Nice traits or nasty states : dispositional and situational correlates of prosocial and antisocial behavior in childhood

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Contents

Chapter 1

General introduction

General introduction

Prosocial behavior and antisocial behavior are thought to be influenced by situational demands (e.g. Anderson & Carnagey, 2009; Van IJzendoorn, Bakermans-Kranenburg, Pannebakker, & Out, 2010) and have also been associated with dispositional factors (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Crick, 1996). However, how situational and dispositional factors together influence prosocial and antisocial behavior in children is largely unknown. The current thesis will therefore study the situational and dispositional correlates of prosocial and antisocial behaior in childhood with a special focus on their interplay.

Prosocial behavior

Prosocial behavior is manifested by children as young as 18 months old (and maybe younger) and is thought to be associated with several beneficial outcomes, also for the young benefactor, such as higher academic achievement, attentional regulation, and better social adjustment (e.g. Caprara et al., 2000; Crick, 1996; Eisenberg et al., 1996; Warneken & Tomasello, 2006). Although prosocial behavior in general is defined as voluntary behavior intended to benefit another (Eisenberg, Fabes, & Spinrad, 2007), different types of prosocial behavior can be distinguished, such as helping, sharing, comforting, and donating, and these distinct categories are not necessarily related (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Warneken & Tomasello, 2006; Warneken & Tomasello, 2009). While a common genetic factor underlying various types of prosocial behavior has been identified in one study (Knafo-Noam, Uzefovsky, Israel, Davidov, & Zahn-Waxler, 2015), another study did not find such a factor (Krueger, Hicks, & McGue, 2001). Besides, unique genetic contributions and distinct underlying social-cognitive mechanisms, likely reflected in different neurobiological correlates, differentiate between types of prosocial behavior (Dunfield & Kuhlmeier, 2013; Knafo–Noam et al., 2015; Paulus, 2014; Paulus, Kühn-Popp, Licate, Sodian, & Meinhardt, 2013). The motivation behind such types of prosocial behavior can also differ. Prosocial behavior can be altruistic, especially when the costs for the benefactor are high (Svetlova, Nichols, & Brownell, 2010; Van IJzendoorn et al., 2010) but it can also be self-serving, for example because of positive reputational effects for the benefactor (Griskevicius, Tybur, & Van den Bergh, 2010).

Although both situational and dispositional characteristics have been identified as precursors of various types of prosocial behavior, these have been scarcely studied together in children. The answer to the question whether distinct types of prosocial behavior have different predictors is largely unknown. The overarching aim of this thesis is to study both situational and dispositional correlates of several types of prosocial, and also antisocial, behavior. We hope that our series of studies will help to unravel whether both dispositional and situational factors contribute to prosocial and antisocial behavior, or that one of these factors may be overridden by the other.

Precursors of prosocial behavior

One line of research suggests that prosocial behavior is driven by characteristics of the individual and thus stems from a dispositional trait. For example, higher levels of inhibition, empathy, and guilt, and lower levels of temperamental anger have been associated with more prosocial behavior in children (Aguilar-Pardo, Martínez-Arias, & Colmenares, 2013; Batson & Ahmad, 2001; Carlo, Roesch, & Melby, 1998; Eisenberg et al., 2002; Krevans & Gibbs, 1996; Moore, Barresi & Thompson, 1998; Ongley & Malti, 2014). Other factors, such as parenting, have also been thought to shape a child's prosocial personality (Carlo, McGinley, Hayes, Batenhorst, & Wilkinson, 2007). For example, parental warmth and positive, noncoercive discipline were associated with higher levels of prosocial behavior whereas coercive, punitive discipline was associated with lower levels of prosocial behavior (Carlo, Mestre, Samper, Tur, & Armenta, 2011; Knafo & Plomin, 2006).

In contrast with studies focusing on prosocial behavior as stemming from a dispositional trait, other studies indicate that prosocial behavior is more likely to depend on the situation (e.g. Van IJzendoorn et al., 2010). One such situational factor is the costs of a prosocial act: lowering the net costs increases the incidences of helping (Perlow & Weeks, 2002). Modelling of prosocial behavior by another person was also found to increase prosocial behavior in adults (Kallgren, Reno, & Cialdini, 2000). Correspondingly, being observed by peers or cameras increased prosocial behavior (Engelmann, Herrmann, & Tomasello, 2012; Van Rompay, Vonk, & Fransen, 2009). Even the simple display of a pair of eyes on the wall causes people to act more prosocial (Powell, Roberts, & Nettle, 2012). Familiarity might also increase prosocial behavior. Children were found to be more likely to defend a familiar victim of bullying than an unfamiliar victim (Chaux, 2005; Oh & Hazler, 2009).

