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Juvenile Justice Policy and Practice: A Developmental Perspective

ABSTRACT

Responses to juvenile offending have swung between rehabilitative and punishment approaches since the 1960s. A shift back toward rehabilitation has been influenced by recent research on adolescence, adolescent decision making, and adolescent brain development. US Supreme Court decisions on juvenile sentencing have been influenced by them. Major changes from adolescence into early adulthood have been demonstrated in the frontal lobe and especially the prefrontal cortex, which helps govern executive functions such as self-control and planning. Compared with adults, adolescents are more impulsive, short-sighted, and responsive to immediate rewards and less likely to consider long-term consequences. Adolescents are thus less blameworthy than adults. Responses to juvenile offending should take account of malleable aspects of psychosocial functioning in a developmentally informed manner.

The early juvenile court viewed and treated juveniles as distinct from adults, with a greater focus on rehabilitation as opposed to punishment for youthful criminal behavior (Mack 1909; Tanenhaus 2005, 2012).

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Since then, the relative orientation toward punishment or rehabilitation has shifted back and forth. The mid-twentieth century witnessed intense evolution of juvenile justice policy (before *Kent* and *Gault* were decided and the proceduralism shift in the 1970s with *McKeiver*).[1] Changes in crime rates, political culture, public perceptions, and public policies in the late twentieth century resulted in a more punitive approach. Since the turn of the twenty-first century, the pendulum has swung back toward more rehabilitative approaches. The shift results from multiple causes, including historic declines in crime rates beginning in the 1990s, increased public support for rehabilitation and prevention (see, e.g., Nagin et al. 2006; Cullen et al. 2007; Applegate, Davis, and Cullen 2009; Piquero et al. 2010; Piquero and Steinberg 2010), and burgeoning evidence on adolescence from developmental psychology and developmental neuroscience. We focus in this essay on how the science of adolescent development has informed understanding of juvenile offending and juvenile punishment.

Since the mid to late 1990s, scientific research has provided consistent evidence that adolescents are developmentally different from adults in ways that have implications for the treatment of young people in the justice system.[2] Adolescents demonstrate unique decision-making processes compared with adults, there are continued changes and growth in brain functioning and maturation from mid adolescence to the mid-20s, and most criminal offending ceases as youths move from adoles-

[1] In *In re Gault*, 387 U.S. 1 (1967), the US Supreme Court decided that juveniles in delinquency proceedings are constitutionally guaranteed a right to counsel and to confront witnesses. In *Kent v. United States*, 383 U.S. 541 (1966), the Court decided that juveniles are entitled to hearings that "measure up to due process" and to specified procedural protections when waiver to adult court jurisdiction is considered. In *McKeiver v. Pennsylvania*, 403 U.S. 528 (1971), the Court held that trial by jury is not constitutionally required in juvenile delinquency proceedings.

[2] It is difficult to pinpoint an exact age range for the adolescence period. Developmental psychologists tend to recognize the period between 12 and 17 years as crucial. Steinberg and Schwartz (2000) note that this period is characterized by rapid and dramatic changes in physical, mental, emotional, and social capabilities; greater susceptibility to external influences from family and peer groups, and formation of developmental trajectories despite characteristic malleability; and tremendous variability within and between individuals. Others have expanded the traditional conception of adolescence. Casey (2015, p. 295) considers adolescence as the "transition from childhood to adulthood that begins around the onset of puberty and ends with relative independence from the parent." Arnett (2000) posits a new phase of the life course, emerging adulthood, spanning the age range between 18 and 25 that bridges adolescence and adulthood.

cence into adulthood. Evidence from each of these areas of research has helped spur a reconsideration of the assumptions underlying the nature and patterning of juvenile offending and the appropriate justice system responses to it (Steinberg 2007, 2008). These lines of research explicitly informed the US Supreme Court's thinking about juvenile punishment. A series of landmark decisions at the beginning of the twenty-first century—*Roper v. Simmons*, 543 U.S. 551 (2005); *Graham v. Florida*, 130 S. Ct. 2011 (2010); *Miller v. Alabama*, 132 S. Ct. 2455 (2012); and *Jackson v. Hobbs*, 132 S. Ct. 1733 (2012)—recognized this emerging developmental science and used it, in part, fundamentally to alter conceptions of adolescent offenders and the nature of juvenile punishment (Steinberg 2013).[3]

Two recent National Academy of Sciences panels have highlighted the importance of using research on adolescent development to guide juvenile justice decision making under a developmentally oriented model. One panel summarized the burgeoning knowledge base on adolescent development and its implications for juvenile justice policy (National Research Council 2013). The other used those insights to develop an implementation plan that adheres to the developmental framework for guiding juvenile justice policy within the Office of Juvenile Justice and Delinquency Prevention (National Research Council 2014).[4]

[3] The United States is unique in how it responds to adolescent offenders. Other Western nations deal with adolescent offenders in a more treatment-focused fashion (Loeber and Farrington 2012). In late 2014, the Dutch government passed legislation for special treatment for 16–23-year-olds. For this age group, judges can consider delinquents as adolescents and apply juvenile justice rules (personal communication from R. Loeber, December 8, 2014). Very little research has been conducted on whether particular sanctions are more or less effective for different adolescent age groups; for an important exception, see Mears et al. (2014).

[4] Recognizing that the goals of the juvenile justice system are to hold youths accountable, provide fair processes and treatment, and prevent reoffending, the 2013 report articulated a "developmental approach" to be carried throughout all of the stages of the juvenile justice process and, in particular, that knowledge about adolescent development and research related to juvenile justice interventions be used in all aspects of decision making. The 2014 report identified seven hallmarks of a developmental approach to juvenile justice: accountability without criminalization, alternatives to justice system involvement, individualized responses based on assessment of needs and risks; confinement only when necessary for public safety; a genuine commitment to fairness; sensitivity to disparate treatment; and family engagement. The panel recommended that they be incorporated into the policies and practices of the Office of Juvenile Justice and Delinquency Prevention and

Our aim in this essay is to examine the behavioral and neuroscience evidence that supports developmental immaturity of youthful offenders. We summarize findings from research over the past 20 years regarding brain, cognitive, and psychosocial development in adolescence. The main conclusions support the view that adolescence is a distinct period of development and that juvenile offenders deserve differential treatment and have much to gain from a less punitive orientation than at present. This recent developmental science is used to consider three issues in juvenile justice policy: the criminal culpability of adolescents, adolescents' competence to stand trial, and the effects of punitive sanctions on adolescents' development and behavior.[5]

This essay has four sections. In Section I, we discuss the literature that characterizes adolescence as a distinct developmental period, highlighting research from developmental neuroscience and at the intersection of developmental neuroscience and behavioral science. Section II discusses the implications of developmental neuroscience for juvenile offending and juvenile processing. We outline implications of developmental science for judgments about juvenile culpability and competence and its implications for juvenile placement and punishment. In Section III, we highlight the influence of brain science on changes in juvenile justice policy over the past quarter century. Section IV outlines desirable next steps with respect to research and policy. Collectively, these sections document a story about the development—and accumulation—of knowledge and its current significant and prospectively substantial influences on conventional understanding of juvenile offending, juvenile justice practices, and juvenile justice policy.

I. Adolescence as a Developmental Period

In the past 25 years, evidence has converged to indicate that criminal behavior—and risk taking more broadly—follows a distinct developmental trajectory. There is more than ample evidence that most forms of risky behavior follow an inverted U-shaped curve, rising during early adolescence and peaking in mid to late adolescence, and declining in early

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local, state, and tribal jurisdictions to achieve the goals of a juvenile justice system based on a developmentally oriented model.

[5] Procedural competence involves a wider range of issues in addition to competence to stand trial.

adulthood and, especially dramatically, through the 20s (Sweeten, Piquero, and Steinberg 2013). This pattern is observed in a variety of behaviors, including crime, age of onset of illicit drug abuse or dependence, unwanted pregnancies, and driver deaths. Similar patterns characterize nonfatal self-inflicted injuries and unintentional drownings (Steinberg 2013, p. 516). Regardless of the outcome variable examined, what many criminologists refer to as the "age-crime curve" may actually be better characterized as an "age-recklessness curve." Crime is just one instance of a more general age-related risky behavior pattern (cf. Gottfredson and Hirschi 1990).

That criminal behavior is one indicator of a larger syndrome of teenage recklessness is important because it suggests that there are many neurobiological and psychosocial similarities between adolescents who break the law and those who express their risk-taking propensities in other ways. Juvenile offenders may simply be different in how this maturational balance is expressed. The universal nature of these behaviors raises some interesting questions (National Research Council 2011). Why are these trends replicable across behaviors? Do these acts have something in common? Is there something potentially different in being an adolescent compared with being an adult?

Our view, supported by a wealth of empirical research, is that increases in criminal and other behavior problems during adolescence are due, in great part, to the neurological and psychosocial immaturity that mark this developmental period. Across adolescence, there are distinct changes in brain development and developmental change in psychosocial processes that appear to make youths susceptible to becoming involved in criminal behavior and reckless behavior more generally. In this section, we highlight key developmental changes in brain structure and function and psychosocial processes that mark adolescence.

A. The Developmental Neuroscience of Adolescence

In general, developmental neuroscience on the adolescent brain can be divided into two areas. In the first, neuroscientists have documented age-related changes in the basic structure of the brain and circuit-based changes within the brain. In the second, neuroscientists have documented age-related changes in how the brain functions.[6]

[6] Feld, Casey, and Hurd (2013) provide additional details regarding the foundations of developmental neuroscience and its implications for juvenile justice.

1. *Brain Structure.* Four structural changes in the brain during adolescence are noteworthy. First, there is a decrease in gray matter in prefrontal regions of the brain, reflective of synaptic pruning, the process through which unused connections between neurons are eliminated (De Bellis et al. 2001; Sowell et al. 2002). This occurs mainly during preadolescence and early adolescence, the periods when major improvements in basic cognitive abilities and logical reasoning are seen. Those improvements are in part due to these anatomical changes (Steinberg 2012). In other words, synaptic pruning during early adolescence increases the efficiency of the brain in ways that promote cognitive abilities and decision making.

Second, there are important changes around the onset of puberty in activity involving the neurotransmitter dopamine (Steinberg 2010). There are substantial changes in the density and distribution of dopamine receptors in pathways that connect the limbic system, where emotions are processed and rewards and punishments experienced, and the prefrontal cortex, which is the brain's chief executive officer. Because dopamine plays a critical role in our experience of pleasure, these changes have important implications for sensation seeking (Gjedde et al. 2010; Norbury et al. 2013; Petit et al. 2013).

A third change in brain structure during adolescence (that continues into the early 20s) is an increase in white matter in the prefrontal cortex (Giedd 2004). This is the result of myelination, the process through which nerve fibers become sheathed in myelin, a white, fatty substance that improves the signal transmission efficiency of brain circuits. Unlike the synaptic pruning of the prefrontal areas, which is mainly finished by mid adolescence, myelination continues well into the 30s. More efficient neural connections within the prefrontal cortex are important for facilitating higher-order cognitive functions regulated by multiple prefrontal areas working in concert—functions such as planning ahead, weighing risks and rewards, and making complicated decisions. In essence, then, across adolescence and into early adulthood, individuals demonstrate increasing higher-order cognitive functioning ability. Giedd's (2004) work with a sample of adolescent youths who were given magnetic resonance imaging (MRI) scans and neuropsychological testing is particularly informative with respect to the development of the adolescent brain. His brain imaging results show that the region charged with controlling impulses (the dorsolateral prefrontal cortex) is one of the last parts of the brain regions to mature.

