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Neural Mechanisms of Criminal Decision Making in Adolescence: The Roles of Executive Functioning and Empathy

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Abstract and Keywords

Adolescence is a time of change in which there is an increase and peak in criminal behavior. This chapter discusses the neurocognitive mechanisms underlying criminal decision making in adolescents. First, it provides a brief overview of the neural basis of decision making in typically developing adolescents. Second, it discusses studies that examine decision-making processes in delinquent and antisocial adolescents compared to their typically developing peers. The chapter focuses on executive functioning and empathy, and it is concluded that delinquent and antisocial adolescents mainly display affective deficits. This is manifested in risky and impulsive decisions and in impaired sensitivity to the distress and perspectives of other people. Finally, the chapter argues that future research on criminal decision making in adolescence could benefit from focusing on subgroups of offenders and from including environmental factors such as peer influence in experimental designs.

Keywords: neurocognitive mechanisms, executive functioning, empathy, criminal decision making, adolescence, conduct disorder

THE prevalence of criminal behavior tends to increase during adolescence, peak in late adolescence, and then decrease in adulthood—a phenomenon referred to as the “age–crime curve” (figure 13.1) (Hirschi and Gottfredson 1983; Loeber and Farrington 2014). It is possible that criminal behavior mostly results from a combination of different factors (e.g., genetic and environmental) that influence decision-making processes (Moffitt 2005). For example, biological dispositions may place certain children at risk for antisocial behavior, but this risk might increase or decrease as a result of life experiences, particularly in interactions with parents and peers (Dodge and Pettit 2003).

This chapter focuses on the underlying neurocognitive mechanisms in criminal decision making in adolescents. Understanding the decision-making processes and the possible differences between adolescents and adults may be crucial for gaining insight into the age–crime curve. The chapter first provides a general overview of the neural basis of decision making in typically developing adolescents. Then, studies that examine these processes in delinquent and antisocial adolescents are discussed.

Several cognitive processes may be involved in decisions that result in a person breaking the law (i.e., criminal decision making). This chapter focuses on two of these processes and their underlying neural circuitry: executive functioning and empathic skills. Executive functioning is an umbrella term that refers to domain general regulatory and control functions, including inhibition, self-regulation, planning, and organization. Poor executive functioning involves an inability to control behavior and may lead to increased impulsive risk-taking and difficulties in considering the future implications (p. 247) of one’s acts. Indeed, poorer executive functioning is generally observed in antisocial compared to typically developing individuals (Morgan and Lilienfeld 2000). Hence, juveniles with executive functioning deficits are at increased risk of criminal behavior, especially when their environment provokes or fosters such behavior (Moffitt and Henry 1989). When criminal acts directly involve victims, offender decision making might be influenced by a lack of empathic feelings. Empathy is the ability to share and understand the feelings of others and is usually divided into affective (e.g., shared affect and emotional resonance) and cognitive (e.g., emotion recognition, perspective-taking, and self–other distinction) aspects (Decety and Jackson 2004; Shamay-Tsoory, Aharon-Peretz, and Perry 2009). Realizing and feeling that the victim will suffer are thought to motivate individuals to inhibit harmful behavior. Many studies have indeed found a negative relationship between empathy and aggression (Lovett and Sheffield 2007). Together, research in the domain of executive functioning and that in the domain of empathy provide insight into how adolescents make decisions that have detrimental consequences for the self (e.g., problems in considering the implications of being arrested) and for others (e.g., lack of empathy for suffering victims of crime).

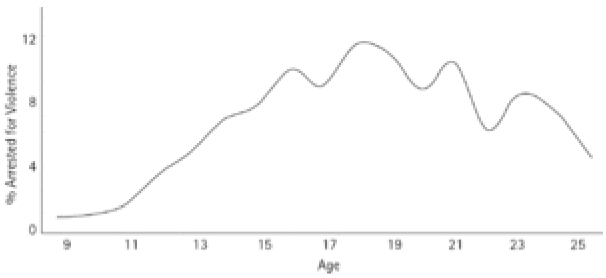

Figure 13.1 Age–crime curve, based on longitudinal data from the Pittsburgh Youth Study and using self-reported delinquency and official records of offending.

Source: Reprinted from Loeber and Farrington (2014).