While situational factors thus may explain part of the variance in prosocial behavior, and possibly even override influences of dispositional factors (Van IJzendoorn et al., 2010), dispositional factors might influence a child's sensitivity to situational cues. This is congruent with the interactionist perspective proposing that behavior is a result from the interaction between the characteristics of a person and characteristics of the situation (Endler & Parker, 1992). For example, prosocial behavior in people with a high need for approval increased when they were observed by others, and a similar result of being observed was found for people low on autistic traits: their prosocial behavior increased while they were being observed, whereas no such effect was found for people higher on autistic traits (Izuma, Matusmoto, Camerer, & Adolphs, 2011; Van Rompay et al., 2009). Therefore the current study investigates both dispositional and situational factors as contributors to prosocial behavior, and also focuses specifically on their interplay.

Antisocial behavior

Prosocial behavior is often contrasted with antisocial behavior (e.g. Boxer, Tisak, & Goldstein, 2004; De Bruyn & Cillessen, 2006). Antisocial behavior in childhood can manifest as for example aggression, rule-breaking behavior, and bullying (Niv, Tuvblad, Raine, & Baker, 2013; Olweus, 1994) and is associated with negative outcomes for the self and others, such as poorer school performance, delinquency, relational problems, violence, and the continuation of antisocial behavior (Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Pouwels & Cillessen, 2013; Van Lier & Crijnen, 2005).

Antisocial behavior was found to be negatively associated with prosocial behavior (e.g. Carlo et al., 2014; Hardy, Bean, & Olsen, 2015; Hastings, Zahn-Waxler, Usher, Robinson, & Bridges, 2000) and an intervention promoting prosocial behavior decreased externalizing problems in children (Vliek, Overbeek, & Orobio de Castro, 2014). Although such results together with the terminology 'antisocial' and 'prosocial', and the opposite effects of such behavior on others suggests that prosocial and antisocial behavior are two ends of the same continuum, these constructs have also found to have a distinct etiology, unique (personality) correlates, and they appeared not always strongly negatively related to each other (Krueger et al., 2001). Also, negative associations that were found between prosocial and antisocial behavior are often rather small (e.g. Carlo et al., 2014; Hardy et al., 2015). Furthermore, in contrast to prosocial behavior which is suggested to depend strongly on the situation, antisocial behavior is thought to be a more stable and heritable trait (e.g. Porsch, et al., 2016). If prosocial and antisocial behavior are indeed such distinct constructs, both have to be studied, especially when we want to develop interventions targeting a decrease of antisocial behavior as well as an increase of prosocial behavior.

Moral reasoning and prosocial behavior

Many studies in the domain of prosocial development focus on moral reasoning (e.g. Pratt, Arnold, Pratt, & Diessner, 1999; Walker & Taylor, 1991), originating from Kohlberg's cognitive stages of moral judgement and Hoffman's theory on the affective route to moral internalization (Gibbs, 2014). However, Eisenberg (1982) suggests that while moral reasoning can predict prosocial behavior, moral reasoning might be affected by the specific situation, resulting in different behavioral outcomes. Also researchers often rely on self-reports of prosocial acts (e.g. Carlo, Hausmann, Christiansen, & Randall, 2003; Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005; Paciello, Fida, Cerniglia, Tramontano, & Cole, 2012), thereby measuring what people *say* they do, but not *observing* the actual behaviors. It has been demonstrated that self-report of prosocial and antisocial behavior can differ greatly from actual behavior (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). Also, a recent study showed that people value utilitarian autonomous cars (i.e. self-navigating cars which would sacrifice a smaller number of passengers to save a larger number of pedestrians). However people were less willing to buy such a utilitarian car for themselves (Bonnefon, Shariff, & Rahwan, 2016). Parents are also suggested to be biased reporters of their child's prosocial behavior (Holmgren, Eisenberg & Fabes, 1998). Prosocial moral reasoning, self- and other-reports on prosocial behavior may thus divert from prosocial acts.

Measuring prosocial behavior

For the current thesis, we therefore used two paradigms to observe prosocial behavior in middle childhood. First, we used a donating task (Van IJzendoorn et al., 2010), to observe charitable giving in children. In an anonymous situation, children could donate their previously earned money to a good cause that was shown in a short video clip. As we were interested in the effect of situational differences on prosocial behavior, we showed half of the children an additional video fragment of a same-sex peer who donated money to the charity. Modelling of prosocial behavior has previously been shown to increase prosocial acts in individuals (Kallgren et al., 2000). The second paradigm was an adapted version (Prosocial Cyberball Game, PCG; Riem, Bakermans-Kranenburg, Huffmeijer, & Van IJzendoorn, 2013; Vrijhof et al., 2016) of the computerized ball tossing game Cyberball (Crowley, Wu, Molfese, & Mayes, 2010; Williams, Cheung, & Choi, 2000). During this game, children can throw the ball to three players, who throw the ball back to the child and each other. After a while, one of the players is excluded by the other two. While the game continues, the participating children can then compensate for the exclusion and defend the victim. They can also join in with the exclusion or remain passive by not choosing sides. This paradigm thus enabled us to observe both prosocial behavior (compensating the excluded player) and antisocial behavior (joining the excluders). Bystander behavior used in the PCG is not a measure of a prosocial or antisocial trait, but indicates children's prosocial or antisocial response to observed social exclusion in a specific game-like setting. The advantage of the PCG is its standardized design and its use in slightly different conditions, e.g. familiarity of the excluded person. Besides its continuous score for number of tosses to the excluded player the PCG also allows for the categorization of three bystander roles during social exclusion.

