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Acceptance, rejection, and the social brain in adolescence : toward a neuroscience of peer relations

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CHAPTER 1

GENERAL INTRODUCTION

1.1 INTRODUCTION

Human beings have a fundamental need to form and maintain lasting positive relationships with others (Baumeister & Leary, 1995). These relationships are a source of companionship, intimacy, and support from infancy to old age. During childhood and adolescence, relationships with peers provide an important socialization context in which many important skills and psychological capacities develop. In interactions with peers, children and adolescents acquire key social skills (e.g. cooperation, conflict resolution) and cognitive abilities (e.g. emotion regulation, perspective taking) that are needed for successful functioning in a complex social environment (Bukowski, Buhmester, & Underwood, 2011; Ladd, 1999; Rubin, Bukowski, & Parker, 2006).

The need for social connection is so vital that many problems arise when this need remains unsatisfied. Events that threaten our need for social connection, such as social exclusion and rejection, are highly distressing and can have detrimental consequences for well-being. Children and adolescents who are chronically rejected by their peers suffer from widespread impairments in daily life that can persist across development and into adulthood, ranging from poor academic achievement (DeRosier, Kupersmidt, & Patterson, 1994) and dropping out of school (Hymel, Comfort, Schonert-Reichl, & McDougall, 1996), to delinquency (Kupersmidt, Burchinal, & Patterson, 1995) and the development of psychopathology (Boivin, Hymel, & Bukowski, 1995; Coie, Terry, Lenox, Lochman, & Hyman, 1995; Parker & Asher, 1987). Therefore, it is of great importance to understand the developmental processes that play a role in the emergence and maintenance of peer group rejection.

The goal of this thesis was to examine the neurocognitive underpinnings of processes that play a role in sustaining peer rejection as well as those that are instrumental in gaining peer acceptance. The first part of the thesis focuses on the neurocognitive processes underlying subjective and behavioral responses to social exclusion, which have been hypothesized to play a crucial role in the emergence or maintenance of peer group rejection (Coie, 1990; Sandstrom, 2004). For example, children and adolescents who react to social exclusion with retaliatory vengeance might be more likely to elicit further rejection from their peer group than those who show behavior aimed at reconnecting after exclusion (Coie, 1990; Sandstrom, 2004). The second part of this thesis concentrates on the neural and psychological processes involved in prosocial behavior, based on the widely established finding that frequent displays of prosocial behaviors, such as cooperating, helping, and sharing, are associated with both gaining and maintaining peer acceptance (Coie & Kupersmidt, 1983; Deković & Gerris, 1994; Layous, Nelson, Oberle, Schonert-Reichl, & Lyubomirsky, 2012). Understanding the neural and psychological mechanisms underlying reactions to social exclusion and prosocial behavior is therefore vital for a better understanding of the emergence and maintenance of peer rejection.

The remainder of this chapter sketches a conceptual framework for the empirical studies in

this thesis. First, a working model is presented that was used for studying the developmental processes governing emergence and maintenance of peer rejection (1.2). Next, we highlight key findings from the literature on the neural and psychological processes involved in reactions to social exclusion (1.3) and those involved in prosocial behavior in the form of sharing of valuable resources (1.4). Together, the working model of peer group rejection and the findings from prior work on social exclusion and sharing behavior laid the foundations for the empirical studies described in this dissertation, of which the aims are summarized at the end of this chapter (1.5).

1.2 MECHANISMS OF EMERGENCE AND MAINTENANCE OF PEER REJECTION

Peer group acceptance and rejection reflect the collective valence of group members' sentiments toward individuals in the group. Acceptance and rejection can be reliably assessed through asking members of a peer group who they like most and who they like least (Bukowski, Sippola, Hoza, & Newcomb, 2000; Coie, Dodge, & Coppotelli, 1982; Newcomb & Bukowski, 1983). Children who receive many negative nominations (liked least) and who receive few positive nominations (liked most) are classified as having a rejected status¹.

