CHAPTER 6

Temperament and Aggression

CHRISTINA C. MOORE, JULIE A. HUBBARD,
and MEGAN K. BOOKHOUT

Brief Introduction

In this chapter, we review theory and research regarding the role of temperament in the development of aggressive behavior in children and adolescents. Recent conceptualizations of temperament define the construct as biologically based individual differences in the domains of motivation, affect, inhibitory control, and attention (Rothbart & Bates, 2006). Temperament is believed to be relatively stable across time and contexts (Rothbart, 2007). Furthermore, theorists recognize the impact of socialization on the stability and change of temperament across development (Rothbart & Derryberry, 1981). Using this framework, we identify temperamental constructs associated with aggressive behavior across development and examine their utility for understanding trajectories of aggression in childhood and adolescence.

Theoretical Considerations

Research on youth temperament and aggression has been conducted in four domains: (1) from the perspective of Rothbart’s theory of temperament; (2) within the framework of Gray’s psychobiological theory of personality; (3) within the context of investigations of the psychophysiology of aggression; and (4) from the viewpoint of callous–unemotional (CU) traits. The goal of this chapter is to integrate findings from these domains into an understanding of the role of temperament in youth aggression. We begin by describing each domain.
Rothbart explains temperament development through the interaction of biologically driven tendencies and environment (Rothbart, 2007). In this framework, temperament consists of a set of "constitutionally" based individual differences in reactivity and self-regulation. Reactivity refers to the automaticity and strength of typical responses to positive and negative stimuli, and self-regulation refers to the tendency to modulate emotional and behavioral reactivity to positive and negative stimuli (Rothbart & Bates, 2006; Rothbart & Derryberry, 1981). Three temperamental factors are particularly relevant to the study of youth aggression—negative emotionality, effortful control, and sensation seeking. Negative emotionality is conceptualized as the tendency to experience high levels of anger when goals are blocked or excessive fear in the face of novel stimuli. Effortful control refers to efficiency in modulating attention, inhibiting behavioral responses, and activating alternative behavioral responses, particularly in the context of emotion-evoking situations. Finally, sensation seeking is defined as a preference for novel or risky activity (e.g., Rothbart, 1989; Rothbart & Bates, 2006).

Gray (1982, 1987) provides an important neurobiological model of temperament in his reinforcement sensitivity theory. Gray proposes two interdependent systems that serve unique functions, the behavioral inhibition system (BIS) and the behavioral activation system (BAS). The BIS is the aversive punishment system thought to control anxiety and inhibit action to avoid negative consequences; it is mediated by the septohippocampal system (Gray, 1982). The BAS reward system controls positive emotions (Gray, 1990, 1994), as well as anger when rewards are blocked (Harmon-Jones, 2003). This system is less clearly defined in terms of its neural origins, but it may be mediated by dopaminergic pathways. Externalizing behavior is thought to result from a combination of lowered anxiety and concern about negative consequences (decreased BIS) and heightened focus on obtaining rewards due to blunted reward sensitivity (elevated BAS).

Fearlessness and sensation-seeking theories of aggression have emerged from research on the psychophysiology of aggression (Murray-Close, 2013a, 2013b). In fearlessness theory, aggression results from an inability to experience appropriate levels of fear (e.g., Raine, 1996, 2002), which puts youth at increased risk for aggression due to lack of proper socialization via punishment processes (e.g., Fung et al., 2005; Raine, 2002). However, lack of fear has also been operationalized as a preference for new and risky activities (Barry et al., 2000; Levenson, Kiehl, & Fitzpatrick, 1995), which overlaps considerably with a theoretical approach to aggression that emphasizes sensation seeking. In sensation-seeking theory, aggression occurs when individuals experience physiological underarousal and engage in dangerous behaviors to increase arousal to normal thresholds (e.g., Raine, 1996, 2002).

