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Making the Sentencing Case: Psychological and Neuroscientific Evidence for Expanding the Age of Youthful Offenders

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Abstract

Youthful offenders convicted of serious crimes continue to be sentenced to death and life without parole in the United States based on legal arguments that cast them as incorrigible and permanent dangers to society. Yet psychological and neuroscientific evidence contradicts these arguments and unequivocally demonstrates significant changes in brain, behavior, and personality throughout the life course, especially during adolescence as it extends into the early twenties. This article (*a*) clarifies the current state of the science on typical behavioral and brain development showing robust changes into the twenties; (*b*) demonstrates that behavior, personality, and psychopathic traits are dynamic and change over time; and (*c*) underscores that reliance on prior criminal behavior only to predict later recidivism is tenuous at best. Together, these scientific insights make a case for extending juvenile protections to youthful offenders sentenced for crimes committed in their teens and early twenties.

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INTRODUCTION

On December 10, 2020, Brandon Bernard became the youngest individual on federal death row in more than 70 years to be executed. Bernard, 18 at the time, was one of five Black adolescents ranging in age from 15 to 19 who were involved in a 1999 carjacking that resulted in the death of two White victims in a national park in Texas. Bernard was convicted of first-degree murder and sentenced to death. The younger accomplices were given lesser sentences as juveniles. During his 20 years in prison, there is no record of Bernard being charged with a single violation, and jurors who supported the original sentence publicly called for his life to be spared (Hale 2020). Despite showing remorse and rehabilitation, his appeals for clemency and a stay of execution were ultimately denied.

Like Bernard, youth who commit serious offenses in their late teens and early twenties are eligible to receive the most punitive sentences in the US justice system: death or life without the possibility of parole (LWOP). These sentences are based on arguments that they are incorrigible and beyond reform for reentry into society. Yet there is robust psychological and neuroscientific evidence that personality, behavior, and the brain change throughout the life span, especially during adolescence as it extends into the early twenties. Behavior, even in extreme forms, is dynamic over the life course, especially during the extended period of adolescence. Legal arguments of full adult capacity by 18 years in the sentencing of youthful offenders contradict this science and other laws in the United States that imply that adult capacity is not reached until the twenties (e.g., age for purchasing tobacco or alcohol is 21). This, however, is not to say that the handling of youthful offenders in the US justice system has not changed with time.

Over the past two centuries, the sentencing of youthful offenders has changed largely as a function of the political and social climate of the time (Bonnie & Scott 2013, Taylor-Thompson 2003). More recently, the laws and policies of the juvenile justice system have been based on scientific evidence and advances in our understanding of adolescent behavior and brain development (Casey et al. 2020, Cauffman et al. 2018). As such, youth involved in crime are seen as distinct from adults and as more vulnerable because of immaturity and thus require special protections (Casey 2019). Nonetheless, commissioned experts (e.g., Welner et al. 2019) are promoting misinformation about the maturity of the youth's mind and brain. These claims are far too reminiscent of the erroneous predictions about the emergence of juvenile superpredators in the 1990s (Snyder 2012). This prophecy never came to fruition. In fact, violent crime among youth has declined dramatically since the 1990s, but not before the superpredator myth robbed many youths, especially Black youths, of their childhood and right to a healthy development (Casey et al. 2020).

This article highlights psychological and neuroscientific evidence to inform the treatment and sentencing of youthful offenders. Specifically, we review the scientific literature to (*a*) clarify the science on robust behavioral and brain development beyond 18 years; (*b*) show that adolescents' behavior, personality, and psychopathic traits are not stable but change with age, life experiences, and intervention; and (*c*) underscore that relying only on prior criminal behavior and psychopathic traits to predict later criminal behavior is tenuous at best. This empirical evidence is presented within a historical context of recent US Supreme Court decisions.

US Supreme Court Decisions on the Sentencing of Youthful Offenders

In the past 30 years, the Supreme Court issued six decisions that brought significant change in the sentencing of juveniles convicted of serious crimes, including the abolishment of the death penalty and mandatory LWOP for offenders 17 years and younger (**Figure 1**). Each decision reflected the Supreme Court's conclusion that imposing these harsh sentences on juveniles violates the Eighth Amendment of the US Constitution and constitutes cruel and unusual punishment.

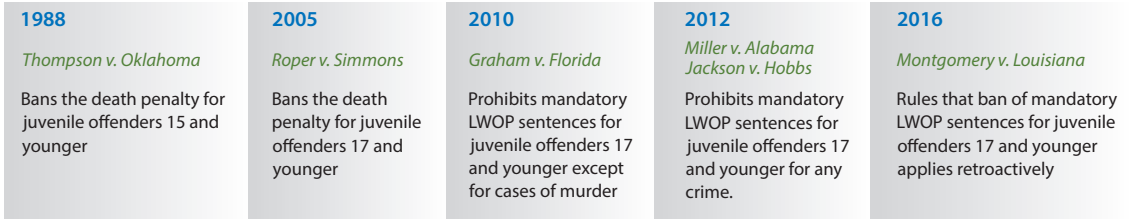

Figure 1

Timeline of US Supreme Court rulings on sentencing of youthful offenders. Abbreviation: LWOP, life without parole.

In its opinions, the Supreme Court concluded that juveniles under the age of 18 are fundamentally different from adults in ways that diminish their culpability and enhance their amenability to rehabilitation. Arguments for diminished culpability were based on evidence that youth are less mature in their ability to consider the future consequences of their actions (Steinberg et al. 2009b) and more susceptible to external pressures from others in comparison to adults (Gardner & Steinberg 2005, Steinberg et al. 2009a). Furthermore, youths' brains are not fully formed (Cohen et al. 2016b, Rudolph et al. 2017), and thus they exhibit greater potential for change than do adults. Together, these differences require that youth receive special protections under US laws.

One of the first US Supreme Court decisions to address juveniles' diminished culpability in relation to sentencing was *Thompson v. Oklahoma* (1988), which placed a ban on the death penalty for juveniles ages 15 or younger. This case resulted in the first demarcation in the age at which a youthful offender could receive the death penalty. Nearly 20 years later, the age would shift to 18 in *Roper v. Simmons* (2005). Contrary to public concerns, the court's decision to eliminate the death penalty for youth convicted of violent crimes was not associated with an increase in violent crime. In fact, the rulings have been paralleled by a steady decline in violent crimes committed by youth (Butts 2016, Casey et al. 2020, Snyder 2012).

Building on the foundations of *Roper*, the court subsequently established a ban on mandatory LWOP sentences for youth convicted of nonhomicide offenses in *Graham v. Florida* (2010). Two years later, the court extended the ban on mandatory LWOP to homicide in *Miller v. Alabama* (2012) and *Jackson v. Hobbs* (2012). With these rulings, a youth convicted of a crime can still receive LWOP, but the sentence cannot be implemented mandatorily for any given crime. Instead, judges must weigh the circumstances and make subjective evaluations of the juvenile's culpability and incorrigibility on a case-by-case basis. The extent of subjectivity in these decisions is seen in disproportionately harsher sentencing of Black and Brown youth relative to White youth in the United States (Natl. Res. Counc. et al. 2013). Thus, the recognition of differences between youths and adults in *Miller* and *Jackson* is not applied equally to all young people (Casey et al. 2020).

Although the court rulings in *Roper*, *Graham*, *Miller*, and *Jackson* impacted several hundred individuals at the time, the ruling of *Montgomery v. Louisiana* (2016) will likely have a bigger impact. In *Montgomery*, the court ruled that its decision in *Miller v. Alabama* (2012) be applied retroactively to individuals who had received LWOP as juveniles prior to 2012. As a result, more than 2,000 individuals are entitled to resentencing hearings.