Longitudinal studies have demonstrated that low levels of acceptance and high levels of rejection during childhood are associated with an array of negative adjustment outcomes, including poor academic achievement (DeRosier et al., 1994) and higher levels of both internalizing (Ladd & Troop-Gordon, 2003) and externalizing behavior problems (van Lier & Koot, 2010). Although the evidence for such longitudinal links is overwhelming, establishing longitudinal links between peer group rejection and adjustment difficulties does not provide insights into the developmental mechanisms through which peer sentiments impact later psychosocial adjustment. To better understand how peer group acceptance and rejection have their impact on adjustment, researchers have begun investigating the transactional relationship between the individual child and the way they are treated by their peer group (Coie, 1990; Sandstrom & Coie, 1999). Transactional models of peer relations posit that characteristics of

¹*Acceptance and rejection are interconnected, but not polar opposite, constructs. Children low in peer acceptance (those who receive few liked most nominations from their peers) do not necessarily have to be rejected by peers (through receiving many liked least nominations from their peers). Indeed, correlations between acceptance and rejection are negative and modest in size (Bukowski et al., 2000). Thus, although acceptance is often regarded as the opposite of rejection, it is more precise to see the opposite of accepted as 'not accepted' and the opposite of rejected as 'not rejected'.*

an individual child help to construct and shape their behavior in social interactions with peers, and interactions with peers in turn shape children's perceptions and dispositions (Ladd, 2003).

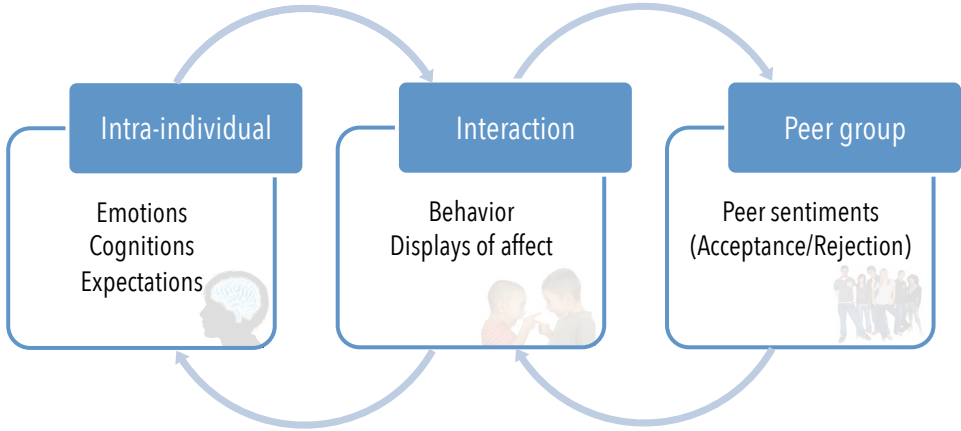


Figure 1.1. A working model of processes playing a role in the emergence or maintenance of peer rejection at three levels of social complexity.

Based on such transactional models, we propose a simplified model of the reciprocal interactions between individual children and their peer group that guided the hypotheses for the empirical studies in this thesis (see *Figure 1.1*). The model is subdivided into three levels of social complexity comparable to a model proposed by Hinde (1979). To be specific, the model distinguishes between processes at the level of the individual child (i.e. intra-individual), those at the level of social interactions (i.e. interpersonal) and those at the level of the peer group.

Intra-individual processes such as emotions, cognitions, and expectations are the processes that individual children bring with them into social interactions. Social interactions are exchanges of sets of behaviors or overt displays of affect between two individuals. Social interactions with peers influence the individual's reputation and standing in the peer group (e.g. peer group acceptance and rejection). Importantly, processes at each level of social complexity both constrain and influence processes at the other levels.

In his transactional model of peer rejection, Coie (1990) distinguished between the so-called 'emergent phase' and the 'maintenance phase' of peer rejection. The emergent phase is characterized by specific interactions between a child and their peer group, which give rise to peer group rejection. For example, a child who has difficulties in perspective taking (intra-individual level) is less likely to consider the needs of other people and as a consequence refuses to share a toy with a classmate (interaction level). The refusal to share with his classmate can then trigger dislike in this member of the peer group. When this pattern of selfish behavior is

shown consistently in interactions with other members of the peer group, individual member's disliking of the child may extend to a consensual disliking in the peer group (i.e. peer group rejection; group level).