Finally, the study of CU traits has led to important advances in subtyping aggressive youth. CU traits parallel the affective dimension of psychopathy in adults; the construct is defined as deficits in empathy and guilt, failure to put forth effort on important tasks, and shallow emotions (Frick, Ray, Thornton, & Kahn, 2014). Classifying aggressive youth based on whether or not they exhibit CU traits has revealed two subgroups that are distinct in neurocognitive (e.g., Pardini, 2011; Stickle, Kirkpatrick, & Brush, 2009), emotional processing (e.g., Jones, Laurens, Herba, Barker, & Viding, 2009; Willoughby, Waschbush, Moore, & Propper, 2011), and physiological (de Wied, van Boxtel, Matthys, & Meeus, 2012; Fung et al., 2005).
correlates. Researchers have attempted to identify the etiological bases of CU traits, and findings have centered around fearlessness and insensitivity to punishment. Thus the study of CU traits has great relevance for our understanding of temperament and aggression.

From these domains of theory and research, two sets of temperamental constructs bearing on the development of youth aggression have emerged. The first set of constructs encompasses negative emotionality and effortful control, whereas the second set incorporates sensation seeking and fearlessness. The goal of this chapter is to organize this work into a cohesive understanding of the role that temperament plays in the trajectories of aggressive youth. First, though, we turn to a brief discussion of the assessment of temperament.

Measures and Methods

In this section, we review the most common means of assessing youth temperament in the aggression literature. Although researchers most often use parent-, teacher-, and self-report questionnaires, we also describe the increasing use of biological measures.

Questionnaires

Rothbart and colleagues have developed a theoretically grounded family of questionnaires to assess temperament based on personality, animal, behavior genetics, and psychophysiological literatures (Rothbart, 1981). Three distinct higher-order factors emerge from these questionnaires in infancy through childhood (Surgency, Negative Affectivity, Effortful Control), with a fourth factor (Affiliativeness) emerging in adolescence (Putnam, Ellis, & Rothbart, 2001). In addition to the higher-order factors of Negative Affectivity and Effortful Control, the subfactor of Sensation Seeking within Surgency is particularly relevant to youth aggression (Putnam et al., 2001).

Subsequently, two questionnaires were developed to tap the constructs of BIS and BAS. The first measure, the Sensitivity to Punishment and Reward Questionnaire, was developed for adults (Torrubia & Tobeña, 1984) and later modified by Colder and O’Connor (2004) for parent report of children and adolescents. The second measure, the BIS–BAS Scale, was developed by Carver and White (1994) and has been modified for use in children (Pagliaccio et al., 2016) and adolescents (Bjørnebekk & Howard, 2012; Gray, Hanna, Gillen, & Rushe, 2016). Factor analyses of these measures differentiate BIS and BAS as separate constructs (e.g., Bjørnebekk & Howard, 2012; Colder & O’Connor, 2004). In addition, BAS further separates into subfactors, with the subfactors most closely linked to youth aggression being Reward Responsiveness and Fun Seeking (Carver & White, 1994; Leone & Russo, 2009; Smillie, Jackson, & Dalgleish, 2006). Reward Responsiveness demonstrates negative relations to aggression because aggressive youth often require higher intensity rewards to reach optimal levels of arousal. In contrast, Fun Seeking, which reflects the desire to seek rewards impulsively, is typically positively related to aggression.
Biological Measures

Questionnaires, however, do not map temperamental traits to specific biological systems and so do not help researchers identify the physiological processes or neurobiological regions associated with the temperamental quality in question. For this reason, in recent years, biological measures have been used to operationalize temperament in relation to youth aggression in theoretically meaningful ways. A thorough discussion of these assessments is beyond the scope of the present chapter. However, the interested reader should refer to an elegant review by Murray-Close (2013a, 2013b) and to Branje and Koot (Chapter 5, this volume). For the purposes of this chapter, we briefly identify common biological measures of temperament and their potential significance to the aggression literature.

Autonomic Psychophysiology

Three autonomic measures have been considered to index temperamental constructs: the sympathetic nervous system (SNS), the pre-ejection period (PEP), and respiratory sinus arrhythmia (RSA). First, lower baseline SNS functioning, particularly low resting heart rate, may mark a tendency toward fearlessness or sensation seeking (see Murray-Close, 2013a, 2013b, for review). In contrast, SNS reactivity may index negative emotionality, especially anger (Hubbard et al., 2002; Rothbart & Bates, 2006).

