc. justice	(8) full model
Social rewards of crime						.48** (.03)		.13** (.03)
Pers. rewards of crime						.10** (.01)		.03** (.01)
Procedural justice								
Proc. justice, cops							−.13** (.03)	−.07 (.03)
Proc. justice, courts							.05 (.03)	.05 (.02)
Police legitimacy							−.28** (.03)	−.11** (.03)
Legal cynicism							.40** (.01)	.02 (.02)
Controls								
Exposure	.04 (.02)	.05 (.01)	.02 (.01)	.01 (.01)	.04 (.01)	.05 (.01)	.04 (.01)	.01 (.01)
Exposure^2	−.01 (.00)	−.01 (.00)	−.01 (.00)	.00 (.00)	−.01 (.00)	−.01 (00)	−.01 (00)	.00 (.00)
Street prop.	.16** (.04)	.25** (.04)	.16** (.03)	.06 (.03)	.21** (.03)	.29** (.03)	.22** (.03)	.16** (.04)
Constant	.86** (.06)	.84** (.06)	.75** (.06)	.76** (.14)	.75** (.06)	.83** (.06)	.83** (.06)	.81** (.07)

** $p < .01$, * $p < .05$ (Bonferroni corrected for 40 tests)

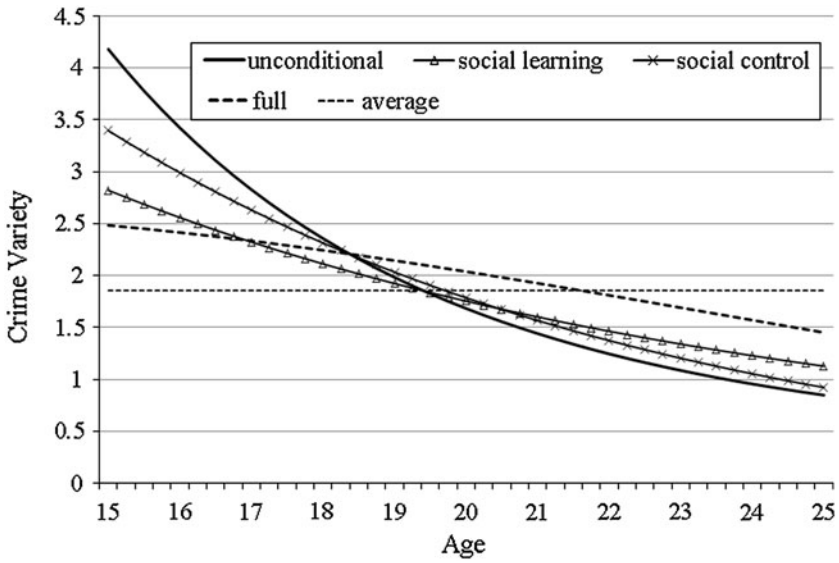

Fig. 1 Unconditional and select adjusted age-crime curves from age 15 to 25, all covariates held at grand mean

remains a substantial and statistically significant direct effect of age on crime that appears inexplicable, at least partly confirming Hirschi and Gottfredson's (1983) assertion.

We turn now to the full model, where we control for forty theoretically-motivated time-varying covariates to assess the extent to which changes in these variables taken together can account for the age-crime relationship. In this model, the magnitude of the linear age coefficient drops by 76.1 %, suggesting that three-fourths of the age-crime curve is explainable by concurrent changes in sociological and psychological variables. However, because the squared age term flips sign, the explained drop in crime between

Table 3 Reduction in magnitudes of age coefficients and crime drop (ages 15–25)

Models	Age coefficients		
	Linear (%)	Squared	Crime drop
Social control	27.4	92.3[a]	25.8
Social learning	46.8	85.1	49.2
Strain	35.5	31.1	40.5
Psychosocial	28.0	60.1	33.7
Rational choice	17.1	66.2	18.1
Proc. justice	0.7	−5.2	3.3
Full	76.1	37.3[a]	69.0

[a] Changed sign

ages 15 and 25 is slightly lower at 69.0 %. Because the squared terms are so small in our models (reflecting the relative absence of individuals who are young enough to be on the upward trending portion of the age-crime curve), they determine only a small degree of curvature and have little substantive significance. As shown in Fig. 1, the predicted age-crime curve holding all 40 covariates constant is by far the flattest of the predicted curves. By any measure, it is clear that a substantial portion of the age-crime curve can be explained by concurrent changes in sociological and psychological variables. At the same time, age continues to have a statistically and substantively significant direct effect on crime when these factors are considered.