The fourth change in brain structure during adolescence is an increase in the strength of connections between the prefrontal cortex and other brain regions (Brenhouse, Sonntag, and Andersen 2008; Steinberg 2012). Improved connectivity between the prefrontal cortex and the limbic system is especially important for emotion regulation, which is facilitated by increased cross-talk between regions important in the processing of emotional information and those important in self-control. Like myelination, these changes in the teenage brain continue well into late adolescence. If one were to compare a young teenager's brain with that of a young adult, a much more extensive network of cables connecting brain regions would be observed in the adult.[7]

2. *Brain Function.* Beyond being an important period for changes in the brain's structure, adolescence is also an important time of change in how the brain functions. There are three major changes. First, over the course of adolescence and into early adulthood, there is a strengthening of activity in brain systems involving self-regulation (Steinberg 2014). For example, during tasks that require a great deal of self-control, adults employ a wider network of brain regions than do adolescents, which may make self-control easier, by distributing the work across multiple areas rather than overtaxing a smaller number of regions. Brain systems important for self-control continue to become more effective into the early 20s. For example, recent functional MRI- (fMRI-) based studies show that "areas underlying emotion regulation and reward sensitivity are in a state of heightened connectivity in the absence of any goal-directed behavior in RT [risk-taking] adolescents compared with NRT [nonrisk-taking] adolescents" (DeWitt, Aslan, and Filbey 2014, p. 162).[8] In other words, the teenage brain appears to become increasingly efficient

[7] There are significant changes during adolescence in three brain areas and their interconnections and circuitry that support self-control: the amygdala, prefrontal cortex, and ventral striatum (Casey 2015). Casey's recent overview of circuit-based accounts of adolescent behavior nicely summarizes these changes and their effects on behavior: "The ability to suppress inappropriate emotions, desires, and actions in favor of alternative appropriate ones is diminished in the presence of salient environmental cues. An apparent sensitivity to environmental cues—positive and negative—leads to heightened reactivity both behaviorally and neurally in adolescents relative to both children and adults along with limited capacity to regulate these responses. In parallel, emotional contexts, especially threatening contexts, yield little behavioral response during this time. These dynamic changes in behavior are paralleled by regional changes in the strength of connections within limbic circuitry across development" (p. 300).

[8] Functional MRI studies use MRI technology to measure brain activity by detecting changes in blood flow (Huettel, Song, and McCarthy 2009).

in self-regulation during adolescence and into early adulthood, particularly in ways that affect regulation of risky behaviors.

Second, around the time of puberty, there are important changes related to hormonal changes that alter the way the brain responds to rewards (Spear 2010). Brain scans during a task in which individuals are shown rewarding stimuli, such as piles of coins or pictures of happy faces, show that adolescents' reward centers "light up" more than do children's or adults' when they expect something pleasurable to happen. Heightened sensitivity to rewards motivates adolescents to engage in acts, even risky acts, when the potential for pleasure is high.

A third change in brain function over the course of adolescence involves increases in the simultaneous involvement of multiple brain regions in response to arousing stimuli, such as pictures of angry or fearful faces. The ability to regulate these feelings improves as regions that govern emotional processing and self-control become more interconnected. This is one reason why susceptibility to peer pressure declines as adolescents mature into adulthood; they are better able to put the brakes on an impulse aroused by friends (Steinberg and Monahan 2007). Not surprisingly, the association between peer and individual delinquency wanes as youths move into adulthood (Monahan, Steinberg, and Cauffman 2009). Co-offending tends to decrease as early adulthood ensues (Reiss and Farrington 1991; Piquero, Farrington, and Blumstein 2007; Zimring and Laqueur 2015).

The emergence of a scientific knowledge base with respect to brain structure and brain functioning is a recent phenomenon, in large part as a result of the advent of the technology (MRI and fMRI) to carry out imaging analyses. This knowledge base is limited by its reliance on small, selective samples (largely because of cost), but the accumulated evidence is consistent with respect to assessing adolescent motivation, especially regarding reward sensitivity, and differences between adolescents and adults in information processing (and decision making) regarding risks and rewards (see, e.g., Smith et al. 2011). We highlight two of the most recent and important scientific studies on brain functioning, structure, and differences across age.

In a study of 53 persons between ages 10 and 23, Van Leijenhorst et al. (2010) examined "developmental differences in neural activation that was related to different phases of reward processing" (p. 62). Using fMRI data in concert with a slot machine task, their analytic focus on the brain regions implicated in reward processing and uncertainty

showed that, overall, "middle adolescence is characterized by overactive incentive-related neurocircuitry, [an effect that was] most pronounced during the phase of reward receipt [and thus] favors the hypothesis that overactive reward-related circuitry and immature PFC circuitry potentially bias adolescents toward taking risks [see also Ernst, Pine, and Hardin 2006; Galvan et al. 2006; Casey, Getz, and Galvan 2008]" (p. 66).

Second, in a notably rare longitudinal study on brain functioning, Ordaz et al. (2013, p. 18109) analyzed longitudinal fMRI data from 123 subjects aged 9–26. They identified distinct developmental trajectories for brain regions and functioning with respect to inhibitory control that supports a "hierarchical pattern of maturation of brain activation that supports the gradual emergence of adult-like inhibitory control."[9] Across these studies, evidence is converging to suggest that the brains of young teens are undergoing changes in structure and function that will ultimately allow for more regulated behavior in early adulthood.

3. *Developmental Timing of Changes in Brain Structure and Function.* The structural and functional changes just described do not all occur along one uniform timetable. Differences in timing raise two important points relevant to the influence of neuroscience on public policy. First, there is no simple answer to the question of when an adolescent brain becomes an adult brain. Brain systems implicated in basic cognitive processes reach adult levels of maturity by mid adolescence, when synaptic pruning of the prefrontal cortex is complete. Cognitive processes important for things like impulse control do not mature, however, until late adolescence or even early adulthood. In other words, adolescents mature intellectually before they mature socially or emotionally (Steinberg, Cauffman, et al. 2009).

Beyond this developmental asynchrony between brain structure and function during adolescence, there are likely to be broad individual differences in these developmental processes, linked at least in part to individual differences in the age of puberty. These individual differences are not well understood. Taken cumulatively, it becomes very difficult to draw a bright line about the age at which an adolescent brain is like

[9] We do not wish to leave readers with the impression that adolescents continually seek risk and engage in antisocial behavior. As is well known, although many adolescents engage in antisocial behavior, many do not necessarily suffer from brain immaturity. In some cases, adolescents may perform better than adults on some cognitive and socio-emotional tasks (Crone and Dahl 2012).

an adult brain, because the answer depends on the individual and the aspect of functioning in question (cf. Casey 2015).

B. The Intersection of Developmental Neuroscience and Behavioral Science

Neuroscientific evidence is mainly important because it can provide additional validation for behavioral evidence when the neuroscience and the behavioral science are conceptually and theoretically aligned. Scientific evidence of any sort is always more compelling when it has been shown to be valid. When neuroscientific findings about adolescent brain development are consistent with findings from behavioral research, the neuroscience provides added confidence in the behavioral findings. But neuroscientific evidence should not be privileged over behavioral evidence (or vice versa); they should be considered in concert (see, more generally, Morse 2006, 2012; Maroney 2009, 2011*a*, 2011*b*, 2014).[10]

One reason why the neuroscience of adolescent development is compelling is that it parallels what we have learned from behavioral science over the past quarter century. For instance, longitudinal studies have illustrated that sensation seeking tends to increase during puberty and decline in the early 20s, while impulse control is low during childhood and adolescence but generally improves in late adolescence and into early adulthood.[11] This developmental pattern has been observed even in samples of known juvenile offenders, providing evidence that this phe-

[10] A somewhat related cautionary lesson can be drawn from an examination of judges' sentencing decisions. Aspinwall, Brown, and Tabery (2012) conducted an experiment in which a sample of US state trial judges were randomly assigned to presenting party (prosecution/defense) and biomechanism (absent/present) and asked to indicate their sentencing preferences in a hypothetical case. Regarding the biomechanism condition, "Participants in the biomechanism-absent condition received only expert testimony concerning the diagnosis of psychopathy. Participants in the biomechanism-present condition received identical expert testimony concerning the diagnosis of psychopathy plus expert testimony from a neurobiologist who presented an explanation of the biomechanism contributing to the development of psychopathy (here, low MAOA activity, atypical amygdala function, and other neurodevelopmental factors)" (p. 846). A key finding is that "the addition of a biomechanism for psychopathy significantly reduced the degree to which psychopathy was rated as aggravating" (p. 847). The expert testimony concerning a biomechanism for psychopathy increased the number of judges invoking mitigating factors.

[11] According to Skeem, Scott, and Mulvey (2014, p. 730), "neurobehavioral research indicates that the onset of puberty marks the beginning of dramatic changes in reward processing, processing of emotional stimuli, and social-cognitive reasoning. Biological changes during this period sensitize youths to their social world and create tendencies to explore and engage" (see also Crone and Dahl 2012).

nomenon may be a general feature of adolescence (Monahan et al. 2013). During adolescence, sensation seeking is at a high point while impulse control is at a low point. Multiple neurological models of adolescence posit that differences in the development of brain systems and connectivity between them influence adolescent risk taking and psychopathology (Nelson et al. 2005; Steinberg 2008; Ernst and Fudge 2009). Relative to adults, adolescents are more impulsive, more likely to focus on potential rewards in lieu of potential costs of a risky situation, and more likely to be short-sighted in their decision making (Steinberg and Scott 2003)—especially "in the heat of the moment, under potential threat, and in the presence of peers thereby increasing the likelihood of reckless behavior" (Cohen and Casey 2014, p. 65).

The relevance and role of peers occupy a much more central place in decision making in adolescence than during adulthood. For example, Gardner and Steinberg (2005) showed that the presence of peers increased risky decision making in a sample of adolescents, assessed with a video game called "Chicken," but not in a sample of older individuals. Further, using fMRI to measure the brain activity of adolescents, young adults, and adults during a simulated driving task, Chein et al. (2011) found that adolescents evinced greater activation in reward-related brain regions, which was related to subsequent risk taking, thereby indicating that the presence of peers activates the reward regions of the brain, which, in turn, increases risk taking. These findings parallel evidence that ability to resist peer influence increases across adolescence (Steinberg and Monahan 2007), that delinquent peer association is a weaker predictor of crime in later adolescence than earlier (Monahan, Steinberg, and Cauffman 2009), and that co-offending declines during the transition to adulthood (see Reiss and Farrington 1991; Piquero, Farrington, and Blumstein 2007; Zimring and Laqueur 2015). In general, these normative developmental increases in psychosocial capacities parallel changes in structure and function of the adolescent brain.

In sum, the brain science, in and of itself, should not carry the day, but when it is taken in concert with the evidence from the behavioral sciences, it suggests that developmentally normative phenomena that mark the lives of many adolescents are a critical (but not the only) piece of the puzzle for understanding antisocial and criminal behavior.[12]

[12] Monahan et al. (forthcoming) review how developmental neuroscience contributes to delinquency and psychopathology more broadly during adolescence.

II. Implications for Juvenile Offenders and Juvenile Processing

Cohen and Casey (2014) considered the intersection of developmental neuroscience and legal policy by focusing on the most recent advances in cognitive and neuropsychological and neurobiological research. They highlight something long known but until recently not backed by scientific evidence: "adolescents are more reactive in emotionally charged and social situations than adults due to changes in refinement of competing brain circuitry" (p. 63). Particularly in emotionally charged situations that involve similar-aged peers, emotional regulation is compromised, resulting in a failure of self-control and a higher probability of poor decision making and involvement in risky behavior. The probability of risky decision making is most notably increased when heightened activity in the reward- or emotion-related region of the brain is met with the presence of peers: "teenagers are attracted to novel and risky activities, including criminal activity, particularly with peers, at a time when they lack the judgment to exercise self-control and to consider the future consequences of their behavior" (Bonnie and Scott 2013, p. 159).[13]

This is a compelling explanation of the increase in criminal behavior observed during adolescence, but this imbalance is not fixed. It is transient. As most adolescents age and enter young adulthood, the prefrontal cognitive control region matures and begins to overpower the limbic (emotion-related) region. There is little denying that "adoption of a developmental perspective holds out substantial promise" (Mulvey 2014, p. 2) for understanding juvenile offending and juvenile punishment. In this section, we consider the implications of developmental neuroscience for culpability and competence and the implications of juvenile placement and punishment for adolescent development.

A. Implications of Developmental Neuroscience for Juvenile Culpability and Competence

The increase in the past quarter century in the number of juveniles tried as adults (or eligible to be) has raised two broad categories of questions about developmental differences between adolescents and adults. One concerns juveniles' *adjudicative and procedural competence*, a phrase

[13] Dahl (2001, p. 69) describes this gap between the limbic system and development of executive control functions as "starting the engines with an unskilled driver."

that refers to their competence to stand trial in adult court and to make legal decisions about such matters as whether to submit to an interrogation by a law enforcement agent, testify in their own defense, or accept a proposed plea agreement.[14] A second concerns juveniles' *criminal culpability*, which refers to the extent to which they should be held to the same standards as adults.