I. Development of Brain Networks in Adolescence

One of the plausible explanations for the increase in offending during adolescence is the increase in risk-taking and impulsive behavior during this age period (Steinberg 2008). In general, decision making by adolescents involves more risky and impulsive choices in comparison with that by adults (Blakemore and Robbins 2012). This developmental (p. 248) pattern is often associated with the finding that executive functioning, which relies heavily on frontal lobe functioning, is still improving during this period (Blakemore and Choudhury 2006). Several landmark studies have shown prolonged brain development during adolescence, especially in the frontal lobes (Giedd et al. 1999; Gogtay et al. 2004). Furthermore, experimental studies have found increasing activation of the dorsolateral prefrontal cortex (dlPFC; for an overview of brain regions discussed in this chapter, see figure 13.2) from childhood toward adulthood, which has been linked to increasing regulation and control with age (Luna et al. 2001; van Leijenhorst et al. 2010; Güroğlu et al. 2011; Steinbeis, Bernhardt, and Singer 2012). In addition to the gradual development of control-related brain areas across adolescence, neuroimaging studies have also shown a specific adolescence-related change in the affective system of subcortical areas, including the amygdala and striatum (Ernst et al. 2005; Hare et al. 2008). In contrast to the prolonged developmental trajectory of the control system, the affective system seems to mature rather early in adolescence (Nelson et al. 2005). This combination of findings has inspired neurodevelopmental theories that explain risky and impulsive adolescent behavior as a result of a developmental mismatch between affective and cognitive control systems in the brain (figure 13.3) (Steinberg 2008; Somerville, Jones, and Casey 2010). These theories hold that faster maturation of the affective subcortical brain areas in comparison to the slower maturation of cortical frontal areas leads to more emotionally driven and risky decisions in adolescence. This maturation mismatch suggests that the strong incentive-seeking behavior typically observed in adolescence is driven by the affective system, whereas the frontal control system is not yet mature enough to properly control this increase in impulses. As a result, adolescent risk-taking might be especially sensitive to “hot” contexts in which emotions play a role, whereas adolescents might show no increased risk-taking in “cold” situations compared to adults (Figner et al. 2009; Crone and Dahl 2012).

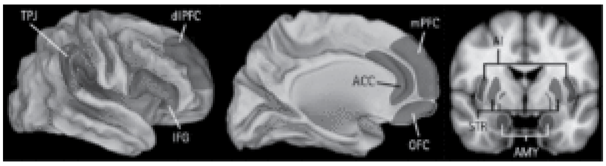

Figure 13.2 Schematic representation of brain networks involved in affective empathy (IFG, inferior frontal gyrus; ACC, anterior cingulate cortex; AI, anterior insula; AMY, amygdalae), cognitive empathy/ mentalizing (mPFC, medial prefrontal cortex; TPJ, temporoparietal junction), regulation and reward processing (dlPFC, dorsolateral prefrontal cortex; OFC, orbitofrontal cortex; STR, striatum).

In addition to the changes in the affective and control systems, adolescence is also characterized by a process of social reorientation marked by an increased focus on peer relationships (Steinberg and Morris 2001). These changes in social behavior are also reflected (p. 249) in an improvement in taking the perspective of others during adolescence (Güroğlu, van den Bos, and Crone 2009; Dumontheil, Apperly, and Blakemore 2010; Vetter et al. 2013). Neuroimaging studies have focused on understanding the neural underpinnings of these social changes by examining specific social processes, such as affective and cognitive empathy (Burnett et al. 2011; Crone and Dahl 2012). Affective empathy (i.e., sharing other's emotions) is often studied using experimental paradigms in which participants observe others in pain. The rationale behind this method is that vicariously experiencing the pain of others partly activates the neural networks involved in feeling pain ourselves (Singer and Lamm 2009). From childhood on, in typically developing populations, a network comprising the anterior insula and anterior cingulate cortex (ACC) is activated when experiencing pain firsthand as well as when observing someone else in pain (Decety, Michalska, and Akitsuki 2008; Bernhardt and Singer 2012). Other brain regions involved in empathy for pain, such as the amygdala, show a decrease in activation from childhood to adulthood, suggesting a reduction in arousal caused by other's distress with increasing age (Guyer et al. 2008; Decety and Michalska 2010). Possibly this reduction in spontaneous arousal or resonance with the feelings of others might be related to or result from increased regulation of emotions. This notion is supported by evidence showing an increase in activation in prefrontal regions involved in cognitive control and affect regulation, such as the dlPFC, with increasing age (Decety and Michalska 2010). These findings suggest that across adolescence, individuals become better at regulating emotions caused by seeing others in pain. According to some theoretical models of the development of empathy, this regulation is necessary to translate the personal stress caused by observing others in pain into positive action (i.e., prosocial behavior such as helping) (Eisenberg and Fabes 1990; Decety and Meyer 2008).