A wealth of research supports these proposed links by showing that consensual disliking in the peer group arises from specific behaviors displayed in social interactions with peers. For example, rejected children show higher levels of aggressive and disruptive behaviors, more social withdrawal and lower levels of prosocial behavior in interactions with their peers than accepted children (Coie, Dodge, & Kupersmidt, 1990; Haselager, Cillessen, Van Lieshout, Riksen-Walraven, & Hartup, 2002; Newcomb, Bukowski, & Pattee, 1993). These behavioral propensities have been shown to precede peer group rejection and to elicit dislike in the emergent phase of peer rejection. For example, children with a rejected status in their school class rapidly become rejected when they enter a new group with unfamiliar peers (Hardy, Bukowski, & Sippola, 2002), and this is driven by rejected children's greater propensity for aggressive behaviors and lower levels of prosocial behavior (Coie & Kupersmidt, 1983; Dodge, 1983). After initial rejection in the emergent phase, some children may maintain their rejected status because they continue to show behaviors that are poorly tolerated by their peer group.

In the maintenance phase peer group rejection becomes stable, and cognitions, emotions and behaviors of both the individual child and its peers are changed in ways that sustain a rejected status. For example, chronic exposure to peer rejection has been shown to foster anxious or angry expectations about rejection (London, Downey, Bonica, & Paltin, 2007). Children with angry expectations about rejection show higher levels of distress in response to acute rejection experiences (e.g. a classmate refuses to work together on an assignment), and show increasingly higher levels of aggression and interpersonal difficulties in their peer group over time (Downey, Lebolt, Rincon, & Freitas, 1998). Thus, social-cognitive processes (intra-individual) shaped by prior interactions in the peer group play a role in sustaining behaviors that further consolidate peer group rejection. These examples show that the three levels in the model are heavily intertwined and influence each other both in the emergent phase and the maintenance of peer rejection.

The emergent phase and the maintenance phase in Coie's (1990) theory represent longer periods of time accruing multiple social interactions over the course of weeks, months or years. However, as can be seen from the examples described above, the developmental processes that contribute to the emergence or maintenance of rejection can be described at finer levels of analysis. That is, peer group rejection can be triggered or be maintained by recursive sequences between rejection-eliciting behaviors, the way the peer group reacts to those behaviors, and the impact of the reactions from the peer group on the rejected child's feelings, cognitions, and behavior.

The main goal of this thesis was to examine four such processes that play a role in the emergence and maintenance of a rejected status. Specifically, we examined the following

processes at the intra-individual level and at the level of the interaction: i) subjective and neural responses to social exclusion, ii) behavioral reactions to social exclusion, iii) behavioral reactions to the exclusion of a peer, and iv) prosocial behavior in the form of sharing valuable resources. To investigate these processes, we used experimental social interaction paradigms in combination with functional Magnetic Resonance Imaging (fMRI), which is a neuroimaging technique that enables the study of brain function while participants are asked to perform a specific task. Furthermore, to gain a better understanding of how these processes at the intra-individual level and the level of the interaction are influenced by processes at the level of the peer group, we examined how these processes varied as function of chronic exposure to peer group rejection. The next sections describe the theories and empirical findings that provided the background for the empirical investigations of these four processes. To highlight each process' involvement in the emergence or maintenance of peer rejection, prior work will be discussed in the light of our working model.

1.3 REACTIONS TO SOCIAL EXCLUSION

Excluding a peer from a group or activity is one of the most common methods children and adolescents use to express dislike toward rejected peers (Coie et al., 1990). In child and adolescent peer groups, social exclusion can take the form of both *direct* refusals of entry to a group or activity (e.g. telling a child he cannot join a game) and *indirect* actions (e.g. ignoring a peer's requests to join a game, or not choosing a peer as a partner for a group activity) (Gazelle & Ladd, 2003). Although social exclusion is a distressing experience across the lifespan (Williams, 2007), adolescence has been hypothesized to be a developmental period during which reactions to exclusion are intensified. During adolescence, concerns about fitting in with the peer group peak (O'Brien & Bierman, 1988), and the failure to integrate oneself in a network of peers both reflects and precedes serious adjustment difficulties (e.g. social withdrawal, loneliness, or depressive symptoms) (Boivin et al., 1995; Prinstein & Aikins, 2004). It has been proposed that adolescence might be particularly stressful for those who were chronically rejected during childhood (Coie et al., 1990). Rejected children have fewer positive affiliations with peers in which many social skills are acquired (e.g. conflict resolution, negotiation) (Boivin & Hymel, 1997; Parker & Asher, 1993). Consequently, as they enter adolescence, chronically rejected children might lack the social skills needed for coping with the increased stresses of the adolescent peer world.