The pattern of statistically significant predictors of crime in the final model is also of interest in further establishing evidence for the strength of theories in explaining the age-crime curve. Most coefficients decrease considerably, many to statistical insignificance. Of the social control variables, only three are related to crime in the full model: dating is criminogenic while the belief that one will avoid trouble with the law proves correct. Probation remains statistically significant, but does not appear to operate via control mechanisms as its sign is positive. Only two social learning-related variables remain statistically significant in the final model, although the antisocial peers scale produces one of the larger estimated coefficients. Strikingly, all strain variables are statistically significant predictors in the final model. Three variables each from psychosocial and rational choice theories emerge as statistically significant in the final model, and only one procedural justice variable remains significant. All told, 16 of 40 time-varying covariates are statistically significant in the final model (the threshold for statistical significance after Bonferroni correction is quite stringent: $p < .00125$), with significant predictors from nearly all considered theoretical perspectives.

Sensitivity Analyses

We conducted several supplemental analyses to ensure that our results are not sensitive to particular methodological choices. First, we replicated our results with fixed effects negative binomial models. Results with the fixed effects estimator were very close to those presented, changing none of our substantive conclusions. Although the fixed effects estimator would focus exclusively on within-individual change, we present the random effects results in this article as the fixed effects negative binomial estimator has been shown to not be a true fixed effects model (Allison and Waterman 2002). Second, we employed an alternate missing data strategy. For those variables that contained the most missing information, we created dummy missing indicators and replaced missing values with sample means. Using this strategy, as opposed to multiple imputation, we were able to closely replicate all key findings with a sample size after listwise deletion of 1,335 (N) and 12,003 (NT). Third, while we do not include stable covariates such as race and sex because by definition they cannot explain change, we did assess the proportion of the crime drop from age 15 to 25 explained by the full model in several subsamples: male (67.4 %), female (89.4 %), Phoenix (79.2 %), Philadelphia (52.4 %), white (51.4 %), black (61.5 %), and Hispanic (77.3 %). These results indicate that this approach has the potential to explain a substantial proportion of the age-crime curve in diverse demographic groups, but that the strength of time-varying covariates may interact with certain stable characteristics. Finally, we replicated our results with crime frequency as the dependent variable. The pattern of results was very similar to those presented in this article, with the full model explaining 77.3 % of the age 15–25 crime drop. Based on these sensitivity analyses, we are confident that our results are robust to numerous alternate modeling strategies.

Discussion

The current study responds to the long-standing provocative claim that sociological and psychological variables cannot explain why crime changes so predictably with age and that age has a direct but inexplicable effect on crime. As we noted earlier, this is a perplexing proposition from the point of view of developmental science, since most experts who study age-related change believe that age is essentially a proxy for some unmeasured developmental process. That is, developmental theory posits that various aspects of human functioning (like antisocial behavior) change with age, but that there must be an underlying, if not always easily identified, mechanism that accounts for the change.

Despite numerous theoretical accounts that identify specific changes that are associated with declines in crime (e.g. Laub and Sampson 2003; Warr 1993), only a handful of previous studies have subjected the inexplicability hypothesis to empirical testing. And no study has taken a catholic approach to the question, drawing potential explanations for age-related changes in crime from a broad array of theoretical perspectives. Using a longitudinal sample of high-risk adolescents, with 40 theoretically-motivated time-varying covariates, we have attempted to better understand which of the many changes from adolescence to adulthood can account for the accompanying drop in crime. Contrary to Hirschi and Gottfredson's inexplicability hypothesis, but consistent with perspectives from developmental science, we find that most of the

change in crime associated with age can be explained with co-occurring changes in sociological and psychological variables. In fact, we explain over two-thirds of the crime drop from age 15 to 25. For sociological and psychological theories of crime, this may be considered a success story. Our endeavor to develop strong, theoretically-guided explanations for age-related crime change has been largely successful. For intervention efforts, this is potentially a story of hope. There are many possible mechanisms for flattening the crime peak in adolescence or accelerating the decline in crime in adulthood. At the same time, despite the breadth of variables controlled, a portion of the age effect remains unexplained, calling for more research to fully understand the changes that account for the relationship between age and crime.