How Far Has the US Justice System Come in the Treatment of Youthful Offenders?

The *Thompson*, *Roper*, *Graham*, *Miller*, *Jackson*, and *Montgomery* cases highlight the impact of developmental science on sentencing. All the crimes were committed prior to the age of 18 and often in the presence of peers. Not to discount the impact of these violent crimes on the victims and

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their families, but it is important to consider the impact of the original sentencing decisions on these youth. Where are Thompson, Simmons, Graham, Miller, Jackson, and Montgomery today?

We begin with the case of *Thompson v. Oklahoma*. William Thompson was convicted of murdering his abusive brother-in-law in 1983 in Oklahoma at the age of 15 and sentenced to death. He arrived on death row weighing less than 100 pounds and reading at a fourth-grade level (Bailey 2019). He spent four years on death row in lockdown for 23 hours a day before the US Supreme Court ruled his death sentence unconstitutional according to the Eighth Amendment prohibiting cruel and unusual punishment. Over thirty years later, Thompson remains incarcerated. Yet, his case set the stage for subsequent landmark US Supreme Court opinions that would protect even older youthful offenders (16- and 17-years-old) from execution and LWOP sentences.

In 1993, Christopher Simmons, 17 and a junior in high school, was found guilty of premeditated murder for a crime he committed with a friend and sentenced to death. He appealed his sentence to the Missouri Supreme Court, which sided with him, resentencing him to LWOP. The State of Missouri, through Warden Roper, petitioned for certiorari in the US Supreme Court. The US Supreme Court not only upheld the Missouri Supreme Court's decision but went further in stating capital punishment for 16- and 17-year-olds was unconstitutional, again based on the Eighth Amendment. Simmons is still incarcerated, but alive. Brandon Bernard, who was only a few months older than Simmons and an accomplice to a murder, is not. The *Simmons* case canceled the death sentences of 72 offenders younger than age 18 when they committed their crimes, including his own.

In 2003, three crimes were committed by youthful offenders whose cases rose to the US Supreme Court for rulings. The first of these cases was of Terrance Jamar Graham, who from ages 16 to 17 had been convicted of nonhomicide crimes, including robbery and armed burglary. The presiding judge in Graham's robbery case at age 17 sentenced him to life in prison. His legal team appealed this harsh sentence for a nonhomicide crime. In 2012, the US Supreme Court ruled on his case in *Graham v. Florida* to abolish mandatory LWOP sentences for nonhomicide crimes, thereby banning states from making the judgment at the outset that a youthful offender was incorrigible and beyond remediation for any crime other than murder. Graham was resentenced by the original trial judge to 25 years even though his record shows him as seeking a General Educational Development (GED) certificate when facing life and helping others to get their GED (Duvall 2017). Graham is still incarcerated (Fla. Dep. Correct. 2021), but his US Supreme Court case is impacting the lives of many other offenders who had been given a mandatory LWOP sentence that now have the opportunity to be resentenced, many of whom are already free, unlike Graham himself.

The second of the 2003 cases was that of Evan Miller, a 14-year-old boy who was convicted of murder during the course of an arson that Miller committed with another adolescent. He was sentenced to mandatory LWOP. The mandatory part of his sentence was struck down in *Miller v. Alabama* in 2012 when the US Supreme Court ruled that mandatory life sentences for juvenile cases, including murder, were unconstitutional. This decision provided the opportunity for the judge of that case to resentence Miller to LWOP again or to life with a chance of parole. To date, there is still no record of the judge's ruling having been made.

Finally, the third 2003 case was of Kuntrell Jackson who was 14 when he was convicted of murder and aggravated robbery after his adolescent friend killed a store clerk during the robbery. Jackson was charged as an adult and given a life sentence with no possibility of parole. His appeal ultimately resulted in the US Supreme Court opinion in *Jackson v. Hobbs* (2012), which stated that mandatory life sentences for any crime for juvenile cases were unconstitutional and entitled him to a new sentencing hearing. The US Supreme Court cases of *Miller* and *Jackson* affected hundreds of youthful offenders whose sentences did not take their age or other mitigating factors into account.

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Of all the Supreme Court cases on the sentencing of youthful offenders over the past three decades, only Jackson has been released to date, after serving 16 years in prison (Assoc. Press 2017).

Based on the rulings of *Miller* and *Jackson*, Henry Montgomery, who had been sentenced to LWOP, petitioned the court for resentencing. Montgomery was found guilty of murder for a crime he committed at the age of 17 and sentenced to death. This verdict was annulled by the Louisiana Supreme Court in 1966, arguing that it was an unfair trial due to public prejudice. At his retrial in 1969, a jury again convicted Montgomery of murder, but this time it resulted in a mandatory sentence of LWOP. Montgomery petitioned for resentencing after the *Miller* decision, which was denied by the Louisiana Supreme Court but later overturned by the US Supreme Court in *Montgomery v. Louisiana* (2016). That ruling mandated that *Miller v. Alabama* be applied retroactively allowing states to undertake resentencing or offer parole to inmates sentenced to life as juveniles. Up to 2,300 cases across the United States are potentially affected by this ruling. Yet Montgomery, who became a model member of the prison community and mentored younger inmates, is now 73 years old and still incarcerated. Montgomery's parole in 2018 and 2019 was denied (Reckdahl 2019).

William Thompson, Christopher Simmons, Terrance Graham, Evan Miller, and Henry Montgomery are all still behind bars, yet their Supreme Court cases have impacted the sentencing and resentencing of hundreds of inmates and youthful offenders. These decisions prevent states from making an automatic judgment at initial sentencing that a youthful offender is incorrigible and beyond remediation and thus should have no right to an opportunity for release. Yet the cases themselves demonstrate that parole for violent crimes is rare, even in nonhomicide cases (e.g., *Graham*), and that parole decisions vary significantly within and across states and at the federal level at the discretion of judges.

Although this set of Supreme Court decisions appears to acknowledge the legal system's capacity for differentiating among offenders over and under the age of 18 during sentencing, US law in other areas draws the line differently (e.g., 21 as the pertinent age to purchase alcohol). How might developmental science inform these inconsistent policy-relevant age demarcations?

CURRENT SCIENCE ON BEHAVIORAL AND BRAIN DEVELOPMENT

Adolescence: A New Informed Definition

The US Supreme Court decisions set 18 as the age demarcation between juvenile and adult for rulings on the two most punitive sentences, death and mandatory LWOP. However, the point at which a person is considered mature and progresses from adolescence to adulthood varies by cultural, political, and social factors. Puberty typically marks the beginning of adolescence, but the end point is less obvious. National and international experts and policy groups acknowledge continued maturity gained well after the age of 18. The World Health Organization (WHO) (2019) defines adolescents as individuals in the age range of 10–19 years but defines youth as those 15–24 years and young people as 10–24 years. The United Nations also defines youth as those persons between the ages of 15 and 24 years (U. N. Dep. Econ. Soc. Aff. 2018). As such, these agencies and organizations extend the end of adolescence and onset of adulthood to between 20 and 25 years.