Although not every child with a rejected status is targeted for social exclusion, rejected children are more likely to be excluded from peer activities than their accepted counterparts. Moreover, adjustment difficulties associated with peer group rejection (e.g. school disengagement) are exacerbated among children who are both rejected and frequently excluded from peer activities

(relative to non-excluded rejected children) (Buhs & Ladd, 2001; Buhs, Ladd, & Herald, 2006). Yet, the processes through which social exclusion may influence the maintenance of a rejected status are far from clear. Therefore, we examined three processes that could each play a unique role in the emergence or maintenance of peer rejection: i) subjective and neural responses to social exclusion, ii) retaliatory and prosocial reactions to social exclusion and iii) behavioral reactions to the exclusion of a peer.

Subjective and neural responses to social exclusion

The way a child responds to social exclusion has been argued to play an important role in determining whether exclusion forms an isolated incident as opposed to a recurring phenomenon (Ladd & Troop-Gordon, 2003; Sandstrom, Cillessen, & Eisenhower, 2003; Zakriski, Jacobs, & Coie, 1997). For example, children who immediately start crying in response to social exclusion are likely to be targeted for exclusion again. As such, heightened exclusion-related distress and associated neural activity might represent potential mechanisms at the intra-individual level of social complexity through which a rejected status might emerge or be maintained across development.

Neuroimaging studies have shown that the distress adolescents and adults report after they are excluded can be reliably linked to activity in neural systems processing negative emotions and emotion regulation (Eisenberger, 2012; Eisenberger, Lieberman, & Williams, 2003). After being ostensibly excluded by two strangers in a virtual ball-tossing game called Cyberball (Williams, Cheung, & Choi, 2000), children, adolescents, and adults report heightened levels of exclusion-related distress in the form of negative emotions (e.g. anger, sadness) and decreases in the satisfaction of vital human needs (e.g. belonging, self-esteem, control, and a meaningful existence) (Abrams, Weick, Thomas, Colbe, & Franklin, 2011; Sebastian, Viding, Williams, & Blakemore, 2010). Self-reports of such exclusion-related distress have been shown to correlate positively with neural activity in the anterior cingulate cortex (ACC) and anterior insula (AI) - brain regions involved in processing conflict and (negative) emotions - during the exclusion experience (Gunther Moor et al., 2012; Masten et al., 2009). Negative correlations have been found between self-reported distress and activity in the ventrolateral prefrontal cortex (vlPFC) - a region implicated in top-down regulatory control- suggesting that the vlPFC is involved in regulating the distress caused by exclusion (Eisenberger et al., 2003; Masten et al., 2009).

Neural activity in brain regions linked to the distressing aspect of exclusion has been shown to vary with individual and social factors characteristic of children with a rejected status. That is, ACC activity is exacerbated in individuals who anxiously expect rejection (DeWall et al., 2012; Masten et al., 2009) and who perceive lower levels of social support in their relationships (Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007). To critically test whether neural processing of social exclusion shows associations with chronic peer group rejection, we examined subjective (i.e. mood and need satisfaction) and neural responses to social exclusion

in adolescents with a history of chronic peer rejection and tested how their responses differed from those in adolescents with a history of stable peer acceptance (**Chapter 2**). Heightened neural reactivity to social exclusion might be an intra-individual process involved in attaining or maintaining a rejected status, given that a heightened emotional or neural reactivity to exclusion might reinforce or provoke excluders and consequently could promote progressively greater dislike in the peer group.