We have presented not only a test of the inexplicability hypothesis but a practical test of numerous criminological theories and their ability to explain how crime changes with age. We find at least some support for all tested theories and find that together they are responsible for two-thirds to three-fourths of the age-crime curve from age 15 to 25. The strongest explanation of the age effect is predicted by social learning theory, specifically, exposure to antisocial peers and antisocial peer pressure. These measures are not without controversy, however, as they may be driven by youths' own projected crime, potentially inflating their apparent impact. When variables from learning perspectives are considered alone, they explain nearly half of the crime drop from age 15 to 25. Assuming at least some of the variation in these measures is driven by actual peer delinquency, our results imply that associating less with antisocial peers, becoming less subject to peer influence, or reductions in antisocial behavior among one's peers facilitate declines in crime. Although there is evidence that the relationship between affiliation with antisocial peers and criminal activity is due not only to the influence of peers on antisocial behavior but to the fact that antisocial individuals choose antisocial peers, a previous analysis of data from this sample found that the correlation between criminal behavior and affiliation with antisocial peers was primarily due, after age 16, to peer socialization, and not to differential selection (Monahan et al. 2009a).

While learning theory yielded the strongest predictions of the theories we tested (see Pratt et al. 2010), a more important point is that all tested theories had at least one variable that emerged as a statistically significant predictor of crime. The process of development from adolescence to adulthood cannot be reduced to a single theory or overarching construct. Dramatic changes occur across multiple domains: less strain is encountered, impulse control and related aspects of psychosocial maturity improve, and perceived rewards of crime decrease, to highlight just a few examples from our analyses. More broadly, profound change occurs in biological, neural, cognitive, emotional and interpersonal functioning, and significant changes occur in every life domain: formal education is completed, new jobs obtained, living situations change often, romantic relationships form and dissolve, marriages, families and careers are launched (Steinberg and Morris 2001). It would be surprising if these changes, taken together, did not account for a great deal of the co-occurring drop in crime.

The inexplicability hypothesis suggests a fatalistic approach to crime control. If nothing can reduce crime but age itself, the only way to reform the chronic offender is via incapacitation. Further, interventions aimed at adolescent offending are futile if age itself directly causes the peak in offending. The implied strategy is to "wait it out," as no theoretical levers are available to effect change. On the contrary, as we have shown in this study, there are many avenues to affect change in crime during adolescence and early adulthood. Research shows that many interventions are effective (Sherman et al. 2002), not all persons follow the trajectory of the aggregate age-crime curve (Piquero 2008), turning points divert individuals from paths of persistent offending (Laub and Sampson 1993), offenders can be responsive to changes in local life circumstances (Horney et al. 1995), and "maturing out" is something that happens across the lifespan for different reasons at different ages (see Vergés et al. 2012). For public policy this is a promising story, as one need not simply wait for age to have its effect, but can pursue strategies to accelerate desistance from crime.

Although we were able to explain three-fourths of the relationship between age and crime, and 69 % of the drop in crime from age 15 to 25, a direct effect of age remained statistically significant at one-quarter its original magnitude. Thus, we are not able to reject completely Hirschi and Gottfredson's (1983) inexplicability hypothesis. To close the gap in understanding age-related changes in crime, we call for even more comprehensive studies that capture the full range of changes that occur as people age. Even within the theoretical perspectives that are represented in our analyses, superior measures may yield a more powerful explanatory model. We did not directly measure elements of the social bond, for example. And we did not capture key constructs from strain theory such as feelings of unfairness and negative affect. In addition, entire domains of change are untapped in our analysis, such as brain functioning, hormonal changes, identity development, and changes in routine activities. We are hopeful that future efforts with more complete measures of developmental change will be able to more completely account for the relationship between age and crime.