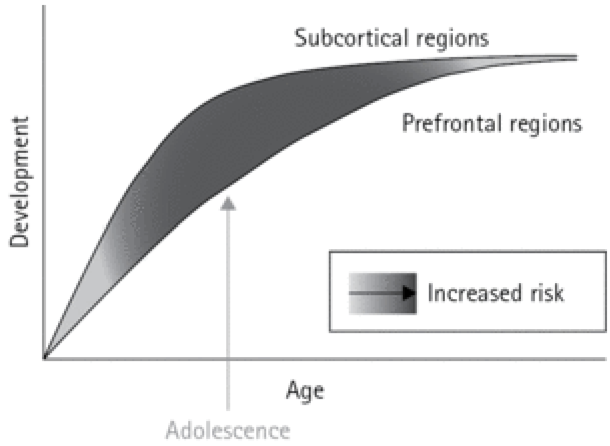

Figure 13.3 Schematic representation of the developmental mismatch model. Subcortical regions such as the amygdala and ventrial striatum (top line) mature earlier compared to prefrontal cortical regions (bottom line), leading to more emotionally driven behavior during adolescence.

Source: Reprinted from Somerville et al. (2010).

Cognitive empathy (i.e., attributing mental states to others) has been studied using a variety of tasks in adolescents, ranging from reflecting on other's thoughts and (p. 250) preferences (Burnett et al. 2009; Pfeifer et al. 2009) to strategic use of mental state information in social interaction games (Güroğlu et al. 2011; van den Bos et al. 2011). One specific example is a task used by Dumontheil et al. (2010) in which participants are instructed by a "director" to move objects between a set of shelves. Because the director can see only the contents of some of the shelves, participants have to take into account the director's visual perspective in order to move the correct objects and ignore those objects that the director cannot see. In this task and other cognitive empathy (or mentalizing) tasks, participants are critically required to represent the mental states and perspectives of other persons (Frith and Frith 2003). "Social brain regions" implicated in cognitive empathy are the temporoparietal junction (TPJ) and the medial prefrontal cortex (mPFC) (see figure 13.2). Several studies have shown that activation in the TPJ tends to increase with age across adolescence, accompanied by an increase in perspective-taking abilities (Blakemore et al. 2007; Güroğlu et al. 2011; van den Bos et al. 2011). In addition, activation in the mPFC decreases with age across adolescence, suggesting a shift in orientation from self to others (Burnett et al. 2009; Pfeifer et al. 2009; Gunther Moor et al. 2011; van den Bos et al., 2011).

Risk-taking in adolescence is also influenced by social changes during this life period. Accordingly, compared to adults, adolescents are more susceptible to the influence of peers on risk-taking behavior. In one study, participants played a video game in which they drove a car on a road with intersections and traffic lights. In this task, more points could be earned by driving fast and without stopping—for example, by driving through yellow traffic lights—but points were lost if the car crashed by hitting another car at an intersection. It was shown that when adolescents played this game in the presence of their peers, they showed an increase in risky decisions (as assessed by a higher number of car crashes), whereas children and adults did not show this increase (Gardner and Steinberg 2005). This study was followed up by a functional magnetic resonance imaging (fMRI) study that used the same experimental design in which participants performed the driving task both alone and with peers observing. During both conditions, compared to adults, adolescents showed less activation in the lateral prefrontal cortex, a brain region important for cognitive control. During peer observation specifically, compared to adults, adolescents showed greater activation in reward-related brain regions, including the ventral striatum. In addition, activity in these regions predicted subsequent risk-taking (Chein et al. 2011). These findings suggest that the presence of peers increases adolescent risk-taking, possibly due to the increased reward associated with risk-taking in a social context.

In summary, research has demonstrated important changes in brain regions implicated in control, affect, and social processes during typical adolescent development. During this life period, the affective brain areas mature relatively fast compared to the more gradual maturation of cortical frontal brain areas involved in control processes. This developmental mismatch between affective and control regions leads to an increase in sensation seeking in the absence of a sufficiently mature control system. In addition, the increased involvement of social brain regions with age, such as the TPJ, is associated with increased sensitivity to the perspective of others that might also heighten (p. 251) peer influence during adolescence. Together, these changes may underlie an increase in risk-taking during adolescence, especially when emotions play a role, such as in a social context with peers. This increase in risk-taking might be an important factor that can explain the age–crime curve. In addition, our understanding of the normative development can serve as a framework to interpret deviant developmental patterns in antisocial youth.