Both sets of questions concern differences between adolescents and adults with respect to their psychological abilities and capacities, but discussions of juveniles' competence and culpability are not the same. Questions about adjudicative and procedural competence ask whether adolescents and adults differ in abilities necessary to make informed decisions and, if so, whether these differences warrant providing juveniles with added or special protections. In this sense, questions about adjudicative competence share much in common with questions about other aspects of juveniles' competence, such as their competence to consent to a medical procedure or provide informed consent in a research setting. In contrast, questions about adolescents' criminal culpability pertain to the extent to which juveniles are legally responsible for criminal behavior and should be punished for it.

Questions about culpability concern the juvenile's mental state at the time of an offense. Questions about competence concern the juvenile's ability to make legal decisions after an offense has occurred or been alleged. Some psychological capacities are relevant to both competence and culpability, but others are not. For instance, the ability to foresee the future consequences of one's actions might influence an adolescent's decision to participate in an activity that might endanger another person (and is therefore relevant to judgments about the juvenile's culpability for any harm that may have occurred as a result). It might also influence how a juvenile responds to a police interrogation (and is therefore relevant to decisions about whether a juvenile who decided to confess to a crime was competent to understand the ramifications of this decision) (cf. Feld 2013).[15]

[14] These are only one portion of broader issues of competence that implicate juveniles' waivers of *Miranda* rights during interrogation (see Feld 2013) and waivers of the right to counsel (Feld 1993; Feld and Schaefer 2010).

[15] We appreciate insights gained from Barry Feld, who observed, "For legal purposes, the decision to waive Miranda does not require an understanding of the ramifications of the decisions—i.e. collateral consequences, impact on plea bargaining, or even nature of the offense itself. It requires only a cognitive understanding of the words of the warn-

By contrast, whether a juvenile defendant who has committed a crime understands the difference between the goals of a prosecutor and a judge is relevant to his or her competence to stand trial but has nothing to do with responsibility for the offense. It is possible, therefore, for an adolescent to be fully responsible for a criminal act but incompetent to be tried in a criminal proceeding or less than fully responsible for a criminal act but competent to stand trial.

1. *Culpability.* Criminal responsibility concerns the extent to which an individual is responsible for his or her actions. In order for something to diminish criminal responsibility, it has to be something outside the person's control. A person with an untreatable tumor on her frontal lobe that makes her unable to control aggressive outbursts is less than fully responsible for her aggressive behavior. This, if believed by the jury or judge, would be viewed as an excusing factor in a trial for a violent crime or as a mitigating factor at sentencing. However, if a person with no neurobiological deficit goes into a bar, drinks himself into a state of rage, and commits a violent crime as a result, that he was drunk does not diminish his responsibility. It does not matter whether the mitigating factor is biological, psychological, or environmental. The issue is whether the diminished responsibility is in some meaningful sense the person's fault and whether the individual could have compensated for whatever it is that was uncontrollable. This is the crux of the argument for why neuroscience of adolescent development is important for understanding criminal culpability: it points to something outside an adolescent's control that affects criminal behavior.

Studies of psychosocial development indicate continued maturation beyond mid adolescence in capacities such as impulse control (Steinberg 2008), risk aversion (Steinberg 2009), resistance to peer pressure (Steinberg and Monahan 2007), sensitivity to costs as well as rewards (Cauffman et al. 2010), and future orientation (Steinberg, Graham, et al. 2009). Steinberg, Cauffman, et al. (2009) argue that developmental immaturity of these processes is relevant to assessments of criminal responsibility. To the extent that neuroscience supports these developmental trends as likely to be the result of universal developmental difference in brain structure and function, adolescents' brain functioning may have implications for criminal responsibility. This developmental immaturity

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ing. Even with respect to basic understanding, the developmental psych is that kids 15 and younger just don't get it" (personal communication, July 31, 2014; see also Feld 2013).

may make a youthful offender somewhat less culpable for his or her behavior.

2. *Competence.* A criminal proceeding satisfies constitutional due process requirements only when the defendant is competent to stand trial, which includes capacities to assist counsel and to understand the nature of the proceeding sufficiently to participate in it and make decisions about it (*Dusky v. U.S.*, 362 U.S. 402 [1960]; *Godinez v. Moran*, 509 U.S. 389 [1993]). The conventional standard for competence to stand trial focuses on mental illness and disability, but there has been growing recognition that some youths without mental illness or disability may be legally incompetent because of developmental immaturity (Grisso et al. 2003).

Analyses of legal competence have outlined specific functional abilities with which the law is concerned (Grisso 2002); these are often referred to as the "*Dusky* criteria." They include basic comprehension of the purpose and nature of the trial process, capacity to provide relevant information to counsel, ability to reason about this information in a logical fashion, and ability to apply information to one's own situation in a manner that is neither distorted nor irrational.[16] In addition to defendants' basic understanding and reasoning abilities, their "decisional competence" may be significant in cases in which defendants must make important decisions about the waiver of constitutional rights (Bonnie 1992, 1993). Adolescents' competence to stand trial is clearly important in discussions of whether and under what circumstances they might be tried as adults (since the *Dusky* criteria apply to all criminal defendants, regardless of age), but they are also important considerations involving juvenile court proceedings that over time have created a more adversarial climate in the juvenile justice system. There is disagreement whether the competence standards in juvenile courts should be identical to or less stringent than those in criminal courts (Redding and Frost 2002; see also Scott and Grisso 2004). The majority of states have agreed that, given the potentially serious outcomes of a delinquency adjudication (including, perhaps, a long period of confinement in a prison-like facility), some minimum standard of competence should apply to juvenile court proceedings (Woolard, Fried, and Reppucci 2013).

[16] Issues of competence generally arise in the context of mental illness or retardation. Recognition of age per se as an entirely disabling condition, which we do not favor, should not be adopted.

There are two obvious ways in which adolescents and adults differ in their basic cognitive abilities (e.g., ability to recall specific pieces of information) and life experiences (e.g., familiarity with the roles of the various participants in a trial). A less frequently considered but potentially important difference between adolescents and adults involves aspects of psychosocial maturation that include progress toward greater future orientation, better risk perception, and less susceptibility to peer influence (Scott et al. 1995; Cauffman and Steinberg 2000).

Several authors have hypothesized that these developmental factors could result in differences between adolescents' and adults' decision making about important rights in the adjudicative process, including—assuming that juveniles have defense counsel—whether to submit to an interrogation (and, if so, how to respond to questions); whether to provide information to one's defense counsel (and, if so, how completely and honestly to disclose important facts); whether to testify in one's defense; and whether to accept a proposed plea agreement (Grisso et al. 2003). Although it might be assumed that adolescents who are less than fully competent can rely on the advice of adults when making these decisions, adults are not always present (e.g., when an adolescent is picked up for questioning) and are not always wise about legal matters (i.e., not all adults are competent). They also do not always have the same interests as those of the adolescent (e.g., a mother who is angry at her adolescent for having gotten into trouble in the past may encourage him or her to confess to a crime not committed; see Woolard et al. 2008).

Several studies of age differences in various capacities relevant to adjudicative and procedural competence have been conducted (for a review, see Grisso [2005]). In general, these studies indicate that individuals 15 and younger may be less likely than those 16 and older to possess the skills and capacities likely to render them competent to stand trial or to make important legal decisions. These include decisions that arise during interrogations (e.g., whether to waive *Miranda* rights) and trial proceedings (e.g., whether to waive a right to a jury trial) and whether to accept a proffered plea agreement.

Steinberg, Graham, et al. (2009) have noted that these age differences concerning adjudicative and procedural competence parallel age differences in other domains of competence (e.g., granting informed consent) and in basic information-processing and logical reasoning abilities. The psychosocial immaturity that marks adolescence compared with adult-

hood (i.e., diminished impulse control, resistance to peer pressure, etc.) may not necessarily result in age differences in competence to stand trial, perhaps because these social and emotional deficiencies are less likely to impair adolescents' judgment under the conditions in which legal decisions are made.[17]

Competence to stand trial is only one aspect of legal competence, which also includes competence to make legal decisions outside the courtroom. The most frequently studied aspect of noncourtroom legal decision making concerns adolescents' responses to interrogations by law enforcement officials (Kassin et al. 2010; Feld 2013). Researchers have studied age differences in individuals' comprehension of *Miranda* warnings (Grisso 1980), in decisions whether to confess to a crime they have committed (Grisso et al. 2003), and in susceptibility to making false confessions (Kassin 2008; Malloy, Shulman, and Cauffman 2014). Generally speaking, these studies show that adolescents, especially those younger than 16, are less likely than adults to understand their rights, more likely to comply with authority, and less likely to make decisions that reflect their best interests (e.g., remaining silent rather than confessing, giving a false confession in order to please an interrogator). Results of these studies have prompted many to call for greater protections for juveniles during interrogations, including mandatory videotaping or the presence of an adult (Kassin et al. 2010; Feld 2013).

B. Effects of Juvenile Placement and Punishment on Adolescent Development

Classical deterrence theory assumes that punishments, including incarceration, reduce offending, with most research being focused on adults. The contemporary consensus is that there is little to no convincing evidence supporting the deterrence assumption (Piquero and Blumstein 2007; Nagin, Cullen, and Jonson 2009; Nagin 2013). This is particularly important concerning juvenile crime because only a small fraction of offenders will continue to offend in adulthood (Piquero, Farrington, and Blumstein 2003). It is exceptionally difficult to identify this subset of youths prospectively, but deterring juveniles from continued offending is a central policy question (Schneider 1990).

Only a handful of studies have examined the effects of juvenile justice involvement on subsequent criminal careers. The limited evidence avail-

[17] Differences between cognitive competence and judgment require a more nuanced appreciation of long-term consequences.

able is due in part to methodological issues of differential selection that determines the likelihood of youth incarceration and in part to challenges in obtaining the data to investigate the effect of juvenile placement on recidivism. Here, we highlight a few of the most relevant studies of the effects of juvenile court and punishment experiences on subsequent offending.[18] We divide these studies into two groups: those that focus on the effects of incarceration and those that focus on the effects of waiver to the adult court. They suggest that neither incarceration (especially lengthy) nor waiver to adult court results in reduced offending among those juveniles affected.

1. *Incarceration.* One key study used 20 years of data from the Montreal Longitudinal and Experimental Study, a sample of over 1,000 boys who attended kindergarten classes in disadvantaged areas of Montreal in 1984 (Gatti, Tremblay, and Vitaro 2009). The goal was to assess the effects of juvenile justice system interventions compared with less restrictive interventions. Juvenile justice intervention was strongly predictive of adult crime, by almost a factor of seven, even after controlling for risk and protective variables collected during adolescence such as self-reported delinquency, verbal ability, deviant peers, impulsivity, family income, and parental supervision. When studying effects of specific forms of juvenile justice interventions (without supervision, with supervision, and with placement), Gatti, Tremblay, and Vitaro found that supervision and placement were significantly and strongly related to adult crime. Placement interventions increased the risk of adult crime by a factor of almost 38.

In an important, methodologically sophisticated extension of work on the same sample of Montreal boys, Petitclerc et al. (2013) assessed longer-term iatrogenic effects of juvenile court exposure and adult crime between ages 18 and 25. They used propensity score matching methods, which help account for potential differences between those exposed and not exposed to juvenile court so as to better isolate a causal relationship.

[18] In this section, we are concerned only with the effects of juvenile justice involvement and not the effects of arrest on subsequent offending (see Bernburg and Krohn 2003; Bernburg, Krohn, and Rivera 2006; Morris and Piquero 2013; Ward, Krohn, and Gibson 2014). Our focus on the effects of placement on subsequent behavior is limited to juveniles and not within samples of adults. Nagin, Cullen, and Jonson (2009) provide an in-depth overview of the literature surrounding imprisonment and reoffending more generally. A few other studies examine the effects of incarceration on subsequent offending in samples that combine adolescent and adult offenders (Sweeten and Apel 2007; Wermink et al. 2013). We focus on juvenile justice placements.