Sawyer and colleagues (2018) suggest that based on evidence of continued neurocognitive maturation, the age range of 10–24 years reflects a more informed definition of adolescence than prior definitions. This protracted period of development aligns with the many demands that adolescents must learn to negotiate as they transition into adult roles (e.g., physical, sexual, cognitive, psychological, and social changes). Others divide this period into separate yet important developmental stages of early, middle, and late adolescence and young adulthood (Casey et al. 2020) based on functionally significant changes in the connections and circuits of the brain across this

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period (Casey et al. 2019, Heller et al. 2016). As such, it would be inaccurate to equate the brains of 13-year-olds to those of 19-year-olds, but both ages look significantly different from adults in important aspects of behavior (Cohen et al. 2016a, Steinberg 2008, Steinberg et al. 2009a).

Emerging or young adulthood, typically defined as 18–21, has been described as its own critical stage of life and is gaining more attention in the developmental literature. This is an important phase of developmental transition, as the individual no longer has the structured support of child- and family-oriented health and social services and often also lacks family and school structure (Sawyer et al. 2018). Arnett (2004), who coined the term "emerging adult," describes this period as an age of identity exploration, self-focus, and feeling in transition but also as an age of possibilities and opportunity. Given these differences from adulthood and the continued changes in neurocognition in the emerging adult, Sawyer et al. (2018) include this developmental period in a new and informed definition of adolescence.

The broadly defined period of adolescence and wide age range in the characterization of youth are analogous to the highly variable characterization of youthful offenders in the US justice system. When examining laws, the age at which adolescence ends and adulthood begins varies from one law, one context, and one state to the next. For example, when an individual reaches the age-of-majority in the United States (18 years), they are granted several civil rights and responsibilities of an adult by law (e.g., voting, signing legal documents, marrying, and serving in the military without parental permission). However, the age an individual can engage in other adult behaviors varies by the activity. For example, in some states, individuals can operate a motor vehicle as early as age 15 but cannot purchase alcohol, tobacco, and cannabis (where legalized) until age 21. Other US laws recognize continued maturation into the early twenties in the form of extended age eligibility for parent insurance coverage and foster care. The extended age boundaries of adolescence for the regulation of recreational substances and insurance are in sharp contrast to the age boundaries for the prosecution of juveniles. Each state sets a maximum age of juvenile court jurisdiction, which is 17 for most states. Yet laws about transfer to adult court vary wildly between crimes and between states, with no minimum age for some states. Consequently, children as young as 10 have been prosecuted and sentenced to death as adults in the United States (Streib 1987). This variability in age at which a juvenile may be charged as an adult raises the question of whether these age boundaries contradict or reflect the science on psychological and human brain development.

Defining Maturation and Adult Capacity

A question that developmental science is raising for the US legal system is whether the age demarcations between juvenile and adult are grounded in empirical evidence on behavioral and brain development. The age-of-majority model assumes that the individual generally reaches adult capacity by 18 years. Yet human development unfolds in complex ways. Not only do individuals develop cognitive competency as they mature, they also develop social and emotional competencies. Thus, reaching adult capacity is not a single process but rather consists of multiple processes that can interact in complex ways. Do all these competencies simultaneously reach adult capacity at the same age? Are we equally able to engage in controlled and flexible behavior in socially or emotionally arousing situations that involve desire, fear, or rage? Here, we clarify the current state of the science on typical behavioral and human brain development across these different domains of competency below.

When does psychological ability reach adult capacity? A large literature provides evidence of different developmental time courses for different psychological abilities. A hallmark of cognitive development is the ability to suppress competing inputs, thoughts, memories, and actions

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(Casey et al. 2002). Cognitive abilities, as measured on simple, self-paced, nonarousing laboratory tasks, show equivalent performance to adults by early adolescence (i.e., 10–12 years) (Ridderinkhof et al. 1997, Rueda et al. 2004). These tasks include simply ignoring distracting information (Stroop 1935) or inhibiting a competing response (Eriksen & Eriksen 1974). Other tasks include recalling a series of several digits in reverse order or attending to the opposite location in a display on which a dot appears (i.e., look left if the target appears on the right and vice versa), which show continued development into mid-adolescence (i.e., 15–16 years) (Luna et al. 2004, Steinberg et al. 2009b). However, strategic behaviors and decision-making under demanding conditions of increased attentional interference, memory load, or speeded response pressures show steady improvements beyond 18 years into the early twenties (Satterthwaite et al. 2013, Weintraub et al. 2013).

Not only do cognitive abilities change throughout adolescence, but social and emotional abilities also change. Several studies have shown that relative to adults, adolescents display a heightened sensitivity to rewarding and emotional cues and context (Bos et al. 2020, Cauffman et al. 2010, Defoe et al. 2015, Figner et al. 2009, Pattwell et al. 2012, Somerville et al. 2011) and peer influences (Burnett et al. 2011, Gardner & Steinberg 2005, Steinberg & Monahan 2007, van Hoorn et al. 2019). Heightened sensitivity to this information can be distracting and bias actions and decisions in suboptimal ways for adolescents (Beardslee et al. 2018, Smith et al. 2014) but can also enhance performance if used to reinforce goal-directed behavior (Barkley-Levenson & Galvan 2014; Braams et al. 2019; Davidow et al. 2016, 2018; Geier et al. 2010; Silva et al. 2016b; Teslovich et al. 2014). One example of a task that has demonstrated suboptimal social influences on cognitive performance reliably in adolescents across multiple studies and cultures is the stoplight game (Chein et al. 2011, Duell et al. 2018, Icenogle et al. 2019, Steinberg et al. 2008). In this task, adolescents and adults are asked to decide whether or not to drive through a yellow light at an intersection when alone or with a peer. Adolescents (13–16 years) exhibited a greater propensity to make more risky decisions when monitored by peers compared to adults (24 years and older) (Gardner & Steinberg 2005). Importantly, studies employing the stoplight game also provide evidence that young adults (18–22 years) exhibit susceptibility to social influence, such that they take more risks in the presence of peers (Gardner & Steinberg 2005, Silva et al. 2016a). It is likely that adolescents' and young adults' heightened susceptibility to social influences places them at risk for criminal activity, an idea corroborated by evidence that most youths commit crimes with accomplices (McCord & Conway 2005).

To illustrate, we provide a concrete example of how emotionally charged situations can impact cognitive capacity across age. **Figure 2** shows variability in cognitive abilities among adolescents (13–17 years), young adults (18–21 years), and adults (22 years and older) in emotionally arousing versus nonarousing conditions (Cohen et al. 2016b). When we compare performance on a cognitive control task under emotionally arousing conditions (i.e., showing fearful faces that signal potential threat) versus no emotional arousal (i.e., neutral faces), we see striking differences across age groups. Adolescents and young adults exhibit less cognitive control in the arousing condition than adults (**Figure 2*b***). However, young adults do not differ from adults in the nonarousing condition (**Figure 2*a***). Thus, cognitive capacity differs under emotional arousal and does not reach adult levels on this task condition until age 22.