II. Deviating Patterns of Development in Adolescence

The normative adolescent increase in risk-taking, associated with the discrepancies between affective and cognitive systems, may partially explain why there is an increase in criminal behavior rates in adolescence. However, it does not explain the frequent and persistent antisocial behavior that is associated with disruptive behavior disorders, particularly conduct disorder (CD). Conduct disorder is characterized by a repetitive and persistent pattern of antisocial behavior in which the basic rights of others or major age-appropriate societal norms are violated (American Psychiatric Association 2013). Recent studies have estimated the lifetime prevalence of CD to be approximately 6.8 or 9.5 percent (Nock et al. 2006; Merikangas et al. 2010), whereas almost half of all incarcerated and detained adolescents fulfill criteria for CD, making it the most frequently occurring psychiatric disorder in this group (Colins et al. 2010). In addition, many symptoms of CD are also delinquent acts (e.g., stealing, raping, fire setting, and weapons use) (Loeber et al. 2000). An important distinction has been made between a relatively infrequent form of CD that begins in childhood and persists into antisocial behavior in adulthood (early onset CD) and a relatively common form of CD that begins in adolescence and mostly desists thereafter (Moffitt et al. 2002). It is hypothesized that CD is related to impairments in brain regions implicated in moral cognition, emotion, and executive functions, resulting in the inability to follow moral guidelines (Raine and Yang 2006). Indeed, difficulties in emotion processing have been found in CD (Herpertz et al. 2005), as well as impairments in executive functioning (Oosterlaan, Logan, and Sergeant 1998; Morgan and Lilienfeld 2000) that are already present in preschool children with CD symptoms (Schoemaker et al. 2012).

Another subgroup of antisocial and aggressive youths that has received increasing attention from researchers in recent years comprises those with conduct problems and high psychopathic traits. This research is focused mostly on a specific component of psychopathy, namely callous-unemotional (CU) traits (e.g., lack of guilt and empathy and callous use of others for one's own gain). Antisocial adolescents with high CU traits are thought to represent a specific group within antisocial and CD youth with a distinct neurocognitive profile characterized by low levels of fear and anxiety, blunted emotional reactivity, and insensitivity to punishment (Blair 2013; Frick et al. 2014). Moreover, it is (p. 252) suggested that antisocial individuals with high levels of CU traits exhibit a pattern of more severe and chronic antisocial behavior than those with low levels of these traits (Frick et al. 2005).

Next, this chapter focuses on studies of decision making in adolescent offenders recruited in forensic settings as well as studies that include antisocial adolescents with a diagnosis of CD (with high or low CU traits). This overview specifically focuses on executive functioning and empathic processes that are related to the antisocial behaviors displayed by these groups.

III. Executive Functioning in Antisocial Adolescents

Multiple studies provide converging lines of evidence that poor self-control is an important risk factor for criminal behavior (Pratt and Cullen 2000). Developmental neuroscience models suggest that risky behavior in adolescence results from slower maturation of cognitive control compared to affective systems in the brain. Accordingly, there is evidence that young offenders represent a subgroup of adolescents with particularly poor executive functioning skills, which are associated with risky decision making. For example, adolescents aged fourteen to eighteen years old with either early or adolescence-onset CD completed a task in which they could make risky decisions involving gains and losses (Fairchild et al. 2009). Participants could choose one of two roulette wheels: One wheel showed equal chances of gaining and losing money, and one wheel displayed various probabilities of gains and losses. Both CD groups exhibited more risky decision making compared to typically developing controls across a range of choices that varied in probability and size of the potential gains and losses. Importantly, these groups did not differ from typically developing controls in performance on the Wisconsin Card Sorting Test, an established measure of global “cold” (i.e., cognitive) executive functioning. This suggests that antisocial youth have specific deficits in affective and not cognitive control because they make more risky choices in a “hot” (i.e., affective) context independent of cognitive executive functioning deficits (Fairchild et al. 2009). In another study of a group of young offenders (aged twelve to eighteen years old) that used a similar roulette wheel task to measure risky choices, young offenders also made more risky decisions compared to typically developing controls (Syngelaki et al. 2009). In addition, compared to control participants, young offenders gambled more just after they had received a small compared to a large win, suggesting again that offenders make more risky decisions in an affective context.

A key function implicated in reward-based decision making is affect regulation. This involves regulatory processes in the orbitofrontal cortex (see figure 13.2) that generate and adjust the emotional responses that are used to assess risks (Ochsner and Gross 2005). For example, neurological patients with damage to the orbitofrontal cortex show (p. 253) impaired decision making under risk, which has been argued to be the result of an inability to optimally learn from rewards and punishments (Bechara 2004). Structural MRI studies have shown that youths with CD have reduced gray matter volume and cortical thickness in the orbitofrontal cortex, suggesting problems with affect regulation (Huebner et al. 2008; Fairchild et al. 2011; Hyatt, Haney-Caron, and Stevens 2012). Possible differences in affect regulation might also manifest themselves in aberrant reward processing in antisocial youth. For instance, in passive avoidance tasks, in which participants learn to respond to rewarding stimuli and to refrain from responding to stimuli that generate punishment, altered neural responses in the orbitofrontal cortex in participants with CD have been shown. In such passive avoidance tasks, youth with CD show reduced activity in both the orbitofrontal cortex and the caudate in response to reward and punishment outcomes (Finger et al. 2011; White et al. 2013). Similarly, in a study in which participants had to respond to target letters only and had to ignore nontarget letters in order to receive rewards, a reward-related dysfunction in the orbitofrontal cortex in boys with CD was found (Rubia et al. 2009).