Donating to a charity can be considered altruistic behavior as the costs to the benefactor are high; previously earned money is given up to a stranger, which eliminates the possibility of getting something back from this person (Van IJzendoorn et al., 2010). Furthermore, there were no reputational benefits for the children in the current paradigm, as the donation was made in private. Although it is not costly in the material sense, defending a victim can be costly as well. It is a risk to oppose a bully (Caravita, Gini, & Pozzoli, 2012), for example because of reputational damage or the risk of being excluded as well. Using two different paradigms to measure prosocial behavior, we do not study prosocial behavior as a unified construct, but as a broad category of different behaviors which may have unique precursors (Padilla-Walker & Carlo, 2014).

Setting

All studies in this thesis were embedded within the Generation R Study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012; Tiemeier et al., 2012). All mothers who had a delivery date between April 2002 and January 2006 and who were resident in Rotterdam were invited to take part in the study. At 6 years of age 8,305 children and their parents were still participating. Information on, among others, cognition and behavior was available for the entire cohort from the prenatal phase up to 8 years postnatally. For three of the studies presented in this thesis, a sub-sample (n = 291) was invited to take part in detailed measures on (f)MRI, neuropsychology, and prosocial and antisocial behavior at the age of 8. To obtain sufficient variation in prosocial and antisocial behavior, we selected highly prosocial, highly antisocial, and control children for this subsample.

Outline

The aim of the current thesis is to examine situational and dispositional correlates of prosocial and antisocial behavior in middle childhood. Parent- and teacher-reported data, observations and neuroimaging data were used to study these associations. In Chapter 2 we examine the longitudinal trajectories of parent-reported aggression and its associations to antisocial behavior in school. We also test the predictive validity of aggression trajectories over a single measurement of aggression. Aggression trajectories from this Chapter were used for the sample selection in Chapters 3-5. In Chapters 3 and 4 we examine the situational and dispositional correlates of prosocial and antisocial behavior. In Chapter 3, we test whether donating behavior is mainly situationally driven or is dependent on child characteristics. Furthermore, we test whether sensitivity to situational cues depends on child characteristics. In Chapter 4 we examine child and parenting correlates of bystander behavior during social exclusion in the PCG. Furthermore, we test whether bystander behavior in this situation is dependent on the familiarity with the excluded victim. Again, differences in children's sensitivity to situational cues are examined.

To find out whether variance in prosocial behavior is not only dependent on situational characteristics, but also has a neuroanatomical component, the association between donating behavior and cortical thickness and resting state functional connectivity is examined in Chapter 5. We end the current thesis with a discussion and conclusion in Chapter 6. In this closing Chapter limitations of the current set of studies and directions for future research are discussed.

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Chapter 2

Early childhood aggression trajectories: Associations with teacher-reported problem behavior

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Abstract

High and stable levels of aggression and the presence of aggressive behavior in multiple settings according to different informants are risk factors for later problems. However these two factors have not been investigated in early childhood. The present study investigates trajectories of parent-reported child aggression from 1.5 up to 6 years of age and their association with aggressive behavior, attention problems and rule breaking behavior in a different setting, as reported by the teacher. In a longitudinal population-based cohort study, parent-reported measures of aggressive behavior were obtained using the CBCL when children were 1.5, 3 and 6 years of age (n = 4,781). Teacher-reported problem behavior at school was assessed at age 6.5, using the TRF questionnaire (n = 2,756). Growth mixture modeling yielded three aggression trajectories, with high increasing (3.0%), intermediate (21.3%) and low decreasing (75.7%) aggression levels. Children in trajectories with higher and increasing levels of aggression showed more teacher-reported aggressive behavior, attention problems and rule breaking behavior. However, parent-reported aggression at age six predicted problem behavior at school to the same extent as did the aggression trajectories, suggesting that the incremental value of trajectories is not always self-evident.

Introduction

Childhood aggression increases the risk of the development of problems later in life, such as physical violence, delinquency, relational problems and the continuation of aggressive behavior (Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Pouwels & Cillessen, 2013). In addition to an early onset of aggressive behavior, (severity) levels, patterns over time, and aggression across different settings are indicators for a heightened risk of later problems (Campbell, Spieker, Burchinal, Poe, & the NICHD Early Child Care Research Network, 2006; Moffitt, 1993; Loeber, 1990). Whereas several studies have focused on the longitudinal patterns and levels of aggression in young children (e.g. Tremblay et al., 2004 ; Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007), few studies have tested whether these factors are related to the reports of aggression and other forms of problem behavior by a different informant from a different setting. The current study investigates early childhood levels and patterns of parent-reported aggression and tests whether these are associated with aggression and related problem behaviors reported by the teacher.