They found that "male adolescents processed in juvenile court . . . had three times the odds of being convicted of an adult criminal offence by age 25, and committed close to twice as many violent and nonviolent adult offences, compared with matched peers who were arrested by the police, but not sent to court" (p. 295). Taken together, these findings provide strong evidence of an iatrogenic effect of court involvement on subsequent criminality.

Two additional studies focus on effects of juvenile justice intervention on youth outcomes: one on criminal behavior (Loughran et al. 2009) and the other on psychosocial outcomes (Dmitrieva et al. 2012). Both used data from the Pathways to Desistance project, a longitudinal study of 1,354 serious adolescent offenders from Philadelphia and Phoenix who were followed from mid adolescence to early adulthood.

Loughran et al. (2009) sought to answer two questions: what is the causal effect of institutional placement compared with probation on subsequent rearrest rates, and what is the marginal effect of longer stays in placement on subsequent offending (i.e., a dose-response analysis)? Using four years of follow-up data subsequent to sanctioning decisions, no deterrent effect of institutional placement on future offending was detected, measured either with official records or with self-reports of offending. There was little benefit (in terms of less offending) from longer lengths of stays among those who were institutionalized. Careful attention was paid to possible selection bias concerning those incarcerated: the authors ruled out 66 potential confounding variables that spanned individual, situational, and familial domains. Like the Montreal studies, this one provides strong evidence against a deterrence effect of placement on subsequent criminal activity.

Dmitrieva et al. (2012) examined the long-term (7-year) effects of different types of incarceration on different components of psychosocial maturity, including temperance, perspective, and responsibility. The study also investigated how youths' ages and facility characteristics moderated the effects of incarceration on subsequent psychosocial maturity. Those who spent more time in secure facilities during the 7-year follow-up period had lower psychosocial maturity at the start of the study; however, more time incarcerated in secure settings was not related to global psychosocial maturity (pp. 1080–81).

The effects for placement in residential treatment facilities, however, were slightly different. Males who spent more time in residential treatment had higher global psychosocial maturity at the outset of the study,

but more time spent in such facilities over the 7-year follow-up was related to slower increases in psychosocial maturity. By the end of the study (age ~25), global psychosocial maturity among males with either low amounts of secure confinement or low amounts of residential treatment facility placement was virtually identical and remained higher (i.e., better psychosocial maturity) than that of males with high secure confinement or high residential treatment exposure. The two groups with high confinement experiences had virtually identical global psychosocial maturity scores at the study's end. Findings regarding potential moderating effects of age and facility quality were mixed, with no clear pattern of results, or null, indicating very few differences.[19]

2. *Waiver to Adult Court.* Researchers have devoted significant attention to understanding the effects of juvenile waiver on subsequent offending. We briefly highlight this line of research. Full reviews are available elsewhere (Fagan 2008; Redding 2008; Feld and Bishop 2012*a*, 2012*b*).

Many of the early studies showed that transferred youths were more likely to recidivate than those who were retained in the juvenile system. That finding was observed in a number of states and using different methodologies, different measures of recidivism, and large samples (see, e.g., Bishop and Frazier 2000; Fagan and Zimring 2000; Kupchik 2003; Lanza-Kaduce et al. 2005). In the late 2000s, the Office of Juvenile Justice and Delinquency Prevention concluded that transfer to adult criminal court "does not engender community protection by reducing recidivism [and in fact] substantially increases recidivism" (Redding 2008, p. 6). With some notable exceptions (Smith and Paternoster 1990; Fagan 1995; Winner et al. 1997; Myers 2003), much of the early work did not adequately address potential selection bias.[20]

[19] Other studies have examined effects of official intervention on subsequent criminal behavior and non-crime-related outcomes such as employment, drug use, and life chances. In general, they show that official intervention increases the likelihood of worse outcomes (Bernburg and Krohn 2003; Bernburg, Krohn, and Rivera 2006; Lopes et al. 2012; Morris and Piquero 2013; Ward, Krohn, and Gibson 2014). Murray et al. (2014, p. 226) examined the long-term effects of conviction and incarceration on males in the Cambridge Study in Delinquent Development, a longitudinal study of South London males followed into late middle adulthood. Results showed that "all adult outcomes [self-reported crime, antisocial personality, poor life success] were worse for men who were first incarcerated between ages fifteen and twenty-six, compared with matched men who were convicted between ages fifteen and twenty-six but not incarcerated up to age twenty-six."

[20] The issue here is that some covariates may simultaneously affect both the likelihood that a youth is transferred and the likelihood of subsequent recidivism. A complete depic-

A recent study using data from the Pathways to Desistance project addressed the issue. After using propensity score matching to reduce potential selection bias for 59 covariates, Loughran et al. (2010) estimated the effects of transfer on 4-year rearrests for 128 youths. They found a null effect on rearrest but differential effects depending on adolescents' offending histories. The sample was divided in two ways, by type of charge (property vs. person) and by the number of prior petitions (zero to one vs. two or more), to assess possible differences in the effects of transfer. The small sample size limited the investigation, but results showed that the rearrest rate was lower among transferred person offenders compared with transferred property offenders. There was no interaction effect between priors and transfer to adult court. There was a main effect for the number of priors: persons with fewer priors had a lower rate of rearrest regardless of juvenile or adult court processing. These findings suggest that it may be worthwhile to examine heterogeneity among youths transferred to adult court in order to draw more accurate conclusions about recidivism outcomes.

Coupled with evidence that transfer policies have no deterrent effects on youthful offenders (McGowen et al. 2007),[21] the weight of the evidence suggests that involvement with the juvenile justice system does more harm than good, with negative effects magnified as punishments become harsher (Petrosino, Turpin-Petrosino, and Guckenburg 2010; Mears et al. 2011). This does not imply that the system cannot be effective, especially if meaningful services are provided to the youths, but that current justice system practices do not appear to deter criminal activity.

In light of the neuroscientific evidence on developmental immaturity, it is a distinct possibility that punitive settings disrupt adolescent development in ways that increase the likelihood of subsequent crime. If adolescence is a critical time for the development of capacities that underlie good adult decision making, it stands to reason that experiences that disrupt that development—such as incarceration—should be minimized. Greater understanding of the neurological and psychosocial effects of these experiences is needed.

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tion of the relationship between transfer and subsequent offending must consider the confounding of these potential covariates. Jordan (2014), using data from a sample of Pennsylvania violent youths, provides a good example.

[21] Zimring and Rushin (2013) examined whether state law changes in juvenile justice systems in the 1990s contributed to declines in juvenile homicide rates through 2009. They found little confirmatory evidence.

III. The Influence of Brain Science on Changes in Juvenile Justice Policy

Four recent US Supreme Court cases have addressed changing views on the culpability, competence, and effects of punishment on youthful offenders. The Court increasingly over time took account of neuroscientific and behavioral evidence. We briefly review these cases and show how developmental psychology informed the Court's views of these cases.

Roper v. Simmons (2005) considered whether juveniles who commit capital crimes before age 18 may be sentenced to death. A 5–4 decision declared it unconstitutional to impose capital punishment for crimes committed under the age of 18. *Roper* overturned the laws of the 25 states with lower minimum ages. Five years later in *Graham v. Florida*, the Court decided that juvenile offenders may not constitutionally be sentenced to life imprisonment without the possibility of parole for cases not involving homicide. In *Miller v. Alabama* and *Jackson v. Hobbs* (usually referred to jointly as *Miller*), the court extended the reasoning in *Graham* to homicide and declared mandatory sentences for juvenile offenders to life imprisonment without the possibility of parole (LWOP) for murder to be unconstitutional.

Before the 2005 *Roper* decision, brain science research documenting differences between adolescents and adults was not acknowledged in Supreme Court juvenile justice decisions, largely because there were few empirical studies of adolescent brain development (Steinberg 2013). By the time *Miller* was decided, however, there had been significant growth in behavioral science research on adolescent brain development and decision making, and in comparison with adults.

The opinion in *Miller* devoted significant attention to this work, discussing issues related to adolescent immaturity in higher-order executive functioning. The Court cited amicus briefs, including one filed by the American Psychological Association (APA), that summarized the relevant literature and related it to the issues facing the Court (Steinberg 2013, p. 4).[22]

The successive briefs that the APA filed in these cases demonstrate the growing influence of adolescent brain science. It was discussed cau-

[22] All APA amicus briefs for these cases can be found at http://www.apa.org/about/offices/ogc/amicus/.

tiously in the *Roper* (2005) brief but with increasing confidence concerning *Graham* (2010) and *Miller* (2012). Collectively, the APA briefs argued against severe sentences for juvenile offenders primarily because juveniles' immaturity, vulnerability, and changeability make them less culpable than adults and accordingly that, as a result of their lower responsibility and ability to change, they should be deemed less responsible and thus less punishable. The APA reviewed evidence showing that adolescents are inherently more impulsive, short-sighted, and susceptible to peer influence.[23]

Scott (2013*b*) observed that the Court has shown its willingness to consider research from developmental science regarding the immaturity that characterizes adolescents' criminal and other risk-taking behavior and to take it into account in forbidding imposition of some harsh punishments on young offenders.[24] She suggests that the Court has embraced a developmental model of crime policy for adolescent offenders that is attuned to the science underlying juvenile decision making and neurobiological and structural brain differences between juveniles and adults. Bonnie and Scott (2013, p. 160) similarly observe that the decisions acknowledged differences in parts of the brain that govern emotional and behavioral control among adolescents and that developmental science can guide and inform juvenile crime policy.[25]

The Court's willingness to use psychological and neuroscientific evidence can be seen in the progression of opinions in the three cases. In *Roper*, writing for the majority, Justice Anthony Kennedy pointed to three differences between adolescents and adults that made it difficult to classify juveniles "among the worst of offenders": their immaturity

[23] Zimring (1998, pp. 76–78) noted that three characteristics of adolescent immaturity explain why juveniles are less culpable than adults. Adolescents lack fully developed cognitive abilities, which inhibit their ability to apply legal and moral rules to social situations. They have a limited capacity to control their impulsiveness. They do not have complete ability to resist peer influence and pressure. This suggests that adolescents process, prioritize, and use information differently than adults (Steinberg and Cauffman 1999, p. 52). With age, children become more adept at processing information, better able to exercise restraint and resist pressure, and better able make more reasoned decisions (see Scott and Grisso 1997).

[24] The cases concern capital punishment and LWOP sentences. Juveniles remain vulnerable to mandatory decades-long and discretionary life sentences.

[25] This does not mean that juveniles cannot be punished, especially for serious offenses. The Court suggested that subjecting juveniles to adult prosecution and punishment "should be 'unusual' and individualized," and sanctions applied to juveniles should "focus on maximizing young offenders' potential for reform" (Scott 2013*a*, p. 71).

and an underdeveloped sense of responsibility, which compromised their decision-making ability (noting that this was the very reason that states limited many juveniles' rights); their heightened susceptibility to external influence, including peer pressure, which gave them less control over their environment; and their still-developing character. The first two differences make adolescents less responsible than adults for their behavior and, accordingly, less culpable for their crimes. The third difference diminishes their culpability but also makes them better candidates for rehabilitation. Kennedy noted that the characteristics that make juveniles less culpable also make them less likely to be deterred by capital punishment, thereby undercutting the deterrence claims of death penalty proponents.

The dissenting justices in *Roper* questioned the need for a categorical exclusion of adolescents from death penalty eligibility instead of case-by-case decision making by judges or juries. They acknowledged that there could be instances in which a juvenile's immaturity mitigated his or her criminal responsibility but raised concerns about cases in which the crime was an especially heinous one committed by an older adolescent who demonstrated adult-like premeditation. The relevant developmental evidence concerned the difficulty of reliably predicting the future behavior of a juvenile offender.

Developmental scientists argued that, even for especially heinous crimes, it is impossible to distinguish between juveniles who are and are not incorrigible. The Court majority agreed, noting, "If trained psychiatrists with the advantage of clinical testing and observation refrain, despite diagnostic expertise, from assessing any juvenile under 18 as having antisocial personality disorder, we conclude that States should refrain from asking jurors to issue a far graver condemnation that a juvenile offender merits the death penalty" (at 19).