Impulsivity and self-control are often measured using a “temporal discounting task,” in which temporal discounting refers to the decreasing value of rewards over time. In such a task, participants are asked to make a series of choices between an immediate small reward and a delayed reward of greater value. In one study, adolescents with CD (mean age, 15.7 years) more often preferred smaller immediate rewards over larger delayed rewards compared to typically developing controls (White et al. 2014). This may reflect a similar discounting in real life: The immediate rewards of criminal acts (e.g., gaining money by stealing) outweigh the temporally distant consequences of crime, such as jail or a criminal record (Petry 2002). As a result, individuals high on impulsivity and low on self-control seem to be more prone to choosing immediate high rewards associated with acts of crime. Furthermore, neuroimaging studies with CD youth suggest that they exhibit reduced activation in response to future rewards and punishments in the striatum and the orbitofrontal cortex during reversal learning (Finger et al. 2008). These impairments in reward representations might also further contribute to the preference for immediate rewards seen in youth with CD (White et al. 2014). This preference might lead to a focus on the short-term gains of crime. In addition, committing the crime may then seem appealing when the risk of getting caught and the impact of the possible punishment are also discounted (and hence probably underestimated).

Taken together, antisocial youth such as offenders and individuals with CD mainly show executive functioning difficulties in affective contexts and when rewards are at stake. These alterations in decision making in affective contexts may be partly explained by structural differences as well as reduced functional activity in brain regions related to the regulation of affect and reward processing, such as the orbitofrontal cortex. The impairments in affect regulation likely lead antisocial youth to make more risky choices. In addition, a heightened preference for immediate versus long-term rewards combined with impairments in predicting future rewards and punishments might make the lawbreaking choices seem much more appealing to adolescent offenders than to their typically developing peers.

(p. 254) IV. Empathy in Antisocial Adolescents

Diminished empathy is one of the main characteristics of aggressive, antisocial groups such as adolescents with CD and especially those with high CU traits (Decety and Moriguchi 2007). It is hypothesized that impairments in affective empathy (i.e., sharing other's emotions) play a more important role than impairments in cognitive empathy (i.e., understanding other's mental states) in antisocial and delinquent populations, particularly those with high CU traits (Blair 2005; but see van den Bos et al. 2014). This is in line with the idea that feeling an aversive emotional signal in reaction to another person in distress helps to inhibit aggressive and violent behavior (Miller and Eisenberg, 1988; Blair 1995). The lack of empathy that is part of high CU traits might be associated with less compassion for suffering of others, resulting in the lack of a barrier to use violence and to commit crimes that result in harm to others.

Several studies have found aberrant neural responses in young offenders and adolescents with CD when they observe photographs or film clips of other persons in distress. For example, brain activation as measured with electroencephalogram (EEG) showed that young offenders (aged fifteen to eighteen years old) have a reduced early response to pictures of others in pain compared to controls in a specific EEG component (the frontal N120 component) that is associated with an automatic aversive reaction to negative stimuli (Cheng, Hung, and Decety 2012). This suggests that offenders show less arousal in response to others in distress compared to controls. Two fMRI studies that used similar photographs of other persons in pain found reduced activation in youths with CD and high CU traits (aged ten to seventeen years old) in the anterior insula–ACC "pain network" and in other brain regions linked to empathy, such as the amygdala and inferior frontal gyrus (Lockwood et al. 2013; Marsh et al. 2013). Using emotional film clips and measures of vicarious responses, such as heart rate activity, studies have shown reduced responses to other's distress in groups of CD youth with CU traits compared to typically developing controls (Anastassiou-Hadjicharalambous and Warden 2008; de Wied et al. 2012). Thus, converging lines of evidence obtained using different techniques show that affective reactions toward others in distress are reduced in offenders and CD youth.