Second, the PEP, an index of sympathetically controlled cardiac functioning, has been proposed by some theorists as a physiological marker of reward sensitivity (Beauchaine, 2001). Lack of PEP reactivity in response to rewards may reflect underactive BAS functioning, thereby leading externalizing youth toward sensation seeking in order to experience normative levels of reward (Beauchaine, Gatze-Kopp, & Mead, 2007).

Finally, RSA assesses the ebb and flow of heart rate during respiration and is the most common index of vagal tone, the fundamental element of the parasympathetic nervous system. RSA has been positively linked with several facets of effortful control (Chapman, Woltering, Lamm, & Lewis, 2010; Sulik, Eisenberg, Silva, Spinrad, & Kupfer, 2013), including executive functioning (Hansen, Johnsen, & Thayer, 2003; Marcovitch et al., 2010), emotional regulation (Beauchaine, 2001), and behavioral regulation (e.g., Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). Some theorists have posited that baseline levels of RSA may reflect trait-like emotional reactivity, whereas RSA suppression may signify an individual's ability to regulate emotionality in that moment (Liew et al., 2011).

Neurobiology

Brain imaging studies are a useful source of information about the neural mechanisms underlying temperamental traits. First, the orbitofrontal cortex and medial prefrontal cortex (PFC) are thought to index effortful control (Davidson, 2002; Heatherton, 2011), with positive correlations demonstrated between RSA and medial PFC activity in functional magnetic resonance imaging (fMRI) studies (Beauchaine & Thayer, 2015; Lane et al., 2009). Second, the amygdala is involved in emotional and social processing (Davis & Whalen, 2001) and has been critical in the
search for the neurobiological bases of anger reactivity, CU traits, and aggression (Bobes et al., 2013). Finally, both the ventral striatum (Gohn et al., 2015) and the medial PFC (Veroude et al., 2016) are implicated in reward sensitivity.

Central Research Findings

In this section, we review the state of literature on temperament and youth aggression. Results are organized into two sections that parallel the theoretical distinction made above: (1) negative emotionality and effortful control and (2) sensation seeking and fearlessness.

Negative Emotionality and Effortful Control

Negative Emotionality

From infancy, children display individual differences in negative emotional responses to environmental stimuli (Cole, Martin, & Dennis, 2004). Moreover, reactivity to anger appears particularly linked to aggressive behavior. Trait anger and frustration has been linked concurrently with aggression in toddlers (Nærde, Ogden, Janson, & Zachrisson, 2014), children (Park et al., 2005), and adolescents (Ojanen, Findley, & Fuller, 2012). Longitudinally, infant distress in response to frustration predicts aggression 2½ years later (Crockenberg, Leerkes, & Barrig, 2008), and young children who are susceptible to anger are more likely than their agemates to develop externalizing behaviors later in childhood (Arsenio, Cooperman, & Lover, 2000; Lengua & Kovacs, 2005; Rothbart, Ahadi, & Hershey, 1994).

Negative emotionality is particularly relevant for reactive, as opposed to proactive, aggression. Reactive aggression may be best described as angry and dysregulated behavior in response to a perceived provocation, whereas proactive aggression may be described as unemotional behavior purposefully directed toward achieving an instrumental or social goal (Dodge & Coie, 1987). It is no surprise, then, that anger has been uniquely linked to reactive but not proactive aggression (e.g., Bettencourt, Talley, Benjamin, & Valentine, 2006; Xu, Farver, & Zhang, 2009), with investigations conducted as early as the toddler years (Vitaro, Barker, Boivin, Brendgen, & Tremblay, 2006) and using observational or physiological measures of anger (e.g., Hubbard et al., 2002).