To further examine the differences in cognitive capacity between adolescents, young adults, and adults, we also examined age as a continuous measure (**Figure 2*c,d***). Performance remained lower for the young adults in the emotional condition similar to the adolescents (**Figure 2*d***). We also observed high variability in performance for all conditions across age, such that the variance in cognitive performance within a single age was as large as the variance between ages. Distinguishing the capacity of a 17-year-old from an 18-, 19-, 20-, or 21-year-old would be impossible for a single individual or even group of individuals, but this distinction in performance becomes more obvious

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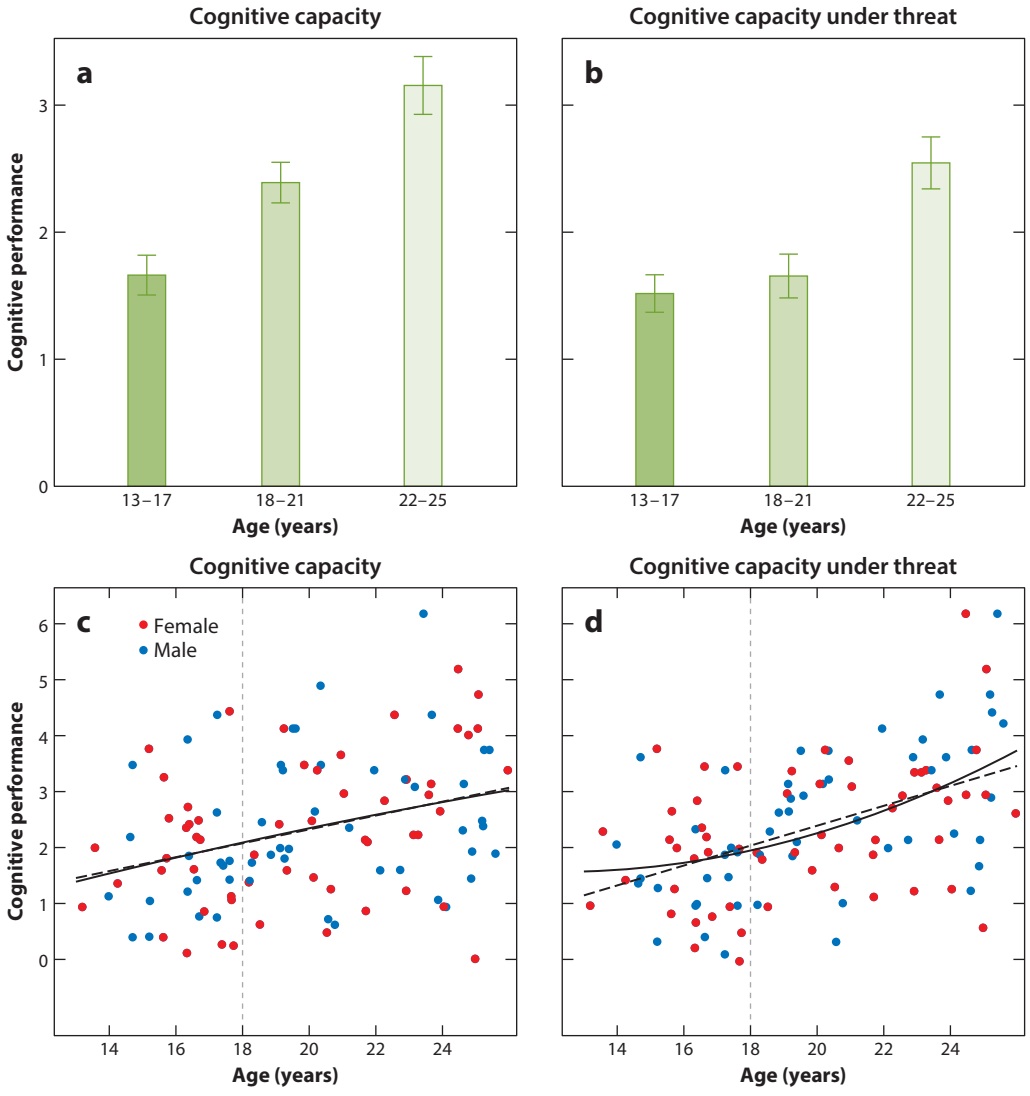

Figure 2

Cognitive capacity in nonarousing and emotionally arousing conditions by age for (*a*) a nonarousing condition and (*b*) an emotionally arousing condition. Age is plotted for the same data continuously for (*c*) a nonarousing condition and (*d*) an emotionally arousing condition. Solid and dashed black lines are quadratic and linear trends for age, respectively. Figure adapted with permission from Cohen et al. (2016b).

by the mid-twenties. Thus, the age at which cognitive ability matures depends on several factors, including the socio-emotional context and cognitive demands of the task. Together, these findings underscore that there is little difference between adolescents and young adults in cognitive capacity in emotionally charged situations, with continued improvement into the early twenties.

Overall, the literature on the development of psychological abilities reveals two key findings. The first is that adolescents and young adults as a group show immature psychological abilities relative to adults, which justifies special treatment and protection of youth. The second is that there is no one age at which an individual reaches maturity in all psychological capacities (Casey

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et al. 2020). The development of cognitive, emotional, and social psychological abilities mature at different ages and this development can extend beyond 18 years. As such, an adolescent may have the capacity to make rational decisions in one context but lack the ability to engage in mature decision-making in another.

When is the brain mature? Neuroscience has demonstrated that a fundamental characteristic of the brain is plasticity, i.e., the capacity for change. The brain exhibits remarkable plasticity throughout the life course, especially during the first two decades of life (Bavelier et al. 2010, Fu & Zuo 2011), as a function of life experiences and interactions with the environment. Thus, the idea that there is a single age when the brain is mature or no longer exhibits plasticity conflicts with neuroscientific evidence of continued changes. Moreover, there is tremendous variability in the age at which changes are observed in the brain, depending on the brain region (e.g., prefrontal cortex, nucleus accumbens, amygdala) (Mills et al. 2014) and imaging modality (i.e., brain structure, function, or connectivity) (Somerville 2016). Regardless of this variability, there are reliable brain changes that occur beyond age 18 that are relevant to criminal behavior and involve brain circuitry implicated in decision-making (e.g., prefrontal cortex) (Casey et al. 2020, Somerville 2016).

There is a large neuroimaging literature that suggests that although the brain is basically intact at birth, connections between and within brain circuits show dynamic changes over the life course. Numerous studies have shown adolescent-specific changes in brain regions and circuits involved in processing information associated with reward (Braams et al. 2015, Chein et al. 2011, Cohen et al. 2016b, Davidow et al. 2016, Ernst & Paulus 2005, Galvan et al. 2006, Geier et al. 2010, Insel et al. 2017, Somerville et al. 2011, van den Bos et al. 2015, Van Leijenhorst et al. 2010), emotional reactivity (Breiner et al. 2018, Dreyfuss et al. 2014, Hare et al. 2008, Heller et al. 2016, Monk et al. 2003), and emotional regulation (Cohen et al. 2016a; Gee et al. 2013; McRae et al. 2012; Pozzi et al. 2021; Silvers et al. 2015, 2017; van Hoorn et al. 2019). These developmental changes in the brain appear hierarchical in nature, with changes at each level facilitating subsequent changes that coincide with patterns of cognitive, emotional, and social development (Casey et al. 2016). This development reflects a shift from reliance on limbic emotional circuitry to more prefrontal control circuitry, with intervening phases of development within and between subcortical (limbic) and cortical (prefrontal) circuits from early adolescence to adulthood (Cohen et al. 2016b, Casey et al. 2019). Thus, adolescent development does not involve simply one or even two changes in brain structure and function but rather a series of changes in multiple brain networks during adolescence that extend into young adulthood (Casey 2015, Casey et al. 2020).

Given these dynamic changes in subcortical and cortical circuits, as well as plasticity and the potential for change in the brain over the life course, there have been admirable attempts to develop a maturational index of the brain, similar to growth curves for height and weight (Brown et al. 2012, Campagne et al. 2016, Dosenbach et al. 2010). For example, Brown and colleagues (2012) examined MRI-based structural changes in the brain to measure maturation in more than 800 three- to twenty-year-olds who were imaged at nine different sites (**Figure 3*a***). They used multiple anatomical measures (e.g., cortical volume, cortical area, subcortical volume) together with nonlinear modeling to track brain maturation. They reported changes in brain structure that extended to 20 years. However, just as different psychological processes develop at different time points, so too do different brain measures contribute to the prediction of age at different time points, with some contributing earlier in development and others contributing later in development beyond 18 years (**Figure 3*b***). These data reinforce the claim of dynamic changes in the brain from childhood to young adulthood.