Another frequently used method within cognitive neuroscience to probe affective empathy is to present facial emotions of distress cues such as fear and sadness and assess spontaneous neural activity to these emotional expressions. Facial expressions of emotions have a communicatory function and can serve as aversive stimuli that can potentially change the behavior of the perceiver (Blair 2003). The amygdala is an important brain structure in processing of aversive stimuli and has been shown to be particularly sensitive to facial stimuli (Sergerie, Chochol, and Armony 2008). Adolescents with CD and psychopathic traits show reduced amygdala responses to fearful facial expressions compared to typically developing peers (Jones et al. 2009; White et al. 2012), as well as reduced coupling between the amygdala and the orbitofrontal cortex (Marsh et al. 2008). (p. 255) A reduced response in the amygdala was also found when fearful faces were presented below conscious awareness (masked by neutral, calm faces) in youth with CD and high CU traits (aged ten to sixteen years old). However, in this study, an increased amygdala response was found for the CD youth with low levels of CU traits compared to those with high CU traits and to controls (Viding et al. 2012). This suggests that affective empathy deficits as displayed by reduced responses to others in distress might not be omnipresent in all CD and antisocial youth but, rather, specific for those with high levels of CU traits. In contrast, antisocial individuals with low CU traits may show more reactive, impulsive aggression resulting from an increased sensitivity to negative emotions of others in comparison to proactive, premeditated aggression that is associated with high CU traits (Dodge et al. 1997).

Further differences in amygdala activation between CD with low and high CU traits were highlighted in a study by Sebastian et al. (2012). In this study, participants had to choose the appropriate ending of a short cartoon story that required them to understand the intentions of one story character (cognitive condition) or to infer how one story character would react to another character's emotional state (affective condition). In the affective condition, reduced activation was found in the amygdala and the anterior insula in the CD group compared to typically developing youth. In addition, a closer examination of amygdala activation within the CD group revealed that CU traits were negatively related to amygdala activation after controlling for the number of CD symptoms, whereas the number of CD symptoms was positively related to amygdala activation after controlling for CU traits (Sebastian et al. 2012). This latter finding might explain the heterogeneity that is often found in affective functioning in CD. For example, one study found increased amygdala activation in a small group of boys with CD when they watched others in pain (Decety et al. 2009), whereas most of the aforementioned studies revealed a reduced amygdala response specifically in relation to CU traits. Other studies also found reduced amygdala activation in response to sad faces in youths with CD regardless of CU traits (Passamonti et al. 2010). Hence, recent studies suggest that especially youths with antisocial behavior and high CU traits are impaired in the affective aspects of empathy. In other words, only a portion of young offenders and antisocial youth may show deficits in affective empathy.

Although most studies report problems with affective empathy in antisocial youth, the role of cognitive empathy and perspective-taking in antisocial behavior is less clear. Some studies suggest that cognitive empathy does not seem to be affected in antisocial populations (Dolan and Fullam 2004; Jones et al. 2010; Schwenck et al. 2012), whereas other studies suggest that there are also difficulties in the cognitive domain of empathy in CD and in detained youth (Happe and Frith 1996; Pardini, Lochman, and Frick 2003). For example, in our recent study (van den Bos et al. 2014), we investigated the role of perspective-taking, a cognitive aspect of empathy, in the context of the mini-ultimatum game (mini-UG). The UG is an interactive economic game with two players—a proposer and a responder (figure 13.4). The game starts with the proposer making a choice on how to split a sum of money, which the responder can decide to accept or reject. (p. 256) When the responder accepts, both players get their share as proposed. When the responder rejects, none of the players get any money. The mini-UG is a modification of the UG and includes experimental manipulations enabling researchers to study intentionality considerations. Most important, it includes trials in which the proposer has a choice to be fair (i.e., fair alternative condition; the proposer has a choice between a fair and an unfair split of money) and trials in which the proposer is forced to make an unfair offer (i.e., no alternative condition; the proposer is given the same two unfair splits of money from which to choose). In our study, a group of adolescent delinquents and a matched control group played the role of the responder while in the MRI scanner. All participants rejected unfair offers significantly less when the other player had no alternative compared to when he or she had a fair alternative. However, the delinquents more often rejected offers when the other player had no alternative compared to typically developing controls, suggesting they were more focused on the unfairness of the offer and less influenced by the perspective of the proposer. The neuroimaging results showed that this behavior was associated with less activation in the TPJ, a region crucial for perspective-taking, but there were no differences in brain regions associated with emotional responses to unfairness (e.g., insula and ACC). This pattern of results suggests a cognitive rather than an affective impairment in situations in which young delinquents are confronted with unfairness. Interestingly, the pattern of both behavior and brain activity of the delinquent group shows striking similarities with that of the younger children reported in a developmental study with the same task (Güroğlu et al. 2011), suggesting that there might be a developmental delay in perspective-taking abilities in the adolescent offenders. However, longitudinal studies are needed to test this hypothesis in order to better characterize possible developmental differences.