Roper was important for three reasons. First, the Court widened the prohibition against capital punishment to a wider age range (*Thompson v. Oklahoma*, 487 U.S. 815 [1988], prohibited capital punishment for youths younger than 16, but almost no murders are committed by people younger than this age). Second, developmental science showing differences between adolescents and adults was mentioned numerous times during oral arguments and in the Court's decision. In previous rulings on juveniles' criminal culpability, differences between adolescents and adults were presented mainly as a matter of common sense. Finally, research on adolescent brain development was introduced as evidence in

support of the contention that adolescents were inherently less mature than adults.

Neuroscience was not mentioned in the Court's opinion but was discussed at oral argument. An exchange between an attorney and Justice Breyer suggested just how influential neuroscience may have been:

> Justice Breyer: Now, I thought that the—the scientific evidence simply corroborated something that every parent already knows, and if it's more than that, I would like to know what more.
>
> Mr. Waxman: Well, it's—I think it's—it's more than that in a couple of respects. It—it explains, corroborates, and validates what we sort of intuitively know, not just as parents but in adults that—that—who live in a world filled with adolescents. And—and the very fact that science—and I'm not just talking about social science here, but the important neurobiological science that has now shown that these adolescents are—their character is not hard-wired. (US Supreme Court 2004, p. 40)

Five years after *Roper*, the Court in *Graham v. Florida* (2010) extended the logic of its abolition of the juvenile death penalty to mandatory LWOP sentences for juveniles convicted of crimes other than homicide. The majority explicitly observed that "no recent data provide reason to reconsider the Court's observations in *Roper* about the nature of juveniles. As petitioner's *amici* point out, developments in psychology and brain science continue to show fundamental differences between juvenile and adult minds. For example, parts of the brain involved in behavior control continue to mature through late adolescence. See Brief for American Medical Association et al. as *Amici Curiae* 16–24; Brief for American Psychological Association et al. as *Amici Curiae* 22–27" (*Graham v. Florida*, No. 08-7412, slip. op. at 17). As in *Roper*, the dissenting justices once again asked why the prohibition of LWOPs for juveniles convicted of nonhomicides needed to be categorical.

The LWOP decision was noteworthy in at least two other respects (Maroney 2011*a*). First, *Graham* was the first case in which developmental neuroscience findings were explicitly mentioned in the opinion ("For example, parts of the brain involved in behavior control continue to mature through late adolescence"; at 17). Developmental differences in behavior remain more important for debates about adolescent culpability than about developmental differences in brain structure or function (Steinberg 2012), but the Court's acceptance of neurobiological imma-

turity as a part of a more general developmental immaturity signaled a shift in thinking that encouraged lower courts to look to brain science to justify differential treatment of adolescents.

Second, moving beyond the realm of capital punishment opened the door for developmental immaturity arguments more generally. If adolescents' relative immaturity made the use of LWOP unfair, why, then, could this argument not be applied to any sentencing decision?

Historically, many of the arguments employed to limit the use of the death penalty relied on the notion that "death is different," which justifies special scrutiny of circumstances under which capital punishment is applied (*California v. Ramos*, 463 U.S. 992 [1983]). In *Graham*, the Court majority argued that, for adolescents, LWOPs were different too, noting that a juvenile sentenced to life would spend more years and proportionately more of his or her life in prison than an adult. This paved the way for subsequent rulings in state courts that limited the use of excessively long sentences for juveniles, even if they were not life sentences.[26]

Graham applied only to instances in which an individual had been convicted of a nonhomicide offense. Its practical implications were limited; nearly all individuals serving LWOP sentences for crimes committed as juveniles had been convicted of homicide. In 2012, the Court revisited juvenile LWOPs in *Miller* and *Jackson*. Each involved a 14-year-old convicted of homicide and sentenced to LWOP. When these cases were argued, nearly 2,500 people were serving life sentences for crimes committed as juveniles.

Just as *Graham* built on *Roper*, *Miller* built on *Graham*, with the Court majority again concluding that adolescents' developmental immaturity limited their criminal culpability. The opinion noted that the science had become stronger since *Roper* and *Graham*, pointed out that the earlier conclusions in the earlier cases continued to be strengthened by neuroscience, and went into greater detail about research findings. For example, the opinion mentioned immaturity in adolescence of higher-order executive functions such as impulse control (which had

[26] In California, e.g., the State Supreme Court ruled that a sentence in which the date of parole eligibility exceeded a juvenile's natural life expectancy violated the portion of the *Graham* ruling that requires that juveniles convicted of nonhomicides be given a meaningful opportunity to demonstrate their rehabilitation. The issue of retroactivity with respect to *Graham* has been decided both ways by appellate courts and at the time of writing is on the Supreme Court's calendar for argument and decision.

been highlighted in *Graham*) and deficiencies in planning ahead and risk avoidance.

The *Miller* ruling differed from *Roper* and *Graham* in one significant way. The earlier cases placed categorical bans on the use of punishments for juveniles. *Miller* left LWOP as an option, prohibiting states only from mandating LWOPs for juvenile murderers, on the grounds that such mandates do not permit courts to take into account the juvenile's developmental immaturity. Justice Elena Kagan in the Court's opinion noted, "But given all we have said in *Roper*, *Graham*, and this decision about children's diminished culpability and heightened capacity for change, we think appropriate occasions for sentencing juveniles to this harshest possible penalty will be uncommon" (*Miller v. Alabama*, No. 10-9646, slip op. at 17, 2012). It is not yet clear whether this prediction will hold true.

IV. What's Next for Research and Policy with Respect to Adolescent Development and Juvenile Justice?

In this essay, we set out to provide a broad overview of the empirical, legal, and policy issues at the intersection of adolescent development and juvenile justice. An authoritative treatment of all the key issues is well beyond the scope of any single article. Our intention has been to give readers a deeper appreciation of the complexity of the issues, the significant research developments made in the past quarter century, how developmental science research has entered into the policy discussion and especially legal decision making at the highest levels, and how advances in the research have influenced government agencies in altering how they carry out their missions.

Starting in the mid-1990s, in large part with support of the MacArthur Foundation and its Research Network on Adolescent Development and Juvenile Justice, research on adolescent development, adolescent decision making, and adolescent brain science began to be linked to debates about juvenile justice policy and practice. In general, findings from brain imaging and neuropsychological research documented that there is great change and continued development from adolescence into early adulthood in the frontal lobe and, especially, the prefrontal cortex, which helps to govern executive functions such as self-control and planning. At the same time, findings from the behavioral and decision making research showed that, compared to adults, adolescents are impulsive,

short-sighted, exceptionally sensitive to the prospect of immediate rewards, and less likely to consider the long-term consequences of their actions—a pattern that is even more pronounced in the context of similar-aged peers. As a result, arguments were made that adolescents are less culpable (or less blameworthy) than adults. In due course, *Roper*, *Graham*, and *Miller* acknowledged the brain and behavioral research on age differences in decision making.

Still, there are a wide range of research questions and policy issues that need attention. In this closing section, we highlight a few of the ones we believe most worth considering.

A. Next Steps in Science

Behavioral and neuropsychological research has provided important evidence regarding adolescent decision making and brain development. With respect to behavioral research, there is a need to undertake studies of high-risk and offender samples as they represent the policy group of interest regarding persistence and desistance from crime (Laub and Sampson 2001; Mulvey et al. 2004). Such studies should consider the full range of developmental and life course issues (e.g., factors associated with the onset of antisocial behavior, its escalation into more severe crimes for some, and the transition away from most adult offending for the majority), including recent findings that bear on legal issues raised in *Roper*, *Graham*, and *Miller* (cf. Piquero 2013).

Second, several studies have shown that individual differences in adolescent psychosocial maturity are moderated by the presence of peers. Consideration of other types of contexts such as family and neighborhood environments should be better understood in concert with adolescent psychosocial maturity. Owing to data constraints, there is little empirical research on "how individual risk factors for criminal involvement interact with different contexts, and even less about how these may differ over the course of adolescent development" (Mulvey 2014, p. 7). More research aimed at understanding the contexts in which individual differences more or less influence antisocial behavior is needed (Cohen and Casey 2014, p. 65).

Third, for several reasons, some related to data and some linked to researchers' reluctance or nervousness about these issues, there is a need to study whether and, if so, how aspects of adolescent development relate differently across ethnicity and gender to risky decision making and serious criminal behavior. Males and minorities are overrepresented in

serious criminal activity. Understanding the reasons for these patterns has received little research attention but remains critically important (Piquero 2008). Research is needed on at least the following questions: Are differences that have emerged from adolescent behavioral and brain research race or gender specific? Do males experience an earlier emotion-driven system while females' executive functioning develops faster and earlier in the life course? Do minorities evince more of the risk factors than nonminorities with respect to crime? Does social context magnify these potential individual differences across race and ethnicity? Do juvenile justice personnel weigh and consider the behavior—and the reasons underlying it—differently depending on the juvenile's race, ethnicity, or gender (e.g., Bridges and Steen 1998; Bechtold et al., forthcoming)?

Fourth, it is clear that adolescence is a distinct period of the life course, one marked by immature decision-making capacities, low impulse control, and lessened ability to resist peer influences (Steinberg and Cauffman 1999). There may be other individual differences among adolescents worthy of investigation. As seen in insights borrowed from general strain theory (Agnew 1997, pp. 112–13), adolescents compared with adults may have more negative relations with others, may interpret such relations as aversive, and may be more likely to cope with adversity through antisocial behavior. But as adolescents move into adulthood, they may come to have more control over their life and learn to react to adverse situations in a more prosocial manner.

With respect to neuroscientific research, several specific issues would be especially helpful to future discussions of adolescents' criminal responsibility and appropriate responses to juvenile crime. First, very few studies have linked changes in brain structure or function between adolescence and adulthood to changes in legally relevant behaviors, especially as they occur outside of controlled laboratory investigations, in order to investigate what other sources, aside from brain structure functioning, influence adolescent offending (Pfeifer and Allen 2012). Research is needed that directly links age differences in brain structure and function to age differences in legally relevant capacities and capabilities, especially within a longitudinal context (see Ordaz et al. 2013). Research is also needed on how social contexts influence the development and functioning of the brain across the adolescence-adult transitional period in an effort to understand how decision making may change, especially around pubertal maturity (e.g., Crone and Dahl 2012). There

also remains a need for longitudinal research on brain functioning and structure to assess both normal developmental changes and changes related to trauma, injury, and substance use and abuse.

Second, almost all research on age-related changes in brain structure and function has been carried out with youths not involved in the justice system. Very few studies involve high-risk samples of young people. Although it has been crucial for purposes of legal policy to draw on studies of brain development in general population samples, it is important to know whether resulting conclusions generalize to populations of adolescents more likely to come into contact with the justice system. These include juveniles subjected to trauma and abuse, exposed to high levels of alcohol and illicit drugs, diagnosed with attention deficit and hyperactivity disorder and conduct disorders, and raised in dire poverty.

Third, although it is often assumed that adolescents are more amenable to rehabilitation than adults, little neurobiological research has examined this proposition. Work is needed on the nature, correlates, and causes of adolescent neuroplasticity, especially in connection with conditions of confinement in juvenile correctional facilities. We have good reason to suspect that harsh conditions such as solitary confinement impair brain development during a time of heightened susceptibility to the environment, but research on this proposition has yet to be conducted.

Finally, there is growing interest in whether neurobiological data, alone or with other types of data, can improve prediction of future behavior at the individual level with respect to recidivism or responses to intervention. Studies have compared juvenile offenders' brain structures or functions with those of nonoffenders, but using neuroscience to predict individuals' future behavior is different and more difficult. It is critically important to assess the accuracy of such predictions, especially when persons do not follow expected paths (i.e., persons without structural deficits who offend and vice versa). Research on these and related issues is necessary to move beyond the science of the laboratory and into real-world decision making and behaviors, so as not to minimize brain processing and behavior as "being defined by a battle between reason/regulation . . . versus the emotions" (Pfeifer and Allen 2012, p. 326).

Developmental science can play an important role in informing the legal response to youth crime (Scott 2013*a*, p. 103). Research on adolescence and adolescent risk taking provides some guidance for formulating crime policies that are fair to young offenders and may be effective in reducing offending.