This study has several limitations that future research would do well to address. First, we only consider the age-crime curve from adolescence to early adulthood. A wider

view of the longitudinal age-crime curve well into adulthood would be important (in order to prevent the increase in crime between early and late adolescence) but more challenging to explain. Conducting a study spanning early adolescence to middle adulthood is a formidable task, and including repeated measures that can be used to explain change throughout the lifespan is especially daunting. The problem for life-course research using secondary data is that as the timespan of the survey increases, the breadth of repeated measurements decreases, limiting the ability to explain change. Put another way, the reasons for a decline in offending between late adolescence and early adulthood may be very different than those for the decline from young adulthood to the late 20s.

Second, our analyses do not establish cause and effect. We are interested in concurrent changes in sociological and psychological variables that are correlated with changes in crime. Although we use terms like "explain," it is possible that the causal relationship is in reverse: changes in criminal behavior may induce changes in these variables. It is also possible that some of the "effects" we identify are simply correlates of crime produced by some unmeasured common cause. However, several of these variables have been shown in previous literature to have a plausibly causal relationship with crime. The goal of our study was to test the assertion that age has a direct effect on crime that cannot be explained by sociological and psychological variables using a recently advanced methodological approach. Because these changes are expected to have immediate effects on crime, as is true of most other inexplicability hypothesis studies, we did not estimate a lagged model.

Finally, we use a select sample of youths in two cities who have involvement with the justice system, which in and of itself is important because serious youthful offenders present an important policy group, especially with respect to persistence/desistance from crime (Laub and Sampson 2001; Mulvey et al. 2004). Studies using population or school-based samples may yield divergent findings. We encourage replication of this investigation using diverse samples. Although these recommendations paint a broad picture, we think that reinvesting in the age-crime discussion is very important for matters of both theory and policy and hope that our effort begins anew a spirited and healthy discussion.

It has long been known that individuals tend to desist from crime as they mature out of adolescence and transition into the conventional roles of adulthood, but previous research has been unable to identify the underlying psychological or sociological mechanisms that account for this change. If criminal activity actually changes with age without any identifiable reason, this bodes poorly for interventions, because while we can potentially change an individual's psychological functioning or social experience, we cannot magically make him older or younger. The results of our investigation shows that one reason it is so difficult to explain why people stop committing crimes as they get older is that this drop is the result of the combined small effects of many, many factors, and not the result of any one or two specific influences operating alone. Thus, the relationship between age and crime may be difficult to explain, but it is by no means inexplicable. Our analyses show that, with the simultaneous application of multiple theoretical perspectives derived from developmental science, we can do a much better job of explaining the inexplicable than has been assumed.

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Author Contributions GS and ARP conceived of the study, participated in its design and coordination and drafted the manuscript; GS, ARP, and LS participated in the interpretation of the data and the finalization of the manuscript; LS and ARP participated in the design and coordination of the study and GS performed the statistical analysis. All authors read and approved the final manuscript.

References

Allison, P. D., & Waterman, R. P. (2002). Fixed-effects negative binomial regression models. *Sociological Methodology, 32*, 247–265.

Arnett, J. (2006). G. Stanley Hall's Adolescence: Brilliance and nonsense. *History of Psychology, 9*, 186–197.

Bandura, A., Barbarnelli, C., Caprara, C. V., & Pastorelli, C. (1996). Mechanisms of moral disengagement in the exercise of moral agency. *Journal of Personality and Social Psychology, 71*, 364–374.

Blumstein, A., Cohen, J., Roth, J. A., & Visher, C. (Eds.). (1986). *Criminal careers and "career criminals"* (Vol. 1). Washington, DC: National Academy Press.

Britt, C. L. (1992). Constancy and change in the U.S. age distribution of crime. *Journal of Quantitative Criminology, 8*, 175–187.

Cameron, A. C., & Trivedi, P. K. (1998). *Regression analysis of count data*. New York: Cambridge University Press.