The neurobiological roots of the link between anger and reactive aggression may reside in the amygdala (e.g., Blair, Peschardt, Budhani, Mitchell, & Pine, 2006). Individuals with high trait anger display amygdala hyperreactivity in response to displays of angry faces (e.g., Carré, Fisher, Manuck, & Hariri, 2012), and this hyperreactivity extends to neutral faces among chronically aggressive men (Bobes et al., 2013; Pardini & Phillips, 2010), indicating that they may perceive even neutral faces as threatening. Most of these studies have been conducted with adults and need to be replicated with youth. However, both trait anger (Schultz, Izard, & Bear, 2004) and reactive aggression (e.g., Brugman et al., 2015; Hubbard, Dodge, Cillessen, Coie, & Schwartz, 2001) in youth samples have been linked to the tendency to attribute hostile intent to others when ambiguously provoked. When viewed in conjunction with work on amygdala hyperreactivity to threatening faces, these maladaptive
neurobiological and social-cognitive processes likely play an important role in triggering reactive aggression among youth (de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002).

**Effortful Control**

At its most basic, temperament concerns the interplay between emotional reactivity and emotion regulation, a tension at the heart of understanding reactive aggression in youth. As described earlier, the temperamental construct that most closely captures emotion regulation is effortful control, which has been inversely linked to externalizing behavior across numerous studies (Duncombe, Havighurst, Holland, & Frankling, 2013; Eisenberg et al., 1996, 2001; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Rothbart et al., 1994; Valiente et al., 2003), including longitudinal prospective investigations (e.g., Eisenberg et al., 2000; Henry, Caspi, Moffitt, & Silva, 1996). This association may be particularly strong for children who exhibit high levels of negative emotionality (Valiente et al., 2003) or when youth attempt to regulate anger or frustration in particular (e.g., Casey & Schlosser, 1994). Moreover, separate components of effortful control, such as attentional control and inhibitory behavioral control, have demonstrated unique negative associations with externalizing behaviors (Eisenberg et al., 2001, 2005, 2009). Strong inhibitory control, in particular, may buffer youth who tend to experience negative emotions from engaging in externalizing behaviors; in one study of preadolescent boys, a link from increased anger and decreased fearfulness to alcohol use initiation was found only for boys without strong inhibitory control (Pardini, Lochman, & Wells, 2004).

Effortful control is uniquely associated with reactive but not proactive aggression in middle childhood (Rathert, Fite, Gaertner, & Vitulano, 2011) and adolescence (Dane & Marini, 2014). In addition, effortful control moderates the relation between anger and reactive aggression (Xu et al., 2009), such that the relation is significant only at low levels of effortful control. Youth with low resting vagal tone are more likely to engage in reactive aggression (Scarpa, Haden, & Tanaka, 2010; Xu, Raine, Yu, & Krieg, 2014), a finding implicating lower baseline RSA in the regulatory deficits of reactive aggression. In the most current work on the psychophysiology of reactive aggression, researchers examined the interaction of youths' SNS reactivity and RSA in the moment as they were given the opportunity to engage in reactive aggression against a provocative virtual peer; RSA moderated the relation between SNS reactivity and reactive aggression, with children who displayed both elevated SNS reactivity and blunted RSA being particularly likely to respond with reactive aggression when provoked (Moore et al., 2018). Thus deficits in effortful control may play a central role in youths' anger and reactive aggression, and both baseline RSA and RSA reactivity may serve as biomarkers of these deficits.

**Sensation Seeking and Fearlessness**

Questionnaire measures of sensation seeking are reliably linked to aggression in children (Copeland, Landry, Stanger, & Hudziak, 2004) and adolescents (i.e., Hira-mura et al., 2010; Kim et al., 2006; Miller, Zeichner, & Wilson, 2012; Taubitz, Pedersen, & Larson, 2015), as well as to CU traits (Morgan, Bowen, Moore, & Van
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Goozen, 2014; Roose, Bijttebier, Van der Oord, Claes, & Lilienfeld, 2013). This finding is consistent with work suggesting that low resting heart rate, considered a physiological indicator of fearlessness and/or sensation seeking, is associated with aggression in youth, with some studies demonstrating unique relations to proactive but not reactive aggression (e.g., Raine, Fung, Portnoy, Choy, & Spring, 2014; Xu et al., 2009, 2014). In a longitudinal study, sensation seeking assessed in early adolescence mediated the relation between low resting heart rate in childhood and aggression in late adolescence among boys (Sijtsema et al., 2010), a finding replicated in a recent concurrent study of adolescent boys (Portnoy et al., 2014). These investigations provide compelling evidence to support sensation-seeking theories of youth aggression, at least among boys.