Behavioral reactions to social exclusion

A potential mechanism at the level of the interaction through which a rejected status among peers might emerge or is maintained, is the way children respond behaviorally to social exclusion (Sandstrom, 2004). For example, retaliatory reactions to exclusion are likely to elicit repeated instances of exclusion from the peer group. In contrast, controlling the urge to lash out against the bullies might stop exclusion, which is likely to have positive effects on peer status. Concurrent associations between peer status and coping with exclusion and other peer-related conflicts suggest that behavioral responses to exclusion might play a role in the maintenance of a rejected status. That is, children and adolescents with a rejected status report a more frequent use of aggressive coping styles when faced with social exclusion in a hypothetical scenario (Sandstrom, 2004) or a recalled conflict with a peer (Bowker, Bukowski, Hymel, & Sippola, 2000). On the contrary, accepted children more often deal with interpersonal anger in non-aggressive ways that minimize further conflict (Fabes & Eisenberg, 1992). Furthermore, prosocial reactions to negative peer treatment have been associated with greater psychological well-being in victims of bullying compared to victims of bullying who predominantly seek revenge (Flanagan, Hoek, Ranter, & Reich, 2012; Park, Enright, Essex, Zahn-Waxler, & Klatt, 2013)

To gain insight into the psychological and neural mechanisms underlying retaliatory and prosocial reactions to social exclusion, we turned to game theoretical paradigms derived from behavioral economics (Camerer, 2003; Rilling & Sanfey, 2011). These paradigms offer a context of social interactions where the decisions people make have actual consequences for their own and their interaction partner's well-being. In two-player exchange games such as the Dictator Game one player receives a valuable set of rewards (e.g. money or candy) from the experimenter and is then given the opportunity to propose a split of the rewards between themselves and a second player (Forsythe, Horowitz, Savin, & Sefton, 1994). In the Dictator Game, the second player cannot influence the distribution of resources and thus passively receives the amount of rewards that the first player is willing to share. Prior work using such economic exchange games has demonstrated that social decision-making depends on distinct, but interacting, networks of brain regions. Importantly, these networks have been shown to support different psychological processes involved in social decision-making, including cognitive/emotional processes involved in the detection of norm-violations (Güroğlu, van den Bos, van Dijk, Rombouts, & Crone,

2011; van den Bos, van Dijk, Westenberg, Rombouts, & Crone, 2011), cognitive-regulatory processes (e.g. impulse control; Steinbeis, Bernhardt, & Singer, 2012), and socio-cognitive processes (e.g. perspective taking; Güroğlu et al., 2011; van den Bos et al., 2011) .

To examine retaliatory and prosocial reactions to exclusion, we gave participants the opportunity to play a Dictator Game in which they could punish (i.e. retaliate) or forgive (i.e. act prosocial toward) the individuals who previously excluded them in Cyberball (i.e. the excluders). Participants could punish the excluders through decreasing their monetary outcomes or they could forgive them through refraining from punishment and sharing a sum of money equally with them. A better understanding of the neurocognitive mechanisms underlying these reactions can increase our understanding of the processes underlying children's decisions to seek revenge or reconnection after exclusion. Prior work has demonstrated that a tendency to retaliate against excluders (interaction level) has been shown to rely on cognitive control capacities (intra-individual level) in adults (Chester et al., 2013). In addition, prosocial motivations toward offenders have been linked to higher levels of socio-cognitive capacities such as perspective taking (i.e. the tendency to adopt another person's perspective; Brown, 2003) and higher levels of activity in neural circuitry implicated in thinking about other people's mental states (e.g. beliefs, intentions, and desires; Young & Saxe, 2009). Consequently, we anticipated that refraining from punishment and acting prosocial toward the excluders would be associated with activity in brain networks supporting cognitive control and perspective taking.

To test whether perspective taking and cognitive control are involved in prosocial reactions to exclusion, we first examined the neural processes involved in punishment and forgiveness of excluders in a sample of young adults (**Chapter 3**). The findings from this study laid the foundations for our next study in which we examined how the neural processes involved in punishment and forgiveness vary as a function of a history of chronic peer rejection and individual differences in cognitive control and perspective taking (**Chapter 4**). Given that aggressive reactions to exclusion are likely to aggravate the situation, we expected that finding links between chronic peer rejection and neural processes underlying behavioral reactions to exclusion would lead to a better understanding of how chronically rejected children might become trapped in a pattern of sustained rejection.