B. Next Steps in Policy and Law

Informed policy making necessitates that actors in the juvenile justice system be knowledgeable about developmental changes during childhood and adolescence and about capabilities and characteristics that are relevant to competence, culpability, and likely responses to treatment (Steinberg 2009, p. 465; National Research Council 2014). For example, police officers need to deal with young persons in a developmentally appropriate manner. Training for police on this already exists, particularly with minority youths, in the police academy curriculum of the Philadelphia Police Department and the Chicago Police Department's training course on Procedural Justice and Police Legitimacy. Scientific information is important for judges' decisions about what to do with a juvenile offender, prioritizing the need to make fair and just decisions. Attorneys need information from developmental science to practice law more effectively and to better assess juveniles' understanding of court processes. Such information is pertinent to mental health professionals who make recommendations about adolescents' adjudicative competence (Grisso 2005). Legislators and other policy makers need this information to create laws and policies that are developmentally appropriate and scientifically reasonable. In short, knowledge about adolescents and adolescent development is needed to improve every component of the juvenile justice system.

The US Supreme Court left open the possibility of LWOPs for juveniles convicted of homicide. This raises two problems. First, it is unclear what criteria should be used to differentiate adolescents who warrant this sentence from those who do not. The majority of juvenile offenders do not become adult offenders, but social scientists are not infallible at predicting which juvenile offenders will become adult criminals (Piquero, Jennings, and Barnes 2012). Only a small proportion of juvenile offenders persist into adulthood, but it is very difficult to predict who they are, even with more, and better, information than any court will ever have (see Laub and Sampson 2003; Mulvey et al. 2010).

Factors that have nothing to do with risks of future violence may unconsciously influence sentencing decisions. Because race is likely to continue to be one of these, concern remains that LWOPs will disproportionately be imposed on black and Latino youths. There is some evidence that subjective perceptions by officials of youthful immaturity vary as a function of the race of the young person, with black adolescents being perceived as more mature and therefore more responsible

for their criminal behavior (Graham and Lowery 2004). More work in this area, especially in the policing and prosecutorial decision-making context, is needed.

States are grappling with implications of *Miller* in at least two respects.[27] First, if not LWOP, then what? Life sentences with the possibility of parole remain available, but individuals convicted of first-degree or capital murder are seldom granted parole. Very long sentences for juveniles without possibility of parole will function much like life sentences. The California Supreme Court, for example, recently held a sentence of 110 years on a juvenile unconstitutional because his eligibility for parole would fall outside his natural life expectancy. But what about less draconian measures? For a 16-year-old, a 50-year sentence, well within his life expectancy, might as well be a life sentence.

A second concern involves retroactivity: Are individuals sentenced to LWOPs as juveniles before *Miller* was decided entitled to resentencing? States disagree. Moreover, it is not clear what an appropriate revised sentence is or the criteria to be used to determine it. Should the focus be the circumstances of the original offense, the behavior of the inmate during his incarceration, the likelihood of rehabilitation, or some combination of the three? And within each of these categories, what factors are relevant? Recently, and in part motivated by prison overcrowding, California Governor Jerry Brown signed into law a bill that provides for review of sentences of juveniles who were convicted as adults and served at least 15 years of their original sentence. This provision will apply retroactively. The review is to take into account the age of the offender at the time of the crime and his or her prospects for rehabilitation.

Two states have applied the logic of *Miller* to discretionary juvenile LWOPs concerning which the youth's age was not fully considered

[27] States are divided on whether *Miller* has retroactive application and on criteria to use in resentencing affected prisoners. They are also grappling with whether *Graham* applies to specific term-of-year sentences, even if very lengthy (see Liles and Moak 2015). Moriearty (2015) addresses retroactivity by considering whether *Miller* articulates a "substantive" rule of constitutional law, in which case it would be retroactive, or is "procedural," in which case it would not. She argues that *Miller* creates a substantive side and should be applied retroactively. The Court was going to consider the question in 2015 (*Toca v. Louisiana*), but a negotiated agreement was reached between Toca and the district attorney. In March 2015, however, the US Supreme Court granted review in *Montgomery v. Louisiana* (USSC No. 14-280, cert. granted March 23, 2015) to address the question of whether *Miller* applies retroactively to individuals serving mandatory juvenile LWOP sentences (Juvenile Law Center 2015).

(South Carolina Supreme Court: *Aiken v. Byars*, 765 S.E.2d 572 [S.C. 2014]; Ohio Supreme Court: *State v. Long*, 8 N.E.3d 890 [Ohio 2014]). *Aiken* held that *Miller* refers retroactively to all individuals serving LWOPs for crimes committed as juveniles and provides for review of cases in which a juvenile's youthful attributes were not considered during sentencing.

Third, the juvenile justice system more than the adult system is likely to offer intensive risk reduction programs and ranges of educational and other services that respond to the developmental needs of adolescents (Bishop and Frazier 2000; Scott and Steinberg 2008; Mulvey and Schubert 2012). Such efforts should be fully funded and supported by policy officials. Several evidence-based programs exist for juvenile offenders (Washington State Institute for Public Policy 2007; Greenwood 2008), and the Office of Juvenile Justice and Delinquency Prevention identifies effective strategies for adolescent offenders on its Model Programs Guide website (http://www.ojjdp.gov/MPG).

Guidelines for correctional interventions among high-risk youths have been outlined and are summarized by Skeem, Scott, and Mulvey (2014, p. 733) to include the following:

1. interventions should be structured to respond to the developmental needs of adolescents;
2. programs should target risk factors for recidivism in individual youths;
3. correctional interventions should be in the community (unless the juvenile poses serious threats): it is important and easier to involve families in community-based treatment, and it is better to equip youths with tools to deal with criminogenic influences in their community (National Research Council 2013);
4. developmentally responsive risk reduction programs should be an integral part of facility-based dispositions; and
5. evidence-based programming should continue during reentry into the community.

In short, and unlike much twentieth-century juvenile offender programming, there should be consideration of the malleable aspects of psychosocial functioning in a developmentally informed manner. Programs need to be modeled after the lessons learned from developmental science in order to intervene most effectively and as early in the life course

as possible (e.g., Piquero et al. 2009). At the same time, there needs to be resistance to any use of such information "on an individual basis for legal purposes" (Bonnie and Scott 2013, p. 158). We anticipate continued research into the areas noted above as well as deeper penetration of this knowledge base into both public discourse and policy-making efforts and decisions surrounding adolescent offenders.

REFERENCES

Agnew, R. 1997. "Stability and Change in Crime over the Life Course: A Strain Theory Explanation." In *Developmental Theories of Crime and Delinquency*, edited by T. P. Thornberry. Vol. 7 of *Advances in Criminological Theory*. New Brunswick, NJ: Transaction.

Applegate, Brian K., R. K. Davis, and Frank T. Cullen. 2009. "Reconsidering Child Saving: The Extent and Correlates of Public Support for Excluding Youths from the Juvenile Court." *Crime and Delinquency* 55:51–77.

Arnett, J. J. 2000. "Emerging Adulthood: A Theory of Development from the Late Teens through the Twenties." *American Psychologist* 55:469–80.

Aspinwall, L. G., T. R. Brown, and J. Tabery. 2012. "The Double-Edged Sword: Does Biomechanism Increase or Decrease Judges' Sentencing of Psychopaths?" *Science* 337:846–49.

Bechtold, J., K. C. Monahan, S. Wakefield, and E. Cauffman. Forthcoming. "The Deep End of the System: Racial Disparity in Response to Juvenile Probation Violations." *Psychology, Public Policy, and Law*.

Bernburg, J. G., and M. D. Krohn. 2003. "Labeling, Life Chances, and Adult Crime: The Direct and Indirect Effects of Official Intervention in Adolescence on Crime in Early Adulthood." *Criminology* 41:1287–1318.

Bernburg, J. G., M. D. Krohn, and C. J. Rivera. 2006. "Official Labeling, Criminal Embeddedness, and Subsequent Delinquency: A Longitudinal Test of Labeling Theory." *Journal of Research in Crime and Delinquency* 43:67–88.

Bishop, D. M., and C. E. Frazier. 2000. "Consequences of Transfer." In *The Changing Borders of Juvenile Justice: Transfer of Adolescents to the Criminal Court*, edited by Jeffrey Fagan and Franklin Zimring. Chicago: University of Chicago Press.

Bonnie, R. J. 1992. "The Competence of Criminal Defendants: A Theoretical Reformulation." *Behavioral Sciences and the Law* 10:291–316.

———. 1993. "The Competence of Criminal Defendants: Beyond *Dusky* and *Drope*." *University of Miami Law Review* 47:539–601.

Bonnie, R. J., and E. S. Scott. 2013. "The Teenage Brain: Adolescent Brain Research and the Law." *Current Directions in Psychological Science* 22:158–61.

Brenhouse, H. C., K. C. Sonntag, and S. L. Andersen. 2008. "Transient D1 Dopamine Receptor Expression on Prefrontal Cortex Projection Neurons: Rela-

tionship to Enhanced Motivational Salience of Drug Cues in Adolescence." *Journal of Neuroscience* 28(10):2375–82.
Bridges, G. S., and S. Steen. 1998. "Racial Disparities in Official Assessments of Juvenile Offenders: Attributional Stereotypes as Mediating Mechanisms." *American Sociological Review* 63:554–70.
Casey, B. J. 2015. "Beyond Simple Models of Self-Control to Circuit-Based Accounts of Adolescent Behavior." *Annual Review of Psychology* 66:295–315.
Casey, B. J., S. Getz, and A. Galvan. 2008. "The Adolescent Brain." *Developmental Review* 28:62–77.
Cauffman, E., E. P. Schulman, L. Steinberg, E. Claus, M. T. Banich, S. Graham, and J. Woolard. 2010. "Age Differences in Affective Decision Making as Indexed by Performance on the Iowa Gambling Task." *Developmental Psychology* 46:193–207.
Cauffman, E., and L. Steinberg. 2000. "(Im)maturity of Judgment in Adolescence: Why Adolescents May Be Less Culpable than Adults." *Behavioral Sciences and the Law* 18:741–60.
Chein, J., D. Albert, L. O'Brien, K. Uckert, and L. Steinberg. 2011. "Peers Increase Adolescent Risk Taking by Enhancing Activity in the Brain's Reward Circuitry." *Developmental Science* 14:F1–F20.
Cohen, A. O., and B. J. Casey. 2014. "Rewiring Juvenile Justice: The Intersection of Developmental Neuroscience and Legal Policy." *Trends in Cognitive Sciences* 18:63–65.
Crone, E. A., and R. E. Dahl. 2012. "Understanding Adolescence as a Period of Social-Affective Engagement and Goal Flexibility." *Nature Reviews Neuroscience* 13:636–50.
Cullen, F. T., B. A. Vose, C. L. Jonson, and J. D. Unnever. 2007. "Public Support for Early Intervention: Is Child Saving a 'Habit of the Heart'?" *Victims and Offenders* 2:109–24.
Dahl, R. 2001. "Affect Regulation, Brain Development and Behavioral/Emotional Health in Adolescence." *CNS Spectrums* 6:60–72.
De Bellis, M. D., M. S. Keshavan, S. R. Beers, J. Hall, K. Frustaci, A. Masalehdan, and A. M. Boring. 2001. "Sex Differences in Brain Maturation during Childhood and Adolescence." *Cerebral Cortex* 11(6):552–57.
DeWitt, Samuel J., Sina Aslan, and Francesca M. Filbey. 2014. "Adolescent Risk-Taking and Resting State Functional Connectivity." *Psychiatry Research: Neuroimaging* 222:157–64.
Dmitrieva, J., K. C. Monahan, E. Cauffman, and L. Steinberg. 2012. "Arrested Development: The Effects of Incarceration on the Development of Psychosocial Maturity." *Development and Psychopathology* 24:1073–90.
Ernst, M., and J. L. Fudge. 2009. "A Developmental Neurobiological Model of Motivated Behavior: Anatomy, Connectivity and Ontogeny of the Triadic Nodes." *Neuroscience and Biobehavioral Reviews* 33(3):367–82.
Ernst, M., D. S. Pine, and M. Hardin. 2006. "Triadic Model of the Neurobiology of Motivated Behavior in Adolescence." *Psychological Medicine* 36:299–312.
Fagan, Jeffery. 1995. "Separating the Men from the Boys: The Comparative Advantage of Juvenile versus Criminal Court Sanctions on Recidivism among

Adolescent Felony Offenders." In *Serious, Violent, and Chronic Juvenile Offenders*, edited by J. Howell, B. Krisberg, J. D. Hawkins, and J. Wilson. Thousand Oaks, CA: Sage.