Other attempts at establishing maturational indices with human brain imaging data have emerged. These studies have focused on changes in functional connectivity of the brain with age (Dosenbach et al. 2010, Kaufmann et al. 2017). Functional connectivity is a measure of how

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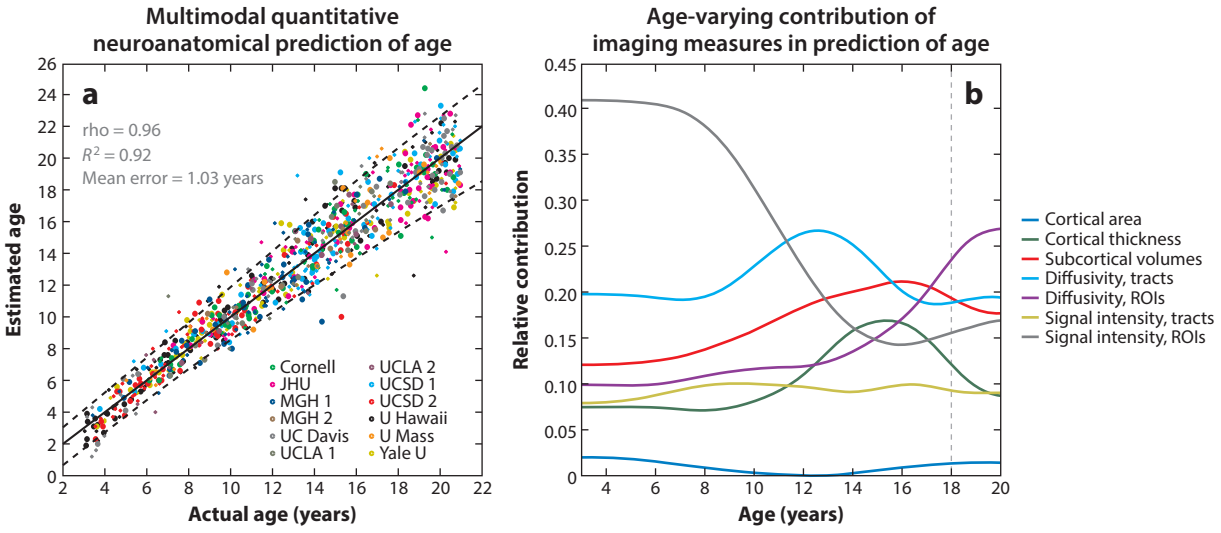

Figure 3

Anatomical prediction of age based on age-varying contributions of multimodal measures. (*a*) For 885 individuals, estimated brain age is plotted as a function of actual chronological age. (*b*) Plots of variation in the contribution of different imaging measures in the prediction of age. Colors in panel *a* correspond to different sites and scanners. Symbol size represents subject sex (larger, female; smaller, male). A spline-fit curve (*solid black line*) with 5% and 95% prediction intervals (*dashed black lines*) is also shown in panel *a*. Figure adapted with permission from Brown et al. 2012. Abbreviations: JHU, Johns Hopkins University; MGH1, Massachusetts General Hospital scanner 1; MGH2, Massachusetts General Hospital scanner 1; ROIs, regions of interest; UC Davis, University of California, Davis; UCLA1, University of California, Los Angeles scanner 1; UCLA2, University of California, Los Angeles scanner 2; UCSD1, University of California, San Diego scanner 1; UCSD2, University of California, San Diego scanner 2; U Hawaii, University of Hawaii; U Mass, University of Massachusetts; Yale U, Yale University.

activity in different regions of a brain network covaries during rest or performance of a task. Across these studies, functional connectivity changes were observed from childhood into young adulthood (Dosenbach et al. 2010) that appeared earlier in females than males (Kaufmann et al. 2017). For example, Dosenbach and colleagues (2010) examined changes in patterns of functional connectivity across brain networks in more than 300 individuals ages 7–30 years to estimate age. They found that they could predict, with some degree of certainty, differences in connectivity patterns between children relative to adults but could not confidently predict differences between 17-, 18-, 19-, and 20-year-olds. Moreover, the pattern of connectivity continued to show changes beyond 20 years before reaching asymptote by the mid-to-late twenties (**Figure 4**).

Measuring brain maturity becomes a bit more complicated when we examine brain connectivity and function in emotional states. Rudolph and colleagues (2017) attempted to predict the true age of more than 200 participants ages 10–25 years using machine learning and patterns of functional connectivity within and across brain networks in different mental states. They found that the model could predict age with some degree of certainty in nonarousing states, but the model was less accurate at predicting age in emotionally arousing states. Where the model was least accurate was in predicting the true age of adolescents (13–17 years) relative to younger and older participants during emotional states. Adolescents were predicted to be younger than they actually were based on their functional connections in these states. Thus, in emotional situations, adolescents' brains appeared less mature. Overall, less mature patterns of functional connectivity in emotional arousal were associated with self-reported risky behavioral preferences and tendencies. The highest risk preferences were reported by young adults (18–21 years)

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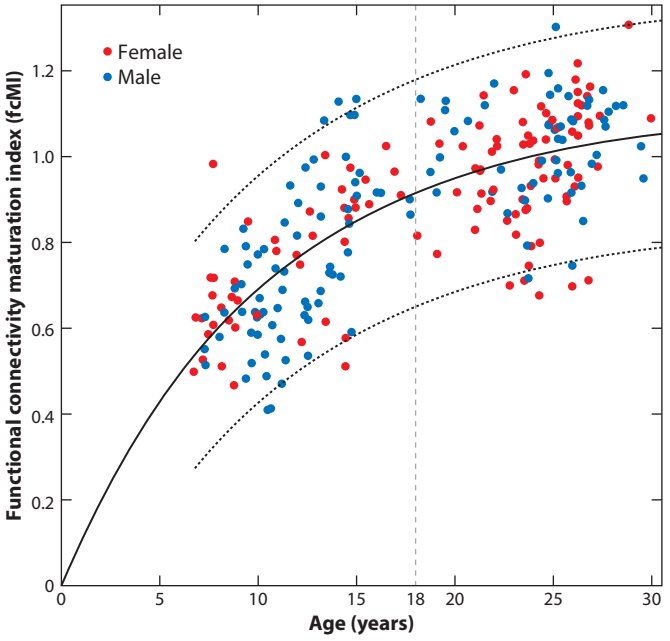

Figure 4

Brain maturation index based on functional connectivity. Cross-sectional changes in patterns of functional connectivity in the brain from 7 to 30 years ($n > 230$). The solid black line indicates best predicted fit and dashed black lines indicate 95% prediction limits. Figure adapted with permission from Dosenbach et al. (2010).

with immature functional connections under emotional arousal. These findings suggest that in emotionally charged situations the brain looks less mature during adolescence, and this shift in immature patterns of connectivity is related to risky behaviors that extend into young adulthood.