Cauffman, E., & Woolard, J. (1999). The future outlook inventory: Measure developed for the MacArthur network on adolescent development and juvenile justice. Department of Psychology and Social Behavior, University of California, Irvine. Unpublished manuscript.

Cernkovich, S. A., Giordano, P. C., & Pugh, M. D. (1985). Chronic offenders: The missing cases in self-report delinquency research. *Journal of Criminal Law and Criminology, 76*, 705–732.

Cherlin, A. (2009). *The marriage-go-round: The state of marriage and the American family today*. New York, NY: Knopf.

Cullen, F. T. (1994). Social support as an organizing concept for criminology. *Justice Quarterly, 11*, 527–559.

Farrall, S., & Bowling, B. (1997). Structuration, human development and desistance from crime. *British Journal of Criminology, 39*, 253–268.

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

Farrington, D. P., Piquero, A. R., & Jennings, W. G. (2013). *Offending from childhood to late middle age: Recent results from the Cambridge study in delinquent development*. New York: Springer.

Giordano, P. C., Cernkovich, S. A., & Rudolph, J. L. (2002). Gender, crime, and desistance: Toward a theory of cognitive transformation. *American Journal of Sociology, 107*, 990–1064.

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

Greenberg, D. (1985). Age, crime and social explanation. *American Journal of Sociology, 91*, 1–21.

Greenberg, D. (1994). The historical variability of the age-crime relationship. *Journal of Quantitative Criminology, 10*, 361–373.

Greenberg, D. (2008). Age, sex, and racial distributions of crime. In E. Goode (Ed.), *Out of control: Assessing the general theory of crime* (pp. 38–48). Stanford, CA: Stanford University Press.

Greenberger, E., Josselson, R., Knerr, C., & Knerr, B. (1975). The measurement and structure of psychosocial maturity. *Journal of Youth and Adolescence, 4*, 127–143.

Hagan, J., & McCarthy, B. (1997). *Mean streets: Youth crime and homelessness*. New York: Cambridge University Press.

Hall, G. S. (1904). *Adolescence: Its psychology and its relations to physiology, anthropology, sociology, sex, crime, religion, and education* (Vol. 1–2). Norwalk, CT: Appelton-Century-Crofts.

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

Hirschi, T., & Gottfredson, M. R. (1983). Age and the explanation of crime. *American Journal of Sociology, 89*, 552–584.

Hirschi, T., & Gottfredson, M. R. (1995). Control theory and the life-course perspective. *Studies on Crime and Crime Prevention, 4*, 131–142.

Hirschi, T., & Gottfredson, M. R. (2008). Critiquing the critics: The authors respond. In E. Goode (Ed.), *Out of control: Assessing the general theory of crime* (pp. 217–231). Stanford, CA: Stanford University Press.

Horney, J., Osgood, D. W., & Marshall, I. H. (1995). Criminal careers in the short-term: Intra- individual variability in crime and its relation to local life circumstances. *American Sociological Review, 60*, 655–673.

Jennings, W. G., & Reingle, J. M. (2012). On the number and shape of developmental/life-course violence, aggression, and delinquency trajectories: A state-of-the-art review. *Journal of Criminal Justice, 40*, 472–489.

Jessor, R., & Jessor, S. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. New York: Academic Press.

King, R., & South, S. (2011). Crime, race, and the transition to marriage. *Journal of Family Issues, 32*, 99–126.

Klein, M. W., & Maxson, C. L. (2006). *Street gang patterns and policies*. New York: Oxford University Press.

Larson, M., & Sweeten, G. (2012). Breaking up is hard to do: Romantic dissolution, offending, and substance use during the transition to adulthood. *Criminology, 50*, 605–636.

Laub, J. H., & Sampson, R. J. (1993). Turning points in the life course: Why change matters to the study of crime. *Criminology, 31*, 301–325.

Laub, J. H., & Sampson, R. J. (2001). Understanding desistance from crime. In M. Tonry (Ed.), *Crime and justice: A review of research* (Vol. 28, pp. 1–69). Chicago: University of Chicago Press.

Laub, J. H., & Sampson, R. J. (2003). *Shared beginnings, divergent lives: Delinquent boys to age 70*. Cambridge, MA: Harvard University Press.