While some studies point to a decrease in (physical) aggression as children grow older (Alink et al., 2006; Bongers, Koot, Van der Ende, & Verhulst, 2004), a substantial percentage of children remain highly aggressive or show increasing levels of aggression over time (e.g. Campbell et al., 2006; Côté et al., 2006; Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007; Tremblay et al., 2004). Trajectories may be more informative than group mean levels of aggressive behavior, and help to identify heterogeneity in the development of aggression (Nagin & Tremblay, 1999; Tremblay, 2000). Emerging different trajectories may be predictive of distinct developmental outcomes. Several studies reported that higher levels and increasing patterns of childhood aggression were predictive of aggression and related behaviors at later ages (Kokko & Pulkkinen, 2005; Kokko, Pulkkinen, Huesmann, Dubow, & Boxer, 2009; Reef, Diamantopoulou, Van Meurs, Verhulst, & Van der Ende, 2010; Temcheff et al., 2008). For example, school-age children who followed a peer-rated trajectory with increasing levels of aggression had higher ratings of externalizing problem behavior, poorer school performance and were more often rejected by their peers as compared to children who showed a stable pattern of moderate or low aggression. Moreover, children in the moderate trajectory were also worse off than the children with a low aggression pattern (Van Lier & Crijnen, 2005). In a similar vein, Campbell et al. (2006) reported that even trajectories with modest or low, but stable levels of aggression were predictive of adjustment problems at later ages. These findings illustrate that both *patterns* and *levels* of aggressive behavior may be predictive of persistent aggression and the development of other problems later in life (Campbell et al., 2006).

Another important aspect indicating the pervasiveness of aggression is stability across informants. Multiple informants, who report each on different settings such as parents and teachers, show overlap in their reports of antisocial behavior, but they also add unique contributions (Achenbach, 2006; Arseneault et al., 2003). These unique contributions could be indicative of measurement error but may also provide information about context-specific child behavior (De Los Reyes et al., 2013; Kraemer, et al., 2003). Agreement could indicate the pervasiveness of these problems (De Los Reyes et al., 2013; Veenstra et al., 2008). The inclusion of multiple informants may thus provide a more detailed observation of the behavior studied.

Whereas some studies report that the presence of problem behavior in one setting was equally predictive of later problems such as crime and substance dependence as compared to problem behavior reported by both parents and teachers (e.g. Fergusson, Boden, & Horwoord, 2009), other studies report that especially the agreement between informants on the presence of problem behavior places children at risk for persistent problems. According to Loeber (1990), the manifestation of problem behavior in multiple settings increases the risk for deviant behavior later in life. When parents and teachers agreed on the occurrence of problem behavior, children were at a heightened risk for future police / judicial contacts and scored worse on effortful control and academic performance (Ferdinand, Van der Ende, & Verhulst, 2007; Veenstra et al., 2008). Campbell et al. (2010) reported that children with the highest teacher-reported physical aggression trajectories were rated by their parents as having the most externalizing problems in sixth grade, while higher parent-reported trajectories of aggression were predictive of teacher reported externalizing problem behavior, ADHD and ODD symptoms at age 12 (Campbell et al. 2006). Thus, both the heterogenic longitudinal aspect of aggression captured in trajectories and the presence of aggression according to multiple informants in different settings are important factors to include.

The studies discussed so far focused on longitudinal patterns of aggressive behavior and examined whether these patterns were related to the occurrence of the broader construct of externalizing problem behavior in middle childhood, reported by a different informant in a different setting. In the current study we examined how levels and patterns of parent-reported aggression (which comprises physical and non-physical aggressive behaviors, such as defiant behavior) in early childhood are related to aggression problems as reported by the teacher, testing whether this specific behavior is pervasive across settings and time at a young age. Since attention problems and rule breaking behavior often co-occur with aggression in childhood (Bartels et al., 2003; Jester et al., 2005; Nagin & Tremblay, 2001; Niv, Tuvblad, Raine, & Baker, 2013), we also investigated how levels and patterns of parent-reported aggression are related to teacher-reported attention problems and rule breaking behavior. We investigate whether we could identify a group of children with a general tendency to show pervasive problem behavior, using reports of different informants in multiple settings. Since it has been argued that the differentiation between physical and other forms of aggressive behavior is important (Tremblay, et al., 1999) we not only examined aggression in general, but also explored whether parent-reported physical and non-physical aggression is related to teacher-reports of these subtypes of aggression.

The importance of a developmental perspective on aggression using trajectory modelling has been repeatedly stressed (e.g. Brame et al., 2001; Nagin & Tremblay, 1999). At the same time, studies generally do not test for the *additional* power of this approach as compared to a single measure of aggression at one point in time (e.g. Campbell et al., 2006; Harachi et al., 2006). We tested whether the use of aggression trajectories is more informative in terms of the power to predict later teacher-reported problem behavior than the use of a single time point assessment of aggression. We hypothesized that children in trajectories with high and stable or increasing levels of aggression will, on average, show higher levels of teacher-reported problem behavior. Furthermore, we tested the superiority of trajectories over single measurements of aggression by examining the strength of the relation with problem behavior at age 6 as reported by the teacher.