One mechanism linking sensation seeking and aggression in youth may be empathic responsiveness (Stadler et al., 2007). Aggressive youth display hyporesponsiveness in amygdala activity when viewing fearful faces (Stadler, Poustka, & Sterzer, 2010), a finding especially true for aggressive youth with CU traits (Jones et al., 2009). In a related finding, reduced amygdala activity in response to fearful faces mediated the relation between CU traits and proactive but not reactive aggression (Lozier, Cardinale, Van Meter, & Marsh, 2014). This mechanism may be particularly important for understanding aggressive youths' lack of concern for their victims.

A second mechanism connecting sensation seeking and aggression is blunted reward sensitivity. Youth who do not experience normative levels of positive affect from rewarding experiences may engage in risky activities to increase pleasure. A negative relation emerges between youth aggression and reward responsiveness as assessed through that subfactor of BIS–BAS questionnaires (Taubitz et al., 2015). In addition, physiological and neural evidence of blunted sensitivity or reactivity to rewards is seen in aggressive youth, including blunted PEP reactivity (e.g., Beauchaine et al., 2007; Beauchaine, Hong, & Marsh, 2008) and less ventral striatum activity (Cohn et al., 2015). These findings are paralleled in youth with CU traits, who display medial PFC hypoactivity in anticipation of reward (Veroude et al., 2016).

Low levels of fear and anxiety also characterize both youth with CU traits (Kimonis et al., 2006; Pardini, 2006) and aggressive youth (Barker, Oliver, Viding, Salekin, & Maughan, 2011). Theorists have long postulated that fearlessness is critical to the insensitivity to punishment that aggressive youth display, and this notion is supported in a cross-sectional study demonstrating that insensitivity to punishment mediated the relation between fearlessness and CU traits, which in turn predicted aggressive behavior (Pardini, 2006). In fact, researchers have questioned whether fearlessness and sensation seeking are, in fact, distinct constructs; in a recent study, behavioral sensation seeking was linked to fearlessness assessed neurally via a lessened ability to detect threat in dangerous situations (Mujica-Parodi, Carlson, Cha, & Rubin, 2014). Further support for the close link between the two constructs is found in work suggesting that both sensation seeking (Xu et al., 2009) and fearlessness (Kimonis et al., 2006) are linked to proactive but not reactive aggressive behavior.

The previous section on negative emotionality highlighted links between youth aggression and overreacting with anger in the face of frustration. However, negative
emotionality also encompasses particularly fearful responses to novel stimuli, reactions that are quite the opposite of the fearlessness discussed earlier. Two lines of research attempting to reconcile these perspectives suggest that fear may be best conceptualized as a continuous dimension on which both the extremes of fearlessness and fearlessness may result in youth aggression and conduct problems (CP). First, fearfulness is linked to reactive but not proactive aggression, whether fear is operationalized as anxiety (Vitaro, Brendgen, & Tremblay, 2002) or as behavioral inhibition (Miller et al., 2012). Second, youth high on both CP and CU traits are marked by fearlessness, whereas youth high on CP but low on CU traits are characterized by fearfulness. The most methodologically rigorous study to make this second point was conducted by Fanti and colleagues (Fanti, Panayiotou, Lazarou, Michael, & Georgiou, 2016), who compared participants within a community sample on a physiological measure of fear-startle potentiation, as well as questionnaire measures of fearfulness, BIS, and sensitivity to punishment. Groups compared included youth high on both CP and CU traits, youth low on both CP and CU traits, and youth high on one construct but low on the other. Youth high on both CP and CU traits scored the lowest of all four group on all four measures indexing fear, whereas youth high on CP but low on CU traits scored the highest of all four groups on all four fear measures (Fanti et al., 2016).