Loeber, R. (2012). Does the study of the age-crime curve have a future? In R. Loeber & B. C. Welsh (Eds.), *The future of criminology* (pp. 11–19). New York: Oxford University Press.

Loeber, R., & Farrington, D. P. (Eds.). (1998). *Serious and violent juvenile offenders: Risk factors and successful interventions*. CA: Newbury Park.

Loeber, R., & Farrington, D. P. (2012). *Transitions from juvenile delinquency to adult crime: Criminal concerns, justice policy, and prevention*. New York: Oxford University Press.

Maruna, S. (2001). *Making good: How ex-offenders reform and reclaim their lives*. Washington, D.C.: American Psychological Association.

Massoglia, M. (2006). Desistance or displacement: The changing patterns of offending from adolescence to young adulthood. *Journal of Quantitative Criminology, 22*, 193–215.

Moffitt, T. E. (1993). 'Life-course-persistent' and 'adolescence-limited' antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674–701.

Monahan, K. C., Steinberg, L., & Cauffman, E. (2009a). Affiliation with antisocial peers, susceptibility to peer influence, and desistance from antisocial behavior during the transition to adulthood. *Developmental Psychology, 45*, 1520–1530.

Monahan, K. C., Steinberg, L., Cauffman, E., & Mulvey, E. P. (2009b). Trajectories of antisocial behavior and psychosocial maturity from adolescence to young adulthood. *Developmental Psychology, 45*, 1654–1668.

Mulvey, E. P., Steinberg, L., Fagan, J., Cauffman, E., Piquero, A. R., Chassin, L., et al. (2004). Theory and research on desistance from antisocial activity among serious juvenile offenders. *Youth Violence and Juvenile Justice, 2*, 213–236.

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.

Nieuwbeerta, P., Blokland, A. A. J., Piquero, A. R., & Sweeten, G. (2011). A life-course analysis of offense specialization across age: Introducing a new method for studying individual specialization over the life course. *Crime & Delinquency, 57*, 3–28.

Osgood, D. W. (2005). Making sense of crime and the life course. *Annals of the American Academy of Political and Social Science, 602*, 196–211.

Osgood, D. W. (2012). Some future trajectories for life course criminology. In R. Loeber & B. C. Welsh (Eds.), *The future of criminology* (pp. 3–10). New York: Oxford University Press.

Osgood, D. W., Wilson, J. K., Bachman, J. G., O'Malley, P. M., & Johnston, L. D. (1996). Routine activities and individual deviant behavior. *American Sociological Review, 61*, 635–655.

Petras, H., Nieuwbeerta, P., & Piquero, A. R. (2010). Participation and frequency during criminal careers across the life span. *Criminology, 48*, 607–637.

Piquero, A. R. (2008). Taking stock of developmental trajectories of criminal activity over the life course. In A. Liberman (Ed.), *The long view of crime: A synthesis of longitudinal research* (pp. 23–78). New York: Springer.

Piquero, A. R., Blumstein, A., Brame, R., Haapanen, R., Mulvey, E., & Nagin, D. S. (2001). Assessing the impact of exposure time and incapacitation on longitudinal trajectories of criminal offending. *Journal of Adolescent Research, 16*, 54–74.

Piquero, A. R., Fagan, J., Mulvey, E. P., Steinberg, L., & Odgers, C. (2005). Developmental trajectories of legal socialization among serious adolescent offenders. *Journal of Criminal Law and Criminology, 96*, 267–298.

Piquero, A. R., Farrington, D. P., & Blumstein, A. (2003). The criminal career paradigm. In M. Tonry (Ed.), *Crime and justice: A review of research* (Vol. 30, pp. 359–506). Chicago: University of Chicago Press.

Piquero, A. R., Farrington, D. P., & Blumstein, A. (2007). *Key issues in criminal careers research: New analysis from the Cambridge study in delinquent development*. Cambridge: Cambridge University Press.

Pratt, T. C., Cullen, F. T., Sellers, C. S., Winfree, L. T., Jr, Madensen, T. D., Daigle, L. E., et al. (2010). The empirical status of social learning theory: A metal-analysis. *Justice Quarterly, 27*, 765–802.