Methods

Participants

The participants were recruited from the Generation R study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012). All mothers who were residents in Rotterdam and had an expected delivery date between April 2002 and January 2006 were invited to participate in the study. Children with at least two measures of parent-reported CBCL aggressive behavior scores available up to 6 years of age were eligible for the study, which resulted in a sample of 5,227 participants. In total, 446 (8.5%) siblings were randomly excluded to prevent paired data. Hence, aggression trajectories were modeled in a sample of 4,781 children (n = 4,778 for physical aggression and n = 4,771 for non-physical aggression). Children were included in further analyses when teacher-reported ratings of problem behavior were available. This resulted in a final sample of 2,756 children (n = 2,753 for physical and n = 2,749 for non-physical aggression). For sample characteristics of the n = 2,756 sample see TABLE 2.1. The study was approved by the Medical Ethical Committee of the Erasmus Medical Center, Rotterdam . Written informed consent was obtained from all adult participants.

Measures

Parent-reported aggression. The Child Behavior Checklist/1½–5 (CBCL, Achenbach & Rescorla, 2000) is a self-administered parent-report questionnaire including 99 items concerning emotional and behavioral problems of the child, rated on a 3 point scale (0 = not true, 1 = somewhat true or sometimes true, 2 = very true or often true). The current study used the CBCL aggression scale, which comprised 19 items such as '*Hits others*' and '*Destroys things belonging to his/her family or other children*'. All aggression items were summed, with higher scores representing higher levels of aggression. A maximum of 25% missing items was allowed for each scale score. Good psychometric properties have been reported for the CBCL (Achenbach & Rescorla, 2000). The aggression scale was administered at 1.5, 3 and 6 years of age and had adequate internal consistencies in the current study, respectively $\alpha = .86$, $\alpha = .86$ and $\alpha = .88$. For reasons of continuity and comparability and because 66.8% of all children were younger than age 6 at the third measurement of parent-reported aggression, we chose to use the CBCL/1½–5 for all three assessment waves. When the children were 1.5 and 6 years of age, the questionnaire was completed by the primary caregiver (95.0% and 92.3% mothers respectively). At age 3, both the primary and secondary caregiver filled out the questionnaire.

TABLE 2.1
Sample Characteristics

Sample characteristics	Values	CBCL and TRF measures	*M* (*SD*)
Child		CBCL total aggr.	
Gender, No. boy (%)[a]	1,386 (50%)	1.5 years	8.48 (5.19-5.21)
Ethnicity, No. (%)[1]		3 years	6.94 (4.86-4.88)
Dutch	1,782 (65%)	6 years	5.59 (4.90-4.92)
Other Western	239 (9%)		
Non-Western	735 (27%)	CBCL physical aggr.	
Parity, No. ≤ 1 (%)[c]	2,297 (83%)	1.5 years	0.77 (1.07-1.11)
Age TRF, *M* (*SD*), months[d]	78.45 (13.99-14.00)	3 years	0.60 (0.95-0.97)
Birth weight, *M* (*SD*), g[a]	3,440.37 (559.21-560.12)	6 years	0.32 (0.76-0.77)
Mother		CBCL non-physical aggr.	
Age, *M* (*SD*), years[a]	31.53 (4.71)	1.5 years	7.72 (4.56-4.59)
Marital status, No. (%)[c]		3 years	6.35 (4.33-4.34)
Married/living together	2,419 (88%)	6 years	5.27 (4.48-4.50)
No partner	337 (12%)		
Education, No. (%)[c]		TRF total aggr.[d]	1.97 (4.25)
None or primary	96 (4%)	TRF attention[d]	5.50 (7.72)
Secondary	1073 (39%)	TRF rule breaking[d]	0.61 (1.46)
Higher	1587 (58%)	TRF physical aggr.[d]	0.32 (1.01)
Hostility, *M* (*SD*)[b]	0.18 (0.27-0.28)	TRF non-physical aggr.[d]	1.65 (3.46)

n = 2,753 for CBCL and TRF physical aggression. *n* = 2,749 for CBCL and TRF non-physical aggression. *n* = 2,756 for all other measures.
Note. Multiple imputed variables are reported in this table. For all continuous variables we report the pooled mean and the range of the standard deviation. For categorical variables we report the pooled *N* and percentages.
[a]Data collected prior to or at birth.
[b]Data collec ted at age 3.
[c]Data collected at age 6.
[d]Data collected at age 6.5.

Ratings of the primary caregiver were used (94.7% mothers). For 1.1% of the children, primary but not secondary caregiver ratings were missing. Since previous studies found very high agreement among mother-reported and father-reported CBCL externalizing problems (e.g. Duhig et al., 2000; Seifge-Krenke & Kollmaer, 1998), ratings of the secondary caregiver were used for these children. We will refer to the CBCL aggression scale as 'total aggression', to make a clear distinction with the physical and non-physical aggression scales.