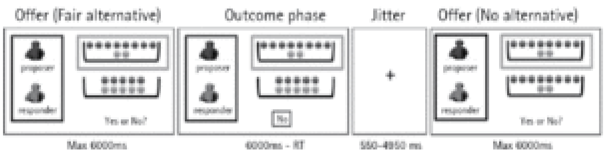

Figure 13.4 Trials from the mini-ultimatum game as used in van den Bos et al. (2014). Two offers each containing dark and light grey coins indicate the share for the proposer (dark grey coins) and the responder (light grey coins), and the offer made by the proposer is encircled in grey (here, eight and two coins, respectively). The responder was given five seconds to select “Yes” or “No” to accept or reject the offer. Upon response, the feedback screen displayed the given response (here, “No”) until six seconds after the start of the trial. Both the “fair alternative” and the “no alternative” condition are displayed.

Source: Reprinted with permission from van den Bos et al. (2014).

In summary, there is clear evidence for impairments in affective empathy in antisocial youth, especially in individuals with high CU traits. Neural responses in reaction to other persons in distress are diminished in the anterior insula and ACC in youth with (p. 257) CD, a brain network that is already involved in these processes in younger typically developing children. In addition, amygdala hypoactivation during affective empathy is mainly found in youth with high CU traits. There is also evidence for deficits in cognitive aspects of empathy such as perspective-taking, although this might be especially the case during social interactions.

V. Concluding Remarks and Suggestions for Future Research

This chapter focused on two important mechanisms of criminal decision making in juveniles, namely executive functioning and empathy. Executive functioning in young offenders and adolescents with CD is particularly weaker in affective contexts, resulting in discounting of risks and deficits in predicting future rewards. As a result, when considering the short-term gains of crime, both the risk of getting caught and the impact of the possible punishment are discounted (and underestimated). Therefore, committing the crime may seem much more appealing to the delinquent than to the typically developing adolescent. In addition, difficulties in affective functioning are also apparent in studies of empathic functioning of young offenders and adolescents with CD. Reduced responses to other’s distress are found in many studies, especially in adolescents with high CU traits, which might explain why some adolescents do not renounce to hurt others with threats or violence. Consequently, not only outcomes for the future self but also outcomes for others are discounted. Offending adolescents seem to combine a lack of care for what happens to others as a consequence of their criminal behavior with misperceptions about what the consequences of crime might be for themselves and possibly a lack of care for one’s own future as well. Hence, we propose that when considering psychological mechanisms, affective deficits are one of the major processes contributing to altered decision making in delinquent and antisocial adolescents. These affective deficits manifest themselves in risky and impulsive decisions caused by problems in affect regulation and by an impaired responsiveness to the distress and perspective of other people, especially in seriously antisocial adolescents such as those with CD.

Another factor that is important in the context of adolescent risk-taking and offending is that adolescents seem to be more sensitive to peer influence compared to children and adults. As studies in typically developing peers have shown, risk-taking and neural processes are changed by the mere presence of peers (Gardner and Steinberg 2005; Chein et al. 2011). Studies have further shown that affiliation with deviant friends is strongly associated with juvenile delinquency (Simons et al. 1994; Laird et al. 1999; Heinze, Toro, and Urberg 2004) and that compared to adults, adolescents are more likely to commit crimes with others (Reiss and Farrington, 1991; Conway and McCord 2002). Indeed, a longitudinal study suggested that the peak in the age–crime curve can be explained in large part by the influence of antisocial (p. 258) peers (Sweeten, Piquero, and Steinberg 2013). When adolescents become older and more resistant to peer influence, engagement in antisocial behavior tends to decline (Monahan, Steinberg, and Cauffman 2009). Moreover, adolescents with poorer executive functioning skills such as self-regulation and greater sensitivity to reward versus punishment are more vulnerable to the influence of deviant peers on antisocial behavior (Goodnight et al. 2006; Gardner, Dishion, and Connell 2008). It would be of great interest to initiate experimental studies to investigate peer influence specifically in antisocial and offending youth. The heightened reward-related brain activity caused by the mere presence of peers in the Chein et al. (2011) study suggests that it is not necessarily the explicit encouragement of peers that influences risk-taking. Using similar paradigms in young offenders or CD youth, it could be investigated how brain and behavior are differentially influenced by deviant and nondeviant peers and whether activation in affective and cognitive brain regions could predict peer influence on later antisocial behavior.

Previous studies have shown that so-called “deviancy training,” in which deviant peers react more positively to each other when discussing rule-breaking compared to more general topics, is linked to increases in violent and delinquent behavior (Dishion et al. 1996, 1997). The use of neuroscience methods in combination with peer influence paradigms has the advantage that more of the underlying processes of the social influences on risk-taking can be disclosed. Another advantage of such experimental studies on peer influence is that they could feature the use of real social interactions by using interactive games such as that used in our recent study (van den Bos et al. 2014). This could help to evade one important limitation of many of the previous studies on empathic functioning in antisocial youth, which are based mostly on passive (viewing) and self-report tasks instead of interactions with others (Dodge 2011). The neurocognitive mechanisms underlying real social interactions probably differ greatly from the mechanisms in merely observing others (Schilbach et al. 2013). In addition, it has been argued that individual differences in empathy become apparent mainly when people are required to act in a situation in which someone else is harmed as opposed to merely observing such a situation (Will and Klapwijk 2014).