———. 2008. "Juvenile Crime and Criminal Justice: Resolving Border Disputes." *Future of Children* 18:81–118.

Fagan, Jeffery, and Franklin Zimring. 2000. *The Changing Borders of Juvenile Justice*. Chicago: University of Chicago Press.

Feld, Barry C. 1993. "The Politics of Race and Juvenile Justice: The 'Due Process Revolution' and the Conservative Reaction." *Justice Quarterly* 20:765–800.

———. 2013. *Kids, Cops, and Confessions: Inside the Interrogation Room*. New York: New York University Press.

Feld, Barry C., and Donna M. Bishop, eds. 2012*a*. *The Oxford Handbook of Juvenile Crime and Juvenile Justice*. New York: Oxford University Press.

———. 2012*b*. "Transfer of Juveniles to Criminal Court." In *The Oxford Handbook of Juvenile Crime and Juvenile Justice*, edited by Barry C. Feld and Donna M. Bishop. New York: Oxford University Press.

Feld, Barry C., B. J. Casey, and Y. L. Hurd. 2013. "Adolescent Competence and Culpability: Implications of Neuroscience for Juvenile Justice Administration." In *A Primer on Criminal Law and Neuroscience*, edited by F. J. Morse and A. J. Roskies. New York: Oxford University Press.

Feld, Barry C., and S. Schaefer. 2010. "The Right to Counsel in Juvenile Court." *Criminology and Public Policy* 9:327–56.

Galvan, A., T. A. Hare, C. E. Parra, J. Penn, H. Voss, G. Glover, and B. J. Casey. 2006. "Earlier Development of the Accumbens Relative to Orbitofrontal Cortex Might Underlie Risk-Taking Behavior in Adolescents." *Journal of Neuroscience* 26:6885–92.

Gardner, M., and L. Steinberg. 2005. "Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study." *Developmental Psychology* 41:625–35.

Gatti, U., R. E. Tremblay, and F. Vitaro. 2009. "Iatrogenic Effect of Juvenile Justice." *Journal of Child Psychology and Psychiatry* 50:991–98.

Giedd, J. N. 2004. "Structural Magnetic Resonance Imaging of the Adolescent Brain." *Annals of the New York Academy of Science* 1021:77–85.

Gjedde, A., Y. Kumakura, P. Cumming, J. Linnet, and A. Møller. 2010. "Inverted-U-Shaped Correlation between Dopamine Receptor Availability in Striatum and Sensation Seeking." *Proceedings of the National Academy of Sciences* 107(8):3870–75.

Gottfredson, M. R., and T. Hirschi. 1990. *A General Theory of Crime*. Stanford, CA: Stanford University Press.

Graham, S., and B. S. Lowery. 2004. "Priming Unconscious Racial Stereotypes about Adolescent Offenders." *Law and Human Behavior* 28:483–504.

Greenwood, P. 2008. "Prevention and Intervention Programs for Juvenile Offenders." *Future of Children* 18:185–210.

Grisso, T. 1980. "Juveniles' Capacities to Waive Miranda Rights: An Empirical Analysis." *California Law Review* 68:1134–66.

———. 2002. *Evaluating Competencies: Forensic Assessments and Instruments*. 2nd ed. New York: Kluwer/Plenum.
———. 2005. *Evaluating Juveniles' Adjudicative Competence: A Guide for Clinical Practice*. Sarasota, FL: Professional Resource Press/Professional Resource Exchange.
Grisso, T., L. Steinberg, J. Woolard, E. Cauffman, E. Scott, S. Graham, F. Lexcen, N. Reppucci, and R. Schwartz. 2003. "Juveniles' Competence to Stand Trial: A Comparison of Adolescents' and Adults' Capacities as Trial Defendants." *Law and Human Behavior* 27:333–63.
Huettel, S. A., A. W. Song, and G. McCarthy. 2009. *Functional Magnetic Resonance Imaging*. 2nd ed. Sunderland, MA: Sinauer.
Jordan, K. L. 2014. "Juvenile Transfer and Recidivism: A Propensity Score Matching Approach." *Youth Violence and Juvenile Justice* 12:315–31.
Juvenile Law Center. 2015. "U.S. Supreme Court to Address Question of Miller Retroactivity" (April 2). http://jlc.org/blog/us-supreme-court-address-question-miller-retroactivity.
Kassin, S. M. 2008. "The Psychology of Confessions." *Annual Review of Law and Social Science* 4:193–217.
Kassin, S. M., S. A. Drizin, T. Grisso, G. H. Gudjonsson, R. A. Leo, and A. D. Redlich. 2010. "Police-Induced Confessions: Risk Factors and Recommendations." *Law and Human Behavior* 34:3–38.
Kupchik, A. 2003. "Prosecuting Adolescents in Criminal Court: Criminal or Juvenile Justice?" *Social Problems* 50:439–60.
Lanza-Kaduce, L., J. Lane, Donna M. Bishop, and C. E. Frazier. 2005. "Juvenile Offenders and Adult Felony Recidivism: The Impact of Transfer." *Journal of Crime and Justice* 28:59–77.
Laub, John H., and R. J. Sampson. 2001. "Understanding Desistance from Crime." In *Crime and Justice: A Review of Research*, vol. 28, edited by Michael Tonry. Chicago: University of Chicago Press.
———. 2003. *Shared Beginnings, Divergent Lives: Delinquent Boys to Age 70*. Cambridge, MA: Harvard University Press.
Liles, A., and S. C. Moak. 2015. "Changing Juvenile Justice Policy in Response to the US Supreme Court: Implementing Miller v. Alabama." *Youth Justice* 15:79–62.
Loeber, R., and David P. Farrington, eds. 2012. *From Juvenile Delinquency to Adult Crime: Criminal Careers, Justice Policy, and Prevention*. New York: Oxford University Press.
Lopes, G., M. D. Krohn, A. J. Lizotte, N. Schmidt, B. E. Vasquez, and J. G. Bernburg. 2012. "Labeling and Cumulative Disadvantage: The Impact of Official Intervention on Life Chances and Crime in Emerging Adulthood." *Crime and Delinquency* 58:456–88.
Loughran, T. A., E. P. Mulvey, C. A. Schubert, L. A. Chassin, L. Steinberg, A. R. Piquero, J. Fagan, S. Cota-Robles, E. Cauffman, and S. Losoya. 2010. "Differential Effects of Adult Court Transfer on Juvenile Offender Recidivism." *Law and Human Behavior* 34:476–88.
Loughran, T. A., E. P. Mulvey, C. A. Schubert, Jeffery Fagan, A. R. Piquero, and S. H. Losoya. 2009. "Estimating a Dose-Response Relationship between

Length of Stay and Future Recidivism in Serious Juvenile Offenders." *Criminology* 47:699–740.
Mack, J. W. 1909. "The Juvenile Court." *Harvard Law Review* 23:104–22.
Malloy, L. C., E. P. Shulman, and E. Cauffman. 2014. "Interrogations, Confessions, and Guilty Pleas among Serious Adolescent Offenders." *Law and Human Behavior* 38:181–93.
Maroney, T. A. 2009. "The False Promise of Adolescent Brain Science in Juvenile Justice." *Notre Dame Law Review* 85:89–176.
———. 2011*a*. "Adolescent Brain Science after Graham v. Florida." *Notre Dame Law Review* 86:765–94.
———. 2011*b*. "Persistent Cultural Script of Judicial Dispassion." *California Law Review* 99:629–82.
———. 2014. "The Once and Future Juvenile Brain." In *Choosing the Future for American Juvenile Justice*, edited by Franklin E. Zimring and D. S. Tanenhaus. New York: New York University Press.
McGowen, A., R. Hahn, A. Liberman, A. Crosby, M. Fullilove, R. Johnson, E. Moscicki, L. Price, S. Snyder, F. Tuma, J. Lowy, P. Briss, S. Cory, G. Stone, and Task Force on Community Preventive Science. 2007. "Effects on Violence of Laws and Policies Facilitating the Transfer of Juveniles from the Juvenile Justice System to the Adult Justice System: A Systematic Review." *American Journal of Preventative Medicine* 32(4S):S7–S28.
Mears, D. P., J. C. Cochran, S. J. Greenman, A. S. Bhati, and M. A. Greenwald. 2011. "Evidence on the Effectiveness of Juvenile Court Sanctions." *Journal of Criminal Justice* 39:509–20.
Mears, D. P., J. C. Cochran, B. J. Stults, S. J. Greenman, A. S. Bhati, and M. A. Greenwald. 2014. "The 'True' Juvenile Offender: Age Effects and Juvenile Court Sanctioning." *Criminology* 52:169–94.
Monahan, K. C., A. Guyer, J. Silk, T. Fitzwater, and L. Steinberg. Forthcoming. "Integration of Developmental Neuroscience and Contextual Approaches to the Study of Adolescent Psychopathology." *Developmental Psychopathology*.
Monahan, K. C., L. Steinberg, and E. Cauffman. 2009. "Affiliation with Antisocial Peers, Susceptibility to Peer Influence, and Desistance from Antisocial Behavior during the Transition to Adulthood." *Developmental Psychology* 45:1520–30.
Monahan, K. C., L. Steinberg, E. Cauffman, and E. Mulvey. 2013. "Psychosocial (Im)maturity from Adolescence to Early Adulthood: Distinguishing between Adolescence-Limited and Persisting Antisocial Behavior." *Development and Psychopathology* 25:1093–1105.
Moriearty, P. L. 2015. "*Miller v. Alabama* and the Retroactivity of Proportionality Rules." *University of Pennsylvania Law Review* 17:929–90.
Morris, R. G., and A. R. Piquero. 2013. "For Whom Do Sanctions Deter and Label?" *Justice Quarterly* 30:837–68.
Morse, S. J. 2006. "Brain Overclaim Syndrome and Criminal Responsibility: A Diagnostic Note." *Ohio State Journal of Criminal Law* 3:397–412.
———. 2012. "Brain Overclaim Redux." *Law and Inequality* 31:509–34.

Mulvey, E. P. 2014. "Using Developmental Science to Reorient Our Thinking about Criminal Offending in Adolescence." *Journal of Research in Crime and Delinquency* 51:467–79.

Mulvey, E. P., and C. A. Schubert. 2012. "Some Initial Policy Implications from the Pathways to Desistance Study." *Victims and Offenders* 7(4):407–27.

Mulvey, E. P., L. Steinberg, J. Fagan, E. Cauffman, A. R. Piquero, L. Chassin, and S. H. Losoya. 2004. "Theory and Research on Desistance from Antisocial Activity among Serious Adolescent Offenders." *Youth Violence and Juvenile Justice* 2:213–36.

Mulvey, E. P., L. Steinberg, A. R. Piquero, M. Besana, J. Fagan, C. Shubert, and E. Cauffman. 2010. "Trajectories of Desistance and Continuity in Antisocial Behavior Following Court Adjudication among Serious Adolescent Offenders." *Development and Psychopathology* 22:453–75.

Murray, J., A. Blokland, D. P. Farrington, and D. Theobald. 2014. "Long-Term Effects of Conviction and Incarceration on Men in the Cambridge Study in Delinquent Development." In *Labeling Theory: Empirical Tests*, edited by D. P. Farrington and J. Murray. Vol. 18 of *Advances in Criminological Theory*. New Brunswick, NJ: Transaction.

Myers, D. L. 2003. "The Recidivism of Violent Youths in Juvenile and Adult Court: A Consideration of Selection Bias." *Youth Violence and Juvenile Justice* 1:79–101.

Nagin, Daniel S. 2013. "Deterrence in the Twenty-First Century." In *Crime and Justice in America, 1975–2015*, edited by Michael Tonry. Vol. 42 of *Crime and Justice: A Review of Research*, edited by Michael Tonry. Chicago: University of Chicago Press.

Nagin, Daniel S., Frank T. Cullen, and C. L. Jonson. 2009. "Imprisonment and Reoffending." In *Crime and Justice: A Review of Research*, vol. 38, edited by Michael Tonry. Chicago: University of Chicago Press.