For the analyses on physical and non-physical aggression we subdivided the CBCL aggression scale into physical and non-physical aggression items. The physical aggression scale was constructed based on prior studies (Bongers et al., 2004; NICHD, 2004). The items *Gets in many fights, Physically attacks people, Hits others,* and *Destroys things belonging to his/her family or other children* were included in the physical aggression scale. The other 15 items comprised the non-physical aggression scale. A maximum of 25% missing items was allowed for each scale. The sample sizes for the physical and non-physical aggression scale scores were slightly smaller (n = 4,778 and n = 4,771 respectively) than for total aggression (n = 4,781) because some extra children had > 25 % missing items on the subscales. The internal consistency for the physical aggression scale was α = .59, α = .58 and α =. 64 at 1.5, 3 and 6 years of age respectively. For non-physical aggression, internal consistencies were α = .84, α = .85 and α = .88 at 1.5, 3 and 6 years of age respectively.

Teacher-reported problem behavior. The Teacher's Report Form (TRF, 6-18 years, Achenbach & Rescorla, 2001) is a questionnaire for teachers to report on children's academic performance, adaptive functioning, and behavioral- and emotional problems. Teachers filled out the questionnaire when the children were on average 6.5 years of age. The Aggressive Behavior, Attention Problems and Rule Breaking Behavior scales were used in the present study. The Aggressive Behavior scale consists of 20 items such as '*Physically attacks people*' and '*Cruelty, bullying or meanness to others*'. The CBCL and TRF both assess aggressive behavior, but several items are unique to each specific questionnaire. The TRF Attention Problems scale includes 26 items such as '*Disturbs others*' and '*Can't concentrate*'. Examples of the 12-item TRF Rule Breaking Behavior scale are '*Lies, cheats*' and '*Breaks rules*'. All items were rated on a 3-point scale (0 = not true, 1 = somewhat true or sometimes true, 2 = very true or often true). For each scale, items were summed, with higher scores representing higher problem levels. Good psychometric properties have been reported for the TRF (Achenbach & Rescorla, 2001). Cronbach's alpha in this sample was α =.92 for Aggressive Behavior, α = .93 for Attention Problems and α = .71 for Rule Breaking Behavior. Because of substantial postive skewness, the scales were transformed using a log10 transformation, to approach normality (Tabachnick & Fidell, 2007).

For the analyses on physical and non-physical aggression we subdivided the TRF aggression scale into physical and non-physical aggression items. The physical aggression scale was constructed based on previous studies

(Bongers et al., 2004; NICHD, 2004). The items *Gets in many fights, Physically attacks people, Destroys property belonging to others, Destroys his/her own things, Cruelty, bullying or meanness to others,* and *Threatens people* were included in the physical aggression scale. The other 14 items comprised the non-physical aggression scale. A maximum of 25% missing items was allowed for each scale. Internal consistencies for the physical and non-physical aggression scale were α = .77 and α = .90 respectively. Because of positive skewness of both scales, physical aggression was transformed using a square root transformation and non-physical aggression was transformed using a log10 transformation to approach normality (Tabachnick & Fidell, 2007).

Covariates. The variables listed below were considered potential confounders, because previous research found associations between these variables and aggression in childhood (e.g. Campbell et al., 2010; Elgen, et al., 2012; Huijbregts et al., 2009; Tremblay et al., 2004). These variables are included in the model when they were significantly related to both the predictor and the outcome variable(s). At the time of enrollment, information on the age of the mother and ethnicity of the child was obtained. In accordance with the criteria of Statistics Netherlands (2004), ethnicity of the child was classified into the categories 'Dutch', 'Western' and 'Non-Western'. Gender and birth weight were obtained from midwives and hospital registries. Data on hostility of the mother was assessed using the Brief Symptom Inventory (BSI, Derogatis & Melisaratos, 1983) when children were 3 years of age. Data on parity, educational level of the mother, and marital status were obtained at age 6. Parity was dichotomized into 'none' and 'one or more siblings'. Educational level was subdivided into three categories: 'none or primary education', 'secondary education' and 'higher education'. Marital status was dichotomized into the categories 'married/living together' and 'no partner'. Furthermore, age of the child at which the TRF was filled out was considered as a potential covariate. Because of skewness, this variable and hostility of the mother were transformed using a log10 and square root transformation respectively, to approach normality (Tabacknick & Fidell, 2007). Individual probabilities were included as a covariate, to take the individual variation in the probability of belonging to a specific class into account. The individual probabilities made the categorical class membership variable continuous, which facilitates the comparison with teacher-reported problems.