The studies discussed in this chapter included offenders recruited in forensic settings as well as participants with CD (with low and high CU traits), meaning that some of the processes that were considered, such as diminished affective empathy, hold only for a particular subgroup of offenders with high CU traits. Therefore, it would be premature to conclude that all adolescent offenders show this affective deficit in executive functioning and empathy. Further comparisons of adolescent offenders and CD youths with low and high CU traits are warranted to characterize the specific pathways that lead to antisocial behavior in different groups. This reveals one of the important difficulties in the scientific study of adolescent criminal decision making: Criminal behavior is conducted by a variety of individuals, and disciplines such as criminology, psychology, and psychiatry study different groups using different labels. Although both offenders and individuals with CD show similar behaviors, such as stealing, aggression, and rule violations, offending and CD are related but not synonymous concepts. Despite these (p. 259) behavioral similarities, it is crucial to distinguish between subgroups of criminal adolescents because it is unlikely that the same intervention or treatment is adequate for such a diverse group (Frick and Ellis 1999). Recent attempts to distinguish a group of adolescents with high CU traits among youths with CD are promising, suggesting that this group differs on a range of genetic, neurocognitive, and personality characteristics from other youths with CD (for reviews, see Blair 2013; Frick et al. 2014). Crucially, neuroscience methods can serve as an important tool in establishing differences between subgroups and in identifying possible new subgroups within CD and antisocial populations. Quantitative measures of well-defined neurocognitive processes that are associated with discrete deficits would help to provide more insight into the differences and areas of overlap between subgroups. For example, efforts have been made to apply this approach to the concepts of impulsivity and compulsivity in a range of overlapping psychiatric disorders, such as attention deficit hyperactivity disorder (ADHD), substance dependence, and obsessive–compulsive disorder (Robbins et al. 2012). A similar approach aimed at underlying mechanisms that cross several of the current diagnostic categories (see also Insel et al. 2010) can be considered for the concept of impulsivity in ADHD, offenders and CD, or for affective and cognitive aspects of empathy in disorders associated with social deficits, such as autism and schizophrenia, in comparison to CD and offenders.

Another major challenge when focusing on the psychological mechanisms involved in adolescent criminal decision making is to integrate research on neurocognitive factors with knowledge about the influence of environmental factors. This chapter focused on the decision maker and on underlying neurocognitive processes of decision making. However, the role of environmental factors in decision making cannot be omitted if one wants to understand criminal behavior of adolescents. One contextual factor highlighted in this chapter is the peer environment, which seems to be of specific importance for decision making in adolescence. Other important contextual factors of antisocial behavior that are often mentioned are the influence of parenting style and neighborhood problems (Rhee and Waldman 2002). It remains an empirical question whether criminal decision making is more influenced by innate neurocognitive deficits than by contextual factors that may lead to crime either by direct influence on behavior or by an indirect influence on neurocognitive abilities. For example, genetic twin studies and longitudinal studies have shown that executive functioning is very highly heritable (Friedman et al. 2008) but also that genetic influences on antisocial behavior are stronger in socioeconomically advantaged compared to disadvantaged environments (Tuvblad, Grann, and Lichtenstein 2006). Likewise, it is also important to take into account the possible harmful effects of incarceration during such an important developmental period as adolescence. Most adolescent offenders already lack certain social and executive functioning skills before being arrested; the stress of incarceration and the separation from their families and neighborhoods might not be helpful in further developing such skills.

In conclusion, the neuroscience of adolescent decision making is a blossoming field, and much can be learned about adolescent-specific behavior from studies of population (p. 260) samples. However, although the prevalence of offending is significantly higher in adolescence, only a minority of adolescents engage in criminal behavior. Hence, if one wants to learn more about criminal decision making in adolescents, one must study groups of adolescents that show deviant behavior. Nevertheless, one should bear in mind that antisocial populations are notoriously difficult to study. Youth who are affiliated with correctional facilities might be suspicious about the agenda of the researchers, whereas antisocial youth outside a judicial setting are difficult to contact and to enroll and keep engaged in a study. However, we believe it is worth the effort to find ways to reach these adolescents and to design suitable paradigms aimed at elucidating the decision-making processes in delinquent and antisocial youth. More fine-grained knowledge about when (e.g., in affective vs. cognitive contexts) and which subtypes (e.g., low vs. high CU traits) of adolescent offenders make adverse decisions that result in crime may eventually help researchers design interventions that support at-risk adolescents to stay at the right path.

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