Nagin, Daniel S., A. R. Piquero, E. S. Scott, and L. Steinberg. 2006. "Public Preferences for Rehabilitation versus Incarceration for Juvenile Offenders: Evidence from a Contingent Valuation Survey." *Criminology and Public Policy* 5(4):627–51.

National Research Council. 2011. *The Science of Adolescent Risk-Taking: Workshop Report*. Washington, DC: National Academies Press.

———. 2013. *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

———. 2014. *Implementing Juvenile Justice Reform: The Federal Role*. Committee on a Prioritized Plan to Implement a Developmental Approach in Juvenile Justice Reform, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

Nelson, E. E., E. Leibenluft, E. McClure, and D. S. Pine. 2005. "The Social Re-orientation of Adolescence: A Neuroscience Perspective on the Process and Its Relation to Psychopathology." *Psychological Medicine* 35:163–74.

Norbury, A., S. Manohar, R. D. Rogers, and M. Husain. 2013. "Dopamine Modulates Risk-Taking as a Function of Baseline Sensation-Seeking Trait." *Journal of Neuroscience* 33:12982–86.

Ordaz, S. J., W. Foran, K. Velenova, and B. Luna. 2013. "Longitudinal Growth Curves of Brain Function Underlying Inhibitory Control through Adolescence." *Journal of Neuroscience* 33:18109–24.

Petit, G., C. Kornreich, P. Verbanck, A. Cimochowska, and S. Campanella. 2013. "Why Is Adolescence a Key Period of Alcohol Initiation and Who Is Prone to Develop Long-Term Problem Use? A Review of Current Available Data." *Socioaffective Neuroscience and Psychology* 3:21890.

Petitclerc, A., U. Gatti, F. Vitaro, and R. E. Tremblay. 2013. "Effects of Juvenile Court Exposure on Crime in Young Adulthood." *Journal of Child Psychology and Psychiatry* 54:291–97.

Petrosino, A., C. Turpin-Petrosino, and S. Guckenburg. 2010. "Formal System Processing of Juveniles: Effects on Delinquency." *Campbell Systematic Reviews* 1:88.

Pfeifer, J. H., and N. B. Allen. 2012. "Arrested Development? Reconsidering Dual-Systems Models of Brain Function in Adolescence and Divisions." *Trends in Cognitive Science* 15:322–29.

Piquero, A. R. 2008. "Disproportionate Minority Contact." *Future of Children* 18:59–79.

———. 2013. "Youth Matters: The Meaning of Miller for Theory, Research, and Policy Regarding Developmental/Life-Course Criminology." *New England Journal on Criminal and Civil Confinement* 39:347–61.

Piquero, A. R., and A. Blumstein. 2007. "Does Incapacitation Reduce Crime?" *Journal of Quantitative Criminology* 23:267–85.

Piquero, Alex R., Frank T. Cullen, James D. Uneever, N. L. Piquero, and J. A. Gordon. 2010. "Never Too Late: Public Optimism about Juvenile Rehabilitation." *Punishment and Society* 12:187–207.

Piquero, Alex R., David P. Farrington, and A. Blumstein. 2003. "The Criminal Career Paradigm: Background and Recent Developments." In *Crime and Justice: A Review of Research*, vol. 30, edited by Michael Tonry. Chicago: University of Chicago Press.

———. 2007. *Key Issues in Criminal Career Research: New Analyses of the Cambridge Study in Delinquent Development*. Cambridge: Cambridge University Press.

Piquero, Alex R., David P. Farrington, Brian C. Welsh, R. Tremblay, and W. Jennings. 2009. "Effects of Early Family/Parent Training Programs on Antisocial Behavior and Delinquency." *Journal of Experimental Criminology* 5 (2):83–120.

Piquero, Alex R., W. G. Jennings, and J. C. Barnes. 2012. "Violence in Criminal Careers: A Review of the Literature from a Developmental Life-Course Perspective." *Aggression and Violent Behavior* 17:171–79.

Piquero, Alex R., and L. Steinberg. 2010. "Public Preferences for Rehabilitation versus Incarceration of Juvenile Offenders." *Journal of Criminal Justice* 38:1–6.

Redding, R. E. 2008. "Juvenile Transfer Laws: An Effective Deterrent to Delinquency?" Juvenile Justice Bulletin 2. Washington, DC: Office of Juvenile Justice and Delinquency Prevention.
Redding, R. E., and L. E. Frost. 2002. "Adjudicative Competence in the Modern Juvenile Court." *Virginia Journal of Social Policy and the Law* 9:353–410.
Reiss, Albert J., Jr., and David P. Farrington. 1991. "Advancing Knowledge about Co-offending: Results from a Prospective Longitudinal Survey of London Males." *Journal of Criminal Law and Criminology* 82:360–95.
Schneider, A. L. 1990. *Deterrence and Juvenile Crime: Results from a National Policy Experiment*. New York: Springer.
Scott, E. S. 2013*a*. "Children Are Different: Constitutional Values and Justice Policy." *Ohio State Journal of Criminal Law* 11:71–105.
———. 2013*b*. "Miller v. Alabama and the (Past and) Future of Juvenile Crime Policy." *Minnesota Journal of Law and Inequality* 31:535–58.
Scott, E. S., and T. Grisso. 1997. "The Evolution of Adolescence: A Developmental Perspective on Juvenile Justice Reform." *Journal of Criminal Law and Criminology* 137:154–67.
———. 2004. "Developmental Incompetence, Due Process, and Juvenile Justice Policy." *North Carolina Law Review* 83:793–845.
Scott, E. S., N. Reppucci, N. Dickon, and J. L. Woolard. 1995. "Evaluating Adolescent Decision Making in Legal Contexts." *Law and Human Behavior* 19:221–44.
Scott, E. S., and L. D. Steinberg. 2008. *Rethinking Juvenile Justice*. Cambridge, MA: Harvard University Press.
Skeem, J. L., E. Scott, and E. P. Mulvey. 2014. "Justice Policy Reform for High-Risk Youth: Using Science to Achieve Large-Scale Crime Reduction." *Annual Review of Clinical Psychology* 10:709–39.
Smith, A. B., R. Halari, V. Giampetro, M. Brammer, and K. Rubia. 2011. "Developmental Effects of Reward on Sustained Attention Networks." *Neuroimage* 56:1693–1704.
Smith, D. A., and R. Paternoster. 1990. "Formal Processing and Future Delinquency: Deviance Amplification as Selection Artifact." *Law and Society Review* 24:1109–32.
Sowell, E. R., D. A. Trauner, A. Gamst, and T. L. Jernigan. 2002. "Development of Cortical and Subcortical Brain Structures in Childhood and Adolescence: A Structural MRI Study." *Developmental Medicine and Child Neurology* 44(1):4–16.
Spear, L. P. 2010. *The Behavioral Neuroscience of Adolescence*. New York: Norton.
Steinberg, L. 2007. "Risk Taking in Adolescence: New Perspectives from Brain and Behavioral Science." *Current Directions in Psychological Science* 16:55–59.
———. 2008. "A Social Neuroscience Perspective on Adolescent Risk Taking." *Developmental Review* 28:78–106.
———. 2009. "Adolescent Development and Juvenile Justice." *Annual Review of Clinical Psychology* 5:459–85.
———. 2010. "A Dual Systems Model of Adolescent Risk-Taking." *Developmental Psychobiology* 52:216–24.

———. 2012. "Should the Science of Adolescent Brain Development Inform Public Policy?" *Issues in Science and Technology* 28(Spring):67–78.

———. 2013. "The Influence of Neuroscience on US Supreme Court Decisions about Adolescents' Criminal Culpability." *Nature Reviews: Neuroscience* 14:513–18.

———. 2014. *Age of Opportunity: Lessons from the New Science of Adolescence*. New York: Houghton Mifflin Harcourt.

Steinberg, L., and E. Cauffman. 1999. "A Developmental Perspective on Serious Juvenile Crime: When Should Juveniles Be Treated as Adults?" *Federal Probation* 63:52–57.

Steinberg, L., E. Cauffman, J. Woolard, S. Graham, and M. Banich. 2009. "Are Adolescents Less Mature than Adults? Minors' Access to Abortion, the Juvenile Death Penalty, and the Alleged APA 'Flip Flop.'" *American Psychologist* 64:583–94.

Steinberg, L., S. Graham, L. O'Brien, J. Woolard, E. Cauffman, and M. Banich. 2009. "Age Differences in Future Orientation and Delay Discounting." *Child Development* 80:28–44.

Steinberg, L., and K. C. Monahan. 2007. "Age Differences in Resistance to Peer Influence." *Developmental Psychology* 43:1531–43.

Steinberg, L., and R. G. Schwartz. 2000. "Developmental Psychology Goes to Court." In *Youth on Trial*, edited by Thomas Grisso and Robert G. Schwartz. Chicago: University of Chicago Press.

Steinberg, L., and E. Scott. 2003. "Less Guilty by Reason of Adolescence: Developmental Immaturity, Diminished Responsibility, and the Juvenile Death Penalty." *American Psychologist* 58:1009–18.

Sweeten, G., and R. Apel. 2007. "Incapacitation: Revisiting an Old Question with a New Method and New Data." *Journal of Quantitative Criminology* 23:303–26.

Sweeten, G., A. R. Piquero, and L. Steinberg. 2013. "Age and the Explanation of Crime, Revisited." *Journal of Youth and Adolescence* 42:921–38.

Tanenhaus, D. S. 2005. *Juvenile Justice in the Making*. New York: Oxford University Press.

———. 2012. "The Elusive Juvenile Court: Its Origins, Practices, and Reinventions." In *The Oxford Handbook of Juvenile Crime and Juvenile Justice*, edited by Barry C. Feld and Donna M. Bishop. New York: Oxford University Press.

US Supreme Court. 2004. Transcript of oral argument in *Roper v Simmons*, No. 03-633, October 13. http://www.supremecourt.gov/oral_arguments/argument_transcripts/03-633.pdf.

Van Leijenhorst, L., K. Zanolie, C. S. Van Meel, P. M. Westenberg, S. A. R. B. Rombouts, and E. A. Crone. 2010. "What Motivates the Adolescent? Brain Regions Mediating Reward Sensitivity across Adolescence." *Cerebral Cortex* 20:61–69.

Ward, J., M. D. Krohn, and C. L. Gibson. 2014. "The Effects of Police Contact on Developmental Trajectories of Violence: A Group-Based, Propensity Score Matching Analysis." *Journal of Interpersonal Violence* 29:440–75.

Washington State Institute for Public Policy. 2007. *Evidence-Based Juvenile Offender Programs: Program Description, Quality Assurance, and Cost*. Olympia: Washington State Institute for Public Policy.

Wermink, H., R. Apel, P. Nieuwbeerta, and A. A. J. Blokland. 2013. "The Incapacitation Effect of First-Time Imprisonment: A Matched Samples Comparison." *Journal of Quantitative Criminology* 29:579–600.

Winner, L., L. Lanza-Kaduce, D. M. Bishop, and C. E. Frazier. 1997. "The Transfer of Juveniles to Criminal Court: Re-examining Recidivism over the Long Term." *Crime and Delinquency* 43:548–63.

Woolard, J. L., H. M. Cleary, S. A. Harvell, and R. Chen. 2008. "Examining Adolescents' and Their Parents' Conceptual and Practical Knowledge of Police Interrogation: A Family Dyad Approach." *Journal of Youth and Adolescence* 37(6):685–98.

Woolard, J. L., C. S. Fried, and N. D. Reppucci. 2013. "Toward an Expanded Definition of Adolescent Competence in Legal Contexts." In *Psychology in the Courts: International Advances in Knowledge*, edited by R. Roesch, R. Corrado, and R. Dempster. London: Routledge.

Zimring, Franklin E. 1998. *American Youth Violence*. New York: Oxford University Press.

Zimring, Franklin E., and H. Laqueur. 2015. "Kids, Groups, and Crime: In Defense of Conventional Wisdom." *Journal of Research in Crime and Delinquency* 52:403–13.

Zimring, Franklin E., and S. Rushin. 2013. "Did Changes in Juvenile Sanctions Reduce Juvenile Crime Rates? A Natural Experiment." *Ohio State Journal of Criminal Law* 11:57–69.

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