Statistical analyses

Developmental trajectories of aggression, measured with the CBCL at three time points, were constructed using Growth Mixture Modeling (GMM, Muthén & Shedden, 1999) in Mplus version 7 (Muthén & Muthén, 1998-2012). In GMM, unobserved heterogeneity in growth is captured in categorical latent classes, allowing for within and between class variation of intercept and slope. Within class variation enables the individuals within a class to vary freely, whereas between class variation implies that variances between classes are free to vary (Jung & Wickrama, 2007). Mplus used full information maximum likelihood estimation in cases of missing data. As previous studies found up to seven aggression trajectories (for a review see Jennings & Reingle, 2012) we estimated one to seven trajectories, which enabled us to test the number of classes that optimally represent this data. Posterior probabilities indicated the likelihood of a child to be assigned to a certain class. Children were assigned to the class for which they obtained the highest posterior probability. The final number of classes was determined on the basis of several criteria. First, Nylund, Asparouhov, and Muthén (2007) showed that from all fit indices available in Mplus, the BIC and BLRT are the most appropriate for selecting the final number of classes. Smaller BIC values indicate a better model fit and significant BLRT values imply that the current model has a better fit than the more parsimonious model. Apart from these fit indices, a number of other criteria are also important to consider, such as class size, posterior probabilities, and interpretability (Jung & Wickrama 2007; Nylund et al., 2007). Class membership based on most likely class membership was used to predict teacher-reported problem behavior. Because we restricted the data to the cases with complete TRF data, the sample was reduced to n = 2,756 (n = 2,753 and n = 2,749 for physical and non-physical aggression respectively). Further analyses were performed on this smaller sample.

Data on the TRF Rule Breaking Behavior scale was missing for three children and on the TRF non-physical aggression scale for two children. Missing data on covariates was less than 10% in all cases. The multiple imputation (Markov chain Monte Carlo) method with five imputations and ten iterations was used to compute missing values on the TRF scales and covariates. Classes were compared on several background variables using chi-square tests and analysis of variance.

MAN(C)OVA models were used to test whether total aggression class membership was related to teacher-reported problems. First, unadjusted analyses were done, including class membership as independent variable and aggression, attention problems and rule breaking behavior as dependent variables. In a second analysis, we added probability of class membership to the MANCOVA model, to show the effect of this specific variable. Third, a fully adjusted MANCOVA was run, including all covariates that were significantly related to the predictor and outcome(s). All three MANCOVA models were followed by univariate tests to evaluate the relation between class membership and the TRF scales separately. For the fully adjusted model, Bonferroni corrected post hoc tests were used to test for differences between classes on each specific TRF scale. AN(C)OVA models were used for physical and non-physical aggression. The same three models (unadjusted, adjusted for probability and fully adjusted) were run for both physical and non-physical aggression separately. For the fully adjusted model, Bonferroni corrected post hoc tests were used to test for differences between classes on the physical and non-physical aggression subscales. Pooled estimates for the MAN(C)OVA are not provided in SPSS 21. Furthermore, the statistics provided for the MAN(C)OVA in SPSS cannot simply be averaged. Therefore we reported the results of the first dataset in text and the range of statistics in Supplementary Material when results in all five imputed datasets were significant. When results were significant in some but not all datasets, we reported the range of statistics in text.

Per total aggression class we report on the percentage of children in the borderline, clinical and the combined (borderline and clinical) range of the three TRF scales. U.S. national sample norms, which are applicable to the Netherlands (Achenbach & Rescorla, 2007), were used to define these ranges. We tested whether group percentages differed between the classes using chi-square tests. Percentages will not be reported for the physical and non-physical aggression scale because no borderline and clinical norm scores are available for these scales.

On average, the TRF was administered 6 months after the last CBCL (age 6) assessment. However the time interval between these measures differed between children. Therefore we performed additional analyses with the time interval as a covariate to control for a potential effect of the difference in time between these assessments. Because the time interval was highly correlated with the age at which the TRF was administered, this latter covariate was excluded from these analyses. Due to moderate skewness of the time interval covariate, we used a square root transformation to approach normality (Tabachnick & Fidell, 2007).

To test whether the use of longitudinal trajectories of aggression was more informative than a single measure of aggression, we also examined parent-reported aggressive behavior at age 6 as predictor of teacher-reported problem behavior instead of class membership. Aggressive behavior at age 6 was the last time point used in the GMM analyses. The same covariates as in the former models were added to make the models comparable. To compare whether the effect size for aggression measured at a single time point (age 6) was different from the effect size for class membership, we converted the partial η^2 to a Cohen's d and computed the 85% confidence intervals using the Comprehensive Meta-Analysis (Borenstein, Rothstein, & Cohen, 2000) program. Confidence intervals that (partly) overlap indicate that the effect sizes for class membership and a single time point assessment of aggression are comparable (Goldstein & Healy, 1995; Julious, 2004; Payton, Greenstone, & Schenker, 2003). An 85% confidence interval was computed for the first imputed dataset because in contrast to a 95% confidence interval it enables testing differences in effect sizes with an error rate of approximately 5% (Julious, 2004).