Implications for Differential Temperamental Trajectories of Youth Aggression

This literature review suggests that youth aggression may emerge from two distinct temperamental trajectories, with the first characterized by sensation seeking and fearlessness and the second marked by negative emotionality and deficits in effortful control. In this section, these trajectories are explored to understand how temperament may underpin youth aggression.

Trajectory of Sensation Seeking and Fearlessness

The first pathway toward youth aggression has temperamental foundations in fearlessness and sensation seeking. Youth on this trajectory display high levels of CU traits and aggress for proactive reasons of instrumental or social gain. They are distinguished by low resting heart rate (Portnoy et al., 2014; Raine et al., 2014; Sijtsma et al., 2010; Xu et al., 2009, 2014), requiring them to seek out novel and dangerous situations including aggressive actions to increase arousal to optimal levels (Copeland et al., 2004; Hiramura et al., 2010; Kim et al., 2006; Miller et al., 2012; Morgan et al., 2014; Roose et al., 2013; Taubitz et al., 2015; Xu et al., 2009). When they do aggress, they often display a lack of concern for their victims, a tendency perhaps rooted in amygdala hyporesponsiveness to fearful facial expressions (Jones et al., 2009; Lozier et al., 2014; Stadler et al., 2007, 2010; White et al., 2012). At the same time, youth on this trajectory also display fearlessness with regard to their own well-being (Barker et al., 2011; Fanti et al., 2016; Kimonis et al., 2006; Mujica-Parodi et al., 2014). This fearlessness, coupled with blunted reward sensitivity (Beauchaine et al., 2007, 2008; Cohn et al., 2015; Taubitz et al., 2015; Veroude et al., 2016), may
lead these youth to be particularly resistant to praise and insensitive to punishment, causing caregivers’ traditional socialization approaches to fail (e.g., Barker et al., 2011; Pardini, 2006). In this respect, the temperamental constructs of sensation seeking and fearlessness may be considered at least partially innate, inherited, or hard-wired (Frick & Viding, 2009).

**Trajectory of Negative Emotionality and Deficits in Effortful Control**

The second pathway toward youth aggression may have its temperamental roots in negative emotionality, including both heightened anger reactivity and fearfulness, as well as deficits in effortful control. Youth on this pathway may tend to anger more easily with less provocation than peers, which can be seen at the neurobiological level in amygdala hyperreactivity to angry faces (Bobes et al., 2013; Carré et al., 2012; Pardini & Phillips, 2010) and at the social-cognitive level in hostile attributional bias (Brugman et al., 2015; de Castro et al., 2002; Hubbard et al., 2001; Schultz et al., 2004). Once angered, they may struggle to regulate angry feelings (Dane & Marini, 2014; Moore et al., 2018; Rathert et al., 2011; Scarpa et al., 2010; Xu et al., 2009, 2014) before resorting to reactive aggression (Bettencourt et al., 2006; Hubbard et al., 2002; Vitaro et al., 2006; Xu et al., 2009). However, once they aggress, these youth may feel remorse, due to low levels of CU traits (Frick, 2012; Frick & Morris, 2004; Frick & White, 2008; Pardini & Frick, 2013). Finally, they may be receptive to praise and amenable to punishment as disciplinary tactics due to normative levels of reward sensitivity and heightened fearfulness and anxiety (Fanti et al., 2016; Miller et al., 2012; Vitaro et al., 2002).