To more fully discern the impact of emotional arousal on brain function, Cohen et al. (2016b) tested the effects of emotional states on cognitive performance and brain activity. As described earlier (**Figure 2**), they found that both adolescents (13–17 years) and young adults (18–21 years) performed worse than adults (22 years and older) under emotional arousal (threat) relative to a nonarousing condition. These patterns in behavior were paralleled by less activity in prefrontal control circuitry in both adolescents and young adults relative to adults but more activity in the limbic (emotional) circuitry. The threatening condition in this experiment rather than the neutral one may best recapitulate the emotionally charged situations in which young people often find themselves when they come into contact with the law. Together, the behavioral and brain imaging findings suggest that brain function and cognitive capacity vary as a function of emotional and social contexts and that full adult capacity in these contexts is not observed until the early twenties.

CRIMINAL BEHAVIOR, PERSONALITY, AND PSYCHOPATHIC TRAITS: EVIDENCE OF CHANGE

Criminal Behavior Decreases with Age: The Age–Crime Curve

Adolescence is characterized as a period of transition from reliance on the caregiver to relative independence from the caregiver (Casey 2015). By definition, this period is transient. Behaviors

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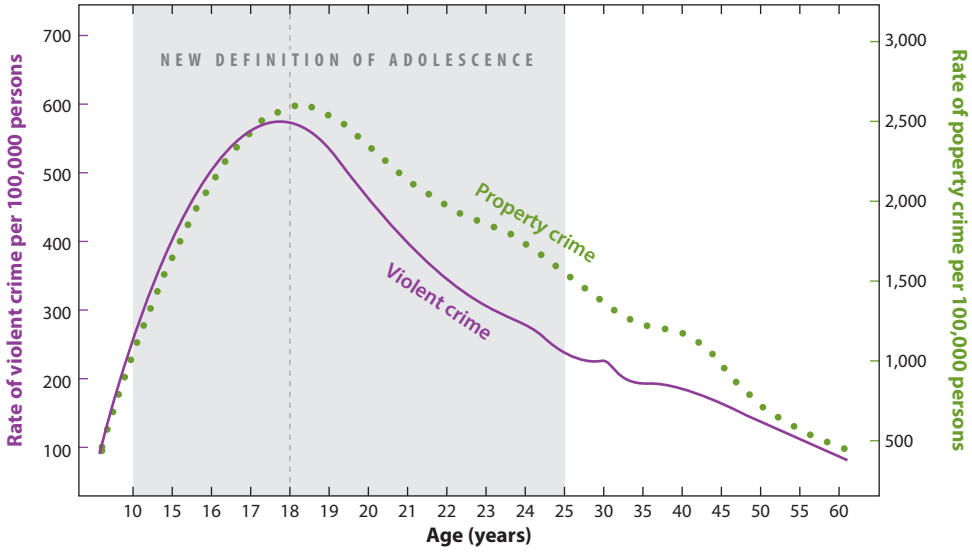

Figure 5

Age–crime curve. The gray box indicates adolescence according to Sawyer et al.'s (2018) definition. Figure adapted with permission from MacArthur Found. Res. Netw. Law Neurosci. (2017).

that emerge during this period peak and decline and are temporary. For example, risky behavior in the presence of peers and diminished cognitive performance in anticipation of reward increase during adolescence and decline in adulthood. Similarly, we see a transient pattern in criminal behavior that peaks during adolescence and subsides by the mid-twenties (**Figure 5**) (Bur. Justice Stat. 2010, Farrington 1986, Farrington et al. 2012). The majority of adolescents who commit crime desist as they mature into adulthood (Moffitt 2018). Although violent crime by youth in the United States has decreased considerably from its peak in the 1990s (Butts 2016, Casey et al. 2020), the association between age and crime has remained relatively constant (Sweeten et al. 2013). The transience of criminal behavior during adolescence and subsequent decline in adulthood suggests that the logic behind punitive life sentences, i.e., youth who commit violent crimes will inevitably commit violent crimes as adults, is not supported by these data.

Evidence of Changes in Personality Across the Life Course

The once popular idea that personality emerges early in development and is a relatively stable, distinctive way of thinking, acting, feeling, and relating to the world has been called into question. There is now strong evidence to show that personality not only develops throughout childhood and adolescence but changes throughout the entire life course (Harris et al. 2016, Roberts & Mroczek 2008, Soto et al. 2011). Research demonstrates that, on average, people show increased self-control and emotional stability as age increases, with ages 20–40 showing the greatest amount of change in key personality traits (Roberts & Mroczek 2008). For example, compared to young adults, middle-aged adults score higher on personality traits related to agreeableness (i.e., cooperative) and conscientiousness (e.g., self-control), and score lower on neuroticism (i.e., heightened negative emotion), extraversion (i.e., sociability), and openness (i.e., open to new experiences) (Srivastava et al. 2003). Unequivocal evidence of these changes in personality traits with age is provided by a comprehensive meta-analysis of more than 90 longitudinal studies covering the ages of 10 to over 100 years (Roberts et al. 2006). Changes in all personality trait domains were found

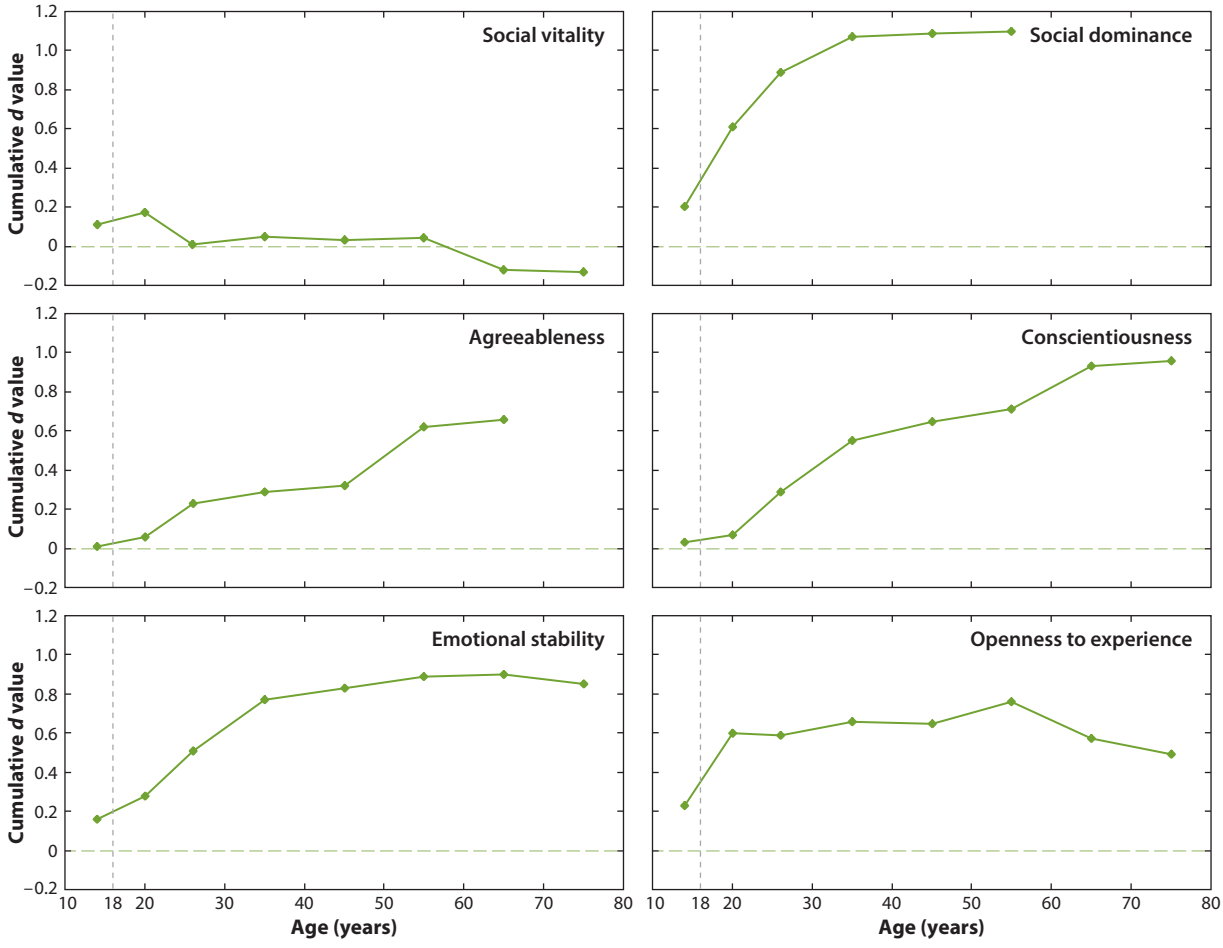

Figure 6

Changes in personality traits from childhood to old age. Abbreviation: *d*, difference between mean levels calculated cumulatively. Figure adapted with permission from Roberts & Mroczek (2008).