Raghunathan, T. E., Lepkowski, J. M., Van Hoewyk, J., & Solenberger, P. (2001). A multivariate technique for multiply imputing missing values using a sequence of regression models. *Survey Methodology, 27*, 85–95.

Schubert, C. A., Mulvey, E. P., Cauffman, E., Steinberg, L., Hecker, T., Losoya, S. H., et al. (2004). Operational lessons from the pathways to desistance project. *Youth Violence & Juvenile Justice, 2*, 37–255.

Sherman, L. W., Farrington, D. P., Welsh, B. C., & MacKenzie, D. L. (2002). *Evidence-based crime prevention*. London: Routledge.

Steffensmeier, D. J., Andersen, E., Harer, M. D., & Streifel, C. (1989). Age and the distribution of crime. *American Journal of Sociology, 94*, 803–831.

Steinberg, L., & Cauffman, E. (1996). Maturity of judgment in adolescence: Psychosocial factors in adolescent decision making. *Law and Human Behavior, 20*, 249–272.

Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43*, 1531–1543.

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology, 52*, 83–110.

Stolzenberg, L., & D'Alessio, S. J. (2008). Co-offending and the age-crime curve. *Journal of Research in Crime and Delinquency, 45*, 65–86.

Sweeten, G. (2012). Scaling criminal offending. *Journal of Quantitative Criminology, 28*, 533–557.

Thornberry, T. P. (1997). Toward an interactional theory of delinquency. *Criminology, 25*, 863–892.

Tittle, C. R. (1988). Two empirical regularities (maybe) in search of an explanation: Commentary on the age/crime debate. *Criminology, 26*, 75–85.

Tittle, C. R., & Grasmick, H. G. (1997). Criminal behavior and age: A test of three provocative hypotheses. *Journal of Criminal Law and Criminology, 81*, 309–342.

Tittle, C. R., & Ward, D. A. (1993). The interaction of age with the correlates and causes of crime. *Journal of Quantitative Criminology, 9*, 3–53.

Tyler, T. R. (1997). Procedural fairness and compliance with the law. *Swiss Journal of Economics and Statistics, 133*, 219–240.

Uggen, C. (2000). Work as a turning point in the life course of criminals: A duration model of age, employment, and recidivism. *American Sociological Review, 67*, 529–546.

Uggen, C., & Piliavin, I. (1997). Asymmetrical causation and criminal desistance. *Journal of Criminal Law and Criminology, 88*, 1399–1422.

Vergés, A., Jackson, K. M., Bucholz, K. K., Grant, J. D., Trull, T. J., Wood, P. K., et al. (2012). Deconstructing the age-prevalence curve of alcohol dependence: Why "maturing out" is only a small piece of the puzzle. *Journal of Abnormal Psychology, 121*, 511–523.

Walden, T. A., Harris, V. S., & Caltron, T. F. (2003). How I feel: A self-report measure of emotional arousal and regulation for children. *Psychological Assessment, 15*, 399–412.

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

Weinberger, D. A., & Schwartz, G. E. (1990). Distress and restraint as superordinate dimensions of self-reported adjustment: a typological perspective. *Journal of Personality, 58*, 381–417.

Weis, J. G. (1986). Issues in the measurement of criminal careers. In A. Blumstein, J. Cohen, J. Roth, & C. A. Visher (Eds.), *Criminal careers and "career criminals"* (Vol. 2, pp. 1–51). Washington, DC: National Academy Press.

Weisburd, D., & Piquero, A. R. (2008). How well do criminologists explain crime? Statistical modeling in published studies. In M. Tonry (Ed.), *Crime and justice: A review of research* (Vol. 17, pp. 453–502). Chicago: University of Chicago Press.

Young, J. T. N., Barnes, J. C., Meldrum, R. C., & Weerman, F. M. (2011). Assessing and explaining misperceptions of peer delinquency. *Criminology, 49*, 599–630.

Zhang, L., & Messner, S. F. (2000). The effects of alternative measures of delinquent peers on self-reported delinquency. *Journal of Research in Crime and Delinquency, 37*, 323–337.

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