Behavioral reactions to the exclusion of a peer

The peer group plays a crucial role in determining whether a rejected child is targeted for exclusion or not. For example, the likelihood that children with a rejected status are victimized is higher in classrooms with fewer peers who stand up for victims of bullying compared to classrooms with more of such prosocial defenders (Kärnä, Voeten, Poskiparta, & Salmivalli, 2010). Indeed, observations in school playgrounds have shown that peers who stand up for victims of bullying are successful in stopping bullying in more than half of the time (Hawkins, Pepler, & Craig, 2001). Furthermore, victims who are defended by classmates are more accepted

in their peer group and report higher levels of self-esteem, and lower levels of internalizing symptoms than non-defended victims (Sainio, Veenstra, Huising, & Salmivalli, 2010). Therefore, in addition to examining reactions to social exclusion at the level of the excluded child, we also investigated processes at the level of the peer group that play a role in stopping or enabling exclusion.

Specifically, we investigated intra-individual processes (i.e. mood and perspective taking) in uninvolved bystanders who witnessed the exclusion of a peer and who were subsequently given the opportunity to help the victim of exclusion and to punish the excluders. Advanced forms of perspective taking, such as inferring another person's feelings in the absence of explicit emotional cues (i.e. affective perspective-taking), have been shown to continue to develop across adolescence (Hoffman, 2000). Given the importance of such perspective-taking skills for prosocial behavior (Vaish, Carpenter, & Tomasello, 2009), we examined helping and punishment in various phases of adolescent development (from late childhood to young adulthood) and tested how individual and developmental differences in perspective taking contributed to performing those behaviors (**Chapter 5**). Identifying the socio-cognitive processes that motivate bystanders to help a victim of exclusion is important, given the positive effects of prosocial action toward victims of bullying in terms of well-being and peer status (Sainio et al., 2010).

1.4 SHARING

Prosocial behaviors such as helping, cooperating and sharing have been shown to be among the strongest predictors of peer acceptance across childhood and adolescence (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Caputi, Lecce, Pagnin, & Banerjee, 2012; Crick, 1996; Deković & Gerris, 1994; Parker & Asher, 1987; Zimmer-Gembeck, Geiger, & Crick, 2005). Prosocial behaviors have even been shown to have a *causal* effect on gaining acceptance among peers; both when they are displayed spontaneously (Coie & Kupersmidt, 1983) and when children are instructed to display them more often (Layous et al., 2012). Consequently, understanding the neural and psychological processes involved in prosocial behavior is critical for a better understanding of the emergence and maintenance of an accepted or rejected status.

A form of prosocial behavior that allows for the examination of several underlying neural and psychological processes and which has been studied extensively is: sharing of valuable resources. First of all, sharing decisions have consequences for both the well being of the person making the distribution and for the person receiving a portion of the resources. Therefore, it has been argued that socio-cognitive capacities such as perspective taking are needed to recognize the need in the other person in order to share with them (Güroğlu, van den Bos, & Crone,

2014). Furthermore, when humans distribute resources, considerations of fairness, that is a concern for an equal distribution based on a comparison of the needs of two or more parties, come into play. Already in infancy, humans prefer equal distributions to unequal distributions and show behaviors that are indicative of aversion to inequality (Schmidt & Sommerville, 2011; Sloane, Baillargeon, & Premack, 2012). Failing to share with a peer might thus rely on separate processes (e.g., failing to recognize the need of the other person, but also diminished aversion to inequality), which have been shown to be supported by separate neural networks. Perspective taking in social exchange is associated with activity in brain regions in the medial frontal and temporo-parietal cortex (Fett, Gromann, Giampietro, Shergill, & Krabbendam, 2013; Güroğlu et al., 2011; van den Bos et al., 2011), whereas the detection of violations of fairness norms have been shown to activate brain regions involved in processing conflict and negative emotions (pre-Supplementary Motor Area/ACC and AI) (Chang & Sanfey, 2011; Güroğlu et al., 2011).