This discussion of the temperamental underpinnings of dysregulated reactive aggression does not imply that these struggles are trait-like or present from birth. Rather, although individual differences in reactivity to emotion-eliciting stimuli may be present from infancy (Arsenio et al., 2000; Lengua & Kovacs, 2005; Rothbart et al., 1994), voluntary control of that reactivity develops later and is less heritable and largely socialized (Beauchaine, 2015). In fact, parental emotion coaching shows positive effects on youth anger regulation and externalizing problems well into adolescence (Shortt, Stoolmiller, Smith-Shine, Mark Eddy, & Sheeber, 2010). Moreover, Beauchaine argues that negative emotionality is not sufficient to lead to conduct-disordered behavior. Instead, he emphasizes that externalizing disorders result from the coupling of this temperamental quality with emotional control deficits conferred through socialization processes that include poor parenting and early life stressors, such as poverty (Hanson, Hair, et al., 2013) and neglect (Hanson, Adluru, et al., 2013). In particular, Beauchaine (2015) argues that emotion dysregulation is learned through repetitive cycles in which aggressive children escape from negative affective exchanges with family members and peers by escalating anger until interactions terminate, resulting in negative reinforcement of the escalation (Patterson, DeBaryshe, & Ramsey, 1989; Snyder, Edwards, McGraw, Kilgore, & Holton, 1994; Snyder & Patterson, 1995; Snyder, Schrepferman, & St. Peter, 1997). Moreover, reactively aggressive children are reinforced not only by escape from others’ negative responses but also by escape from their own aversive physiological state (Beauchaine & Zalewski, 2016; Skowron et al., 2011). Thus the temperamental quality of effortful control, in particular, may be heavily affected by socialization...
processes, a statement in contrast to theoretical conclusions drawn about the etiology of the temperamental traits of sensation seeking and fearlessness.

**Distinctiveness of Temperamental Trajectories**

Based on this summary, readers may conclude that two distinct trajectories for aggressive youth exist, with one trajectory marked by reactive aggression driven by heightened negative emotionality coupled with deficits in effortful control and the second trajectory characterized by proactive aggression propelled by fearlessness, sensation seeking, and CU traits. However, the correlation between reactive and proactive aggression is consistently high across studies (Card & Little, 2006; Polman, de Castro, Koops, van Boxtel, & Merk, 2007), suggesting that many youth engage in both subtypes of aggressive behavior. To some degree, then, the subtypes of aggression may be more accurately conceptualized as continuous measures of the extent to which youth display each subtype of aggression, rather than as categories into which youth are placed.

However, two recent rigorous investigations suggest that some youth may display reactive aggression only, whereas others display both reactive and proactive aggression. In the first study, self-report data on reactive and proactive aggression from a large sample of adolescents were analyzed using latent class analysis; two latent classes of aggressive adolescents emerged, one that engaged in primarily reactive aggression and a second that displayed both reactive and proactive aggression (Smeets et al., 2016). Similarly, in a recent study of adolescents in community, at-risk residential, and detained samples, cluster analyses of reactive and proactive aggression revealed two aggressive groups, with the first elevated on reactive aggression only and the second elevated on both reactive and proactive aggression. With a few exceptions, these findings were replicated across the three samples, across boys and girls, and across physical and relational aggression (Marsee et al., 2014). These groups differed in severity, with the combined group displaying higher levels of emotion dysregulation, CU traits, and delinquency than the reactive-only group (Marsee et al., 2014). Both studies converged to suggest that few if any youth display proactive aggression only.

Furthermore, when the SNS arousal of youth diagnosed with disruptive behavior disorders was assessed in both a baseline condition and a peer provocation, externalizing youth demonstrated both lower baseline arousal indicative of sensation seeking and fearlessness and greater negative emotional reactivity to the peer provocation than controls (Van Goozen, Matthys, Cohen-Kettenis, Buitelaar, & van Engeland, 2000). These results suggest that aggressive youths' blunted baseline SNS arousal may put them at risk for displaying proactive aggression when faced with the opportunity to aggress for instrumental gain, and their SNS arousal to peer provocation may also increase the chance that they will display reactive aggression. In fact, if aggressive youths' SNS profiles are characterized by both of these patterns, then it follows that many aggressive youth may aggress for both reactive and proactive reasons, albeit in different contexts.