at different times in the life course, with changes extending into middle (40–60 years) and old age (over 60 years). Thus, personality traits are not stable but change throughout the life course.

Changes in personality from childhood to old age are illustrated in **Figure 6** (Roberts & Mroczek 2008). This figure shows cumulative changes in five key personality traits across the life course (McCrae & Costa 2008), with extroversion further subdivided into social vitality (gregariousness) and social dominance (assertiveness) (Roberts & Mroczek 2008). The majority of change in traits occurs after young adulthood. Specifically, the trait of conscientiousness characterized by being disciplined shows substantial changes from 22 to 40 years (see also Roberts et al. 2006, Roberts & Wood 2006). Likewise, emotional stability shows the biggest change after 22 years. This latter finding is reminiscent of the previously described differences between individuals under and over 22 years in patterns of brain activity and cognitive performance under emotional arousal (Cohen et al. 2016b). Thus, these findings together illustrate changes in behavior, brain, and personality that extend beyond 18 years. Moreover, this work on personality development highlights that people retain the capacity to change at all ages.

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It is important to highlight not only that there are changes in personality with age but that the environment and life experiences can influence personality development. Life experiences, like the start of a new relationship or career, may place new demands on youth that result in long-lasting personality changes (Costa et al. 2019, Damian et al. 2019). These same experiences may act as turning points for serious criminal behavior, through which youth adopt new roles, responsibilities, and attitudes that lead them to desist from crime (Sampson & Laub 2005). For youth and young adults, it is essential that opportunities for different life experiences exist to promote the development of personality. Overall, findings of personality change and development, as well as the importance of investing in the social development of youth, contradict legal arguments of youthful offenders as incorrigible, beyond reform or reentry into society, and that incarceration promotes any sort of positive change. Given that personality is constantly changing beyond 18 years, with potential for positive change even after young adulthood, to punish youthful offenders indefinitely (e.g., LWOP) and place them in environments rife with violence (i.e., prison) for actions from an earlier developmental period is not only unfounded but may stifle the potential for growth in these youth.

Callous-Unemotional and Psychopathic Traits Diminish with Age and Treatment

In the previous section, we provided evidence of dynamic changes in personality across the life course. However, what about extreme behaviors and traits such as callous-unemotional and psychopathic traits? Youth with these traits display high rates of antisocial behavior but also exhibit affective and interpersonal traits marked by callousness, low empathy, and low interpersonal emotions. These traits are important for designating a subgroup of antisocial youth who show early-onset delinquency and an increased risk for later antisocial and delinquent behavior (Frick 2009, Frick et al. 2014).

Historically, callous-unemotional and psychopathic traits have been described as emerging early with a stable course (Cleckley 1964, Frick et al. 2014, Lykken 1996). However, there is emerging empirical evidence of change in the developmental course of these traits. Hawes and colleagues (2018) examined the development of early psychopathic traits of more than 1,000 boys from childhood to adulthood and highlighted significant heterogeneity with age. Although a small group of boys showed persistently high trajectories of psychopathic traits, the majority of the boys who initially had high levels of psychopathic traits exhibited decreasing patterns during development and no longer presented with psychopathic traits in adulthood. These findings are consistent with a prior study examining the trajectories of callous-unemotional traits in a similarly large but independent sample of 1,170 justice-involved adolescent males (Baskin-Sommers et al. 2015). Three groups of youth were identified, those with low (27%), moderate (57%), and high (16%) levels of callous-unemotional traits. Youth in moderate callous-unemotional trait trajectories showed decreases in callous-unemotional traits from 16 to 24 years. Together, these studies indicate that the callous-unemotional/psychopathic traits decrease with age in the majority of youth whether justice involved or not.

The prior studies focused on developmental trajectories of callous-unemotional and psychopathic traits without the consideration of intervention or treatment. Treatment of these traits within the community, schools, or justice system is challenging. Often these youth are treated for their impulsivity, failure to follow instructions, and aggressive tendencies with pharmacological treatments, such as stimulants that help with attention-deficit/hyperactivity disorder and aggression (Connor et al. 2002). However, the impact of pharmacological interventions on the interpersonal and affective features of callous-unemotional and psychopathic traits is minimal

(Wilkinson et al. 2016). In terms of psychological interventions, there is mixed evidence regarding the effectiveness of treatment in youth showing callous-unemotional and psychopathic traits. Some studies report reductions in the expression of callous-unemotional traits and antisocial behavior following treatment (Bansal et al. 2019, Caldwell 2011, Caldwell et al. 2016); some report that youth with psychopathic traits show worse antisocial behavior following treatment (Wilkinson et al. 2016); and some report no relationship between these traits and changes in antisocial behavior following treatment (Wilkinson et al. 2016). Taken together, there is evidence that youth with callous-unemotional or psychopathic traits, regardless of whether they are justice involved or not, show treatment responsiveness in terms of clinical traits but mixed evidence that this responsiveness translates into any or sustained treatment outcomes (e.g., reduction in antisocial behavior) (Muratori et al. 2019). The inadequacy of traditional interventions to improve outcomes equally across levels of callous-unemotional and psychopathic traits has led to an increased focus on using knowledge on the etiology of these traits to develop innovative interventions aimed at improving outcomes.

Several possible interventions for callous-unemotional and psychopathic traits are emerging. For example, approaches involving parent training interventions delivered in early childhood appear to produce lasting reductions in callous-unemotional and psychopathic traits (Hawes et al. 2014) and antisocial behavior (Kimonis et al. 2019), particularly in younger children. For youth with callous-unemotional/psychopathic traits, a focus on increasing parental warmth, an important parenting factor related to the onset and maintenance of callous-unemotional traits, appears particularly useful in combating the unemotional expression commonly observed in youth with these traits. For youth with callous-unemotional/psychopathic traits who are ensnared in the justice system, one promising intervention comes from the Mendota Juvenile Treatment Center in Wisconsin (Caldwell 2011, Caldwell et al. 2007). This treatment was developed based on factors related to callous-unemotional and psychopathic traits (Viding & Kimonis 2018) and included a reward-oriented structure matched with specific goals, empathy skill development, and ways to appeal to the self-interests of incarcerated adolescents. Institutional behavior and post-treatment violent and general offending were assessed over 2–6.5 years in 250 youth after they were released from custody. The treatment condition was associated with improved institutional behavior and reduced post-release recidivism relative to the comparison treatment condition. Moreover, youth in the treatment condition exhibited improved behavior regardless of their psychopathic traits (i.e., interpersonal, affective, behavioral, and antisocial). Thus, it is inappropriate to say that these youth are "treatment resistant" or even "less responsive to treatment" as has been argued, but rather it is more a problem of getting the right treatment (see Baskin-Sommers 2022). Together, the findings suggest that extreme criminal behaviors and traits decrease with age from adolescence into adulthood but even more so with effective treatments. Sentencing youthful offenders to prison for extensive periods of time with few opportunities for growth only stifles their potential to change, adds to an already overcrowded prison system in the United States, and increases the economic burden on society.