What mechanisms could underlie the typically found lower levels of prosocial behavior shown by rejected children relative to their accepted counterparts? First of all, rejected children's lower levels of prosocial behavior have previously been linked to a lesser understanding of other people's minds (e.g. less advanced 'theory of mind' skills) (Fink, Begeer, Hunt, & de Rosnay, 2014; Slaughter, Dennis, & Pritchard, 2002). Second, a diminished tendency to behave prosocially could also be associated with lower degrees of internal conflict or negative affect experienced when violating a fairness norm (e.g. when keeping all resources to oneself). To gain insights into these two underlying processes, we first examined the neural correlates of violations of fairness norms in sharing decisions in a sample of young adults (**Chapter 7**). Subsequently, to investigate whether the previously described mechanisms involved in sharing decisions show associations with peer group acceptance or rejection, we examined the neural correlates of sharing decisions in adolescents with a history of stable peer acceptance and adolescents with a history of chronic peer rejection (**Chapter 8**). A better understanding of the mechanisms underlying prosocial behavior at the intra-individual level and at the level of the interaction can provide valuable insights into the role of prosocial behavior in gaining or maintaining peer acceptance.

1.5 OUTLINE OF THIS THESIS

The overarching goal of this thesis was to examine the neural, psychological, and behavioral processes, which play a role in the emergence or maintenance of a rejected status. To explore these processes, we combined experimental paradigms borrowed from social psychology (Cyberball) and behavioral economics (economic games such as the Dictator Game) with neuroimaging methods from cognitive neuroscience (fMRI), and multi-informant survey

measures on psychological and social functioning from developmental psychology (self-, peer, and parent-reports). The empirical studies were guided by our transactional model of peer interactions, which distinguished between processes at the level of the individual child (i.e. intra-individual), those at the level of social interactions and those at the level of the peer group. Together these studies not only aimed to advance our understanding of the processes that give rise to peer group rejection and its maintenance, but they also provide valuable insights into the affective, cognitive-regulatory, and socio-cognitive processes underlying social interactions in general.

The first part of this thesis (**Chapters 2-5**) focuses on the affective, cognitive and neural (intra-individual) processes underlying subjective and behavioral reactions to social exclusion (at the level of the social interaction) and how these processes varied as function of chronic peer group rejection (group level). **Chapter 2** describes a neuroimaging study that shows how sustained exposure to peer group rejection across six years of elementary school is associated with heightened neural responses to social exclusion in early adolescence. **Chapter 3** reports on a study that examined the neural correlates of retaliatory (i.e. punishment) and prosocial (i.e. forgiveness) reactions toward peers who previously excluded them in a sample of young adults. **Chapter 4** investigated how the neural processes involved in punishment and forgiveness of excluders in adolescence vary as a function of individual differences in chronic exposure to peer rejection, cognitive control capabilities and perspective-taking skills. **Chapter 5** describes a behavioral study that examined how affective perspective-taking skills contribute to individual and developmental differences (age 9-22) in third-party decisions to help victims of social exclusion and to punish excluders.

The second part of this thesis (**Chapter 6-8**) focuses on the neurocognitive (intra-individual) processes underlying sharing decisions (in social interactions) involving real costs and benefits for self and others and how these processes are associated with individual histories of sustained exposure to either high or low levels of peer acceptance (group level). **Chapter 6** presents a review of the evidence for the hypothesis that developmental changes in cognitive control and perspective-taking skills and their underlying neural circuitry are critical to understanding developmental changes in strategic thinking and an increased incorporation of other's perspectives into social decisions. **Chapter 7** describes a study on the neural correlates of violations of a fairness norm in sharing decisions in young adults. We examined neural activity when participants violated a norm of equality to benefit themselves, but also when they violated a norm of equality to benefit another person. **Chapter 8** investigated how activation of neural systems involved in the detection of norm-violations and those supporting perspective taking during sharing choices differs between adolescents who were stably accepted and adolescents who were chronically rejected during childhood. Finally, **Chapter 9** summarizes the results of the studies in this thesis and discusses the implications of the findings for understanding the mechanisms of emergence and maintenance of peer rejection.