These findings may have important implications for our understanding of multiple temperamental pathways to youth aggression. They suggest a first and less severe pathway characterized primarily by reactive aggression, as well as a second
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and more severe pathway marked by both types of aggression and CU traits. It may well be that some externalizing youth aggress predominantly when provoked, whereas other disruptive youth aggress both when provoked and to achieve instrumental or social gain (Muñoz, Frick, Kimonis, & Aucoin, 2008). Importantly, the literature reviewed here suggests that the first pathway may be rooted in negative emotionality and deficits in effortful control, whereas the second pathway has a foundation in these temperamental constructs, along with sensation seeking and fearlessness.

A recent fMRI study supports the notion that both youth with and without CU traits evidence anger reactivity when provoked. Compared with a control sample, all adolescents with disruptive behavior disorders displayed reduced amygdala-ventromedial PFC connectivity when provoked, regardless of whether or not they had CU traits, and this reduction predicted their tendency to retaliate during a laboratory task, as well as parent ratings of reactive aggression. These results suggest that all youth with disruptive behavior disorders may be at risk for reactive aggression and propose one neural mechanism of this risk (White et al., 2016).

In many ways, this theory is parallel to Frick’s hypothesis of two pathways toward aggressive behavior, with one marked by anger dysregulation and the other by CU traits (Frick, 2012; Frick & Morris, 2004; Frick & White, 2008; Pardini & Frick, 2013). However, the models diverge in that we emphasize that youth on the reactive-proactive pathway also struggle with negative emotionality and emotion dysregulation and, in fact, that their regulatory deficits may be more serious than those of youth who do not evidence CU traits or proactive aggression. Thus we deviate from Frick’s thinking by emphasizing that both pathways toward disruptive behavior disorders are characterized by negative emotionality and deficits in effortful control. This point is further emphasized by a recent study suggesting that, among youth with acute CP (criminal or inpatient history), the most aggressive youth displayed both elevated CU traits and elevated anxiety (Euler et al., 2015). Thus it may that the most aggressive youth struggle with negative emotionality and deficits in effortful control with respect not only to anger but also to fear and anxiety. These findings are preliminary, but they suggest that we have much more work to do to fully understand the role of negative emotionality and effortful control in youth aggression across trajectories.

Future Directions

We have outlined two potential trajectories for youth aggression, both characterized by reactive aggression driven by negative emotionality and deficits in effortful control, but only one of which is marked by proactive aggression grounded in CU traits, sensation seeking, and fearlessness. In future studies, researchers should continue to investigate the divergent and convergent temperamental bases for youth aggression across these trajectories. For example, assessing negative emotionality and emotion dysregulation separately for anger versus fear may lead to important advances in our understanding of these trajectories. In addition, as we have seen in a number of recent studies, person-centered approaches to investigating youth aggression and temperament, rather than correlational methods, are likely to
continue to advance our knowledge of the various pathways that youth aggression can take.

In addition, further clarity about the etiology of youth aggression may be achieved by mapping behavioral and biological measures of temperament to one another. For example, sensation seeking, but not fearlessness, has been found to mediate the relation between low autonomic arousal and adolescent aggression in two studies (Portnoy et al., 2014; Sijtsema et al., 2010). The continued use of multimethod approaches to assess temperament may help elucidate the mechanisms most relevant for understanding youth aggression.

Finally, associations between temperament and aggression are likely to differ for males and females. As we have seen across many of the studies reviewed, female participants tend to be underrepresented in this work, particularly in samples with severe conduct problems. Furthermore, some investigations of gender as a moderator find that associations between temperament and aggression may not apply to female participants (e.g., Sijtsema et al., 2010), perhaps because females often display lower levels of the temperamental qualities linked to aggressive behavior, suggesting that the temperamental pathways toward aggression may be less applicable to females than males (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). As such, the extent to which the work reviewed here can be generalized to females is unclear, and greater attention to this issue is critical.

Conclusions

This review of the current state of research on temperament and youth aggression has revealed important advances but also significant gaps in our understanding of the temperamental underpinnings of trajectories of aggression in children and adolescents. Much work remains as we continue to move forward in our understanding of the multiple pathways toward and subtypes of youth aggression, particularly with respect to temperamental foundations of these trajectories. We feel certain that our field is up to the task and look forward to the exciting advances that are sure to come in the years ahead.

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