PREDICTING FUTURE CRIMINAL BEHAVIOR AND RECIDIVISM

Predictive Utility of Behavioral Evidence

Punitive sentences of LWOP or death are based on legal arguments of youthful offenders as incorrigible, i.e., beyond reform or reentry into society. Likewise, the media and others (Welner et al. 2019) portray youth who murder as having mental illnesses for which there is no potential for remediation, and thus they will remain a threat to society. However, can we truly predict who will or will not commit violent crimes in the future? Can the presence of mental illness help

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us predict which youth are more likely to commit crimes? Based on the National Comorbidity Survey–Adolescent Supplement (2001–2004) of more than 10,000 youth ages 13–17, Coker et al. (2014) found that although youth with lifetime DSM-IV-based diagnoses are more likely to report arrest-related crime than youth without a diagnosis, the majority do not. Ninety-three percent of youth with alcohol-use disorders and 80% of youth with a conduct disorder report never being arrested for a violent crime. Youth with anxiety and mood disorders reported even lower rates of crime. Moreover, 88% of those who had never been arrested report they had never committed a crime. Only youth with three or more diagnoses had higher rates of crime than those with no diagnosis. Moreover, there is some evidence that many youths who display antisocial psychopathology (e.g., conduct disorder, callous-unemotional traits) do not develop adult forms of antisocial psychopathology (e.g., antisocial personality disorder, psychopathy) commonly associated with elevated levels of criminal activity (Lynam et al. 2007, McMahon et al. 2010, Washburn et al. 2007). Thus, youth diagnoses can be informative and predictive but are not deterministic. The assumption that psychopathology in youth is a strong predictor of future behavior that warrants a life sentence or even death for those 18 and older is specious.

For those with psychopathology who commit crimes as a youth, it is difficult to predict who of them will recidivate. Recidivism depends on a host of factors related to the individual and the broader social context in which the individual develops. Even for youth showing callous-unemotional or psychopathic traits, meta-analyses suggest considerable heterogeneity when examining associations between these traits and recidivism. Associations between juvenile psychopathic traits and delinquency are only moderately related to recidivism (Asscher et al. 2011, Edens et al. 2007). Importantly, these associations are based on observational data and any claim of causality or determinism is unfounded. Therefore, evidence is modest, at best, that psychopathology is a predictor of recidivism. When considering sentencing decisions that can impact the lives of young people, the law and society should require more than modest evidence.

Statistically Significant Versus Clinically Meaningful Effects: Understanding the Difference

Although delinquency, antisocial behavior, and callous-unemotional and psychopathic traits in youth may be significantly associated with violent recidivism, it is important to distinguish between statistically significant and clinically meaningful effects. Statistical significance is often misinterpreted as clinically meaningful (Ranganathan et al. 2015). Measures of statistical significance like *p*-values quantify the probability of a study's results being due to chance, whereas clinically meaningful refers to the magnitude of the actual effect, which determines its clinical impact. Thus, a statistically significant association with $p = 0.05$ means that the results of a study are due to chance and not a real effect 1 in 20 times of performing that identical study. Clinically meaningful, in contrast, reflects whether the change observed in individuals makes a real difference to the subjects' lives and how long that difference or effect lasts (Ranganathan et al. 2015). To quantify clinical meaning, researchers often use effect size thresholds proposed by Cohen (2013), such as $d = 0.2$, which reflects a small effect size; $d = 0.5$, which reflects a medium effect size; and $d = 0.8$, which reflects a large effect size. Following this pattern, if groups differ by 0.2 or fewer standard deviations, this difference is considered trivial, even if statistically significant.

Statistical significance is heavily dependent on the sample size of the study. With large sample sizes, even small effects, which are clinically inconsequential, can be statistically significant. Any interpretation of study results should take into account the clinical meaning of a result by looking at the effect size and confidence intervals rather than basing a decision on simple statistical probabilities (e.g., *p*-value). This distinction is especially important when making subjective sentencing

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decisions about the lifetime potential of a youthful offender's future criminal behavior. The potential for change in extreme behavior and callous-unemotional/psychopathic traits for the majority of youth, combined with only moderate associations in their past and future criminal behavior, calls into question our ability to predict with certainty and beyond a reasonable doubt who will recidivate.

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CONCLUSIONS

Scientific evidence has emerged over the past several decades that shows unequivocally that there are continued changes in behavior and brain over the life span, especially during the prolonged period of adolescence. The decisions made in *Roper* and *Miller* were based largely on behavioral evidence of differences between youths and adults, with little knowledge or appreciation of the functionally significant and legally relevant brain changes throughout adolescence and into young adulthood. That evidence is now available and further confirms the behavioral science. Not only do these findings apply to *Roper*, *Miller*, and *Montgomery* but they also inform the extension of these decisions beyond 18 years.

An accumulation of evidence now shows that there are changes in personality over the life span beyond childhood and adolescence. This work contradicts the lay perspective that most personality development occurs early in life. Moreover, changes in personality later in life, on average, reflect increases in conscientiousness, emotional stability, and social maturity, indicators of a capacity to be a productive and contributing member of society. Since personality continues to change, especially beyond young adulthood in socially positive ways, life sentences based on behavior at a single developmental time point are unfounded.

Science now shows that not only are there changes in personality beyond child and adolescence but that extreme forms of behavior and traits diminish too. In fact, the majority of youth who engage in antisocial behavior and display callous-unemotional or psychopathic traits show a decrease in criminal behavior with age (Baskin-Sommers et al. 2015); with interventions, this decline is even greater (Caldwell et al. 2016). Given the potential for change in the individual and their environment throughout development, the ability to predict future criminal behavior based on prior behavior is tenuous at best. Sentencing decisions based largely on past behavior further open a door to subjective bias reflecting stigmas associated with extreme behaviors and traits as well as racial disparities that permeate the US criminal justice system.

Developmental science played a decisive role in the US Supreme Court decisions in *Roper* and *Miller* that youth should be treated differently from adults in the US criminal justice system. Now the science shows unambiguously that 18-, 19-, and 20-year-olds are more similar than different from 17-year-olds in many important aspects of behavioral and brain maturity, a conclusion that has already been drawn by the US legal system in other domains (e.g., regulation of tobacco sales to youth younger than 21). Yet individuals like Brandon Bernard continue to be severely punished for crimes committed as adolescents. Brandon is no longer with us. With his death comes the obligation to extend the age of juvenile status beyond 17, just as we extended the age from 15 years in *Thompson v. Oklahoma* (1988) to 17 years in *Roper v. Simmons* in 2005. The US justice system proclaims the importance of compelling evidence in the regulation of laws. So, let the evidence speak and prevent the opportunity for subjective bias in punitive sentencing decisions for youthful offenders and extend *Roper* and *Miller* beyond 17 to at least the 18–20 period of young adulthood, as other laws do. Let the behavior at the time of parole hearings be the defining basis for release and limit punitive death and life sentences given that the scientific evidence clearly shows the potential for change.

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