Non-response analyses

Children included in the final sample (n = 2,756) did not differ on gender, birth weight and parent-reported total aggression at age 1.5, 3 and 6 from the children not incorporated in this sample. However, the included children were more often Non-Western than the excluded children (res_{adj} = 4.0) and the excluded children were more often Western than the included children (res_{adj} = 2.8), $\chi^2(2, n = 5209) = 19.89, p < .001, \varphi = .06$. Mothers of the included children did not differ on age at intake and the level of hostility reported at age 3, compared to mothers of the excluded children. However, mothers of excluded children had more often higher educational levels than mothers of included children (res_{adj} = 9.1) and mothers of the included children had more often secondary (res_{adj} = 8.6) or none / primary education (res_{adj} = 2.0) compared to the mothers of excluded children, $\chi^2(2, n = 4771) = 83.12, p < .001, \varphi = .13$.

Results

Trajectories of total aggressive behavior

Growth mixture models (GMM) with one to seven classes were tested for all children who had at least two measures of the CBCL total aggression scale available ($n = 4{,}781$). Models for which within-class and between-class variation were allowed did not converge. Allowing between-class variation only, led to models that converged. See **TABLE 2.2** for class solutions of one to seven classes. The BIC decreased with an increasing number of classes and the BLRT remained significant. Consequently, no definite conclusion on the number of classes could be drawn from those two fit indices. Therefore other criteria should be used for model selection. The posterior probabilities, as well as the number of participants per class decreased with an increasing number of classes, which are important factors in model selection (Jung & Wickrama, 2007; Nylund et al., 2007). This indicated that solutions with more classes were less suitable in terms of certainty of class assignment and group size. The three-class model was considered to be more informative than the two class model because it added a class with intermediate, relatively stable levels of aggression, in line with previous studies on the development of aggression (e.g. Côté et al., 2006). Solutions with four to seven classes contained multiple very small groups, with accompanying replication problems in future research. Therefore we chose the more parsimonious three class solution with higher posterior probabilities (> .80) and relatively large classes (***FIGURE 2.1***). The first class of the three class estimated model had the lowest levels of aggression with significantly decreasing aggression levels over time, $p < .001$. This class is referred to as 'low decreasing'. The second class had intermediate aggression levels that significantly increased over time, $p = .033$. This class is named 'intermediate'. The third class had intermediate aggression levels at the start that increased significantly over time, $p < .001$. The third class is referred to as 'high increasing'. TRF scores were available for 2,164 children in the low decreasing class, 527 children in the intermediate class and 65 children in the high increasing class. Between the three classes, children did not differ on ethnicity, parity, birth weight and age of the mother in all imputed datasets. However, there were more boys in the intermediate ($res_{adj} = 4.4$) and high increasing class ($res_{adj} = 3.1$) and more girls in the low decreasing class ($res_{adj} = 5.3$), $\chi^2 (2, n = 2{,}756) = 30.74$, $p < .001$, $\varphi = .1$ (the range of the five imputed datasets is reported in **TABLE S2.4**).

TABLE 2.2

Class Solutions for GMM Models for Total, Physical and Non-Physical Aggression

	1	2	3	4	5	6	7
Total aggression							
BIC	77,748.82	76,927.39	76,548.91	76,372.09	76,274.62	76,061.43	75,996.88
BLRT	N/A	< .001	< .001	< .001	< .001	< .001	< .001
Entropy	1.00	0.84	0.82	0.84	0.82	0.81	0.82
N class (%)							
1	4,781 (100%)	4,176 (88%)	3,620 (76%)	3,556 (74%)	3,498 (73%)	2,863 (60%)	2,782 (58%
2		605 (13%)	1,017 (21%)	970 (20%)	217 (5%)	1,229 (26%)	1,239 (26%
3			144 (3%)	138 (3%)	167 (4%)	291 (6%)	287(6%)
4				117 (3%)	771 (16%)	197 (4%)	227 (5%)
5					128 (3%)	141 (3%)	167 (4%)
6						60 (1%)	45 (1%)
7							34 (1%)
Physical aggression[a]							
BIC	34,093.33	31,154.92	29,321.75	25,865.17			
BLRT	N/A	< .001	< .001	< .001			
Entropy	1.00	0.97	0.96	0.97			
N class (%)							
1	4,778 (100%)	4,377 (92%)	3,780 (79%)	3,777 (79%)			
2		401 (8%)	843 (18%)	601 (13%)			
3			155 (3%)	346 (7%)			
4				54 (1%)			
Non-physical aggression[b]							
BIC	74,612.61	73,883.63	73,545.51	73,387.52	73,307.71		
BLRT	N/A	< .001	< .001	< .001	< .001		
Entropy	1.00	0.80	0.80	0.79	.81		
N class (%)							
1	4,771 (100%)	4,053 (85%)	3,395 (71%)	2,844 (60%)	2,849 (60%)		
2		718 (15%)	1,169 (25%)	1,343 (28%)	1,301 (27%)		
3			207 (4%)	494 (10%)	472 (10%)		
4				90 (2%)	84 (2%)		
5					65 (1%)		

Total aggression n = 4,781; Physical aggression n = 4,778;
Non-physical aggression n = 4,771.
[a]Models with > 4 classes did not converge.
[b]Models with > 5 classes did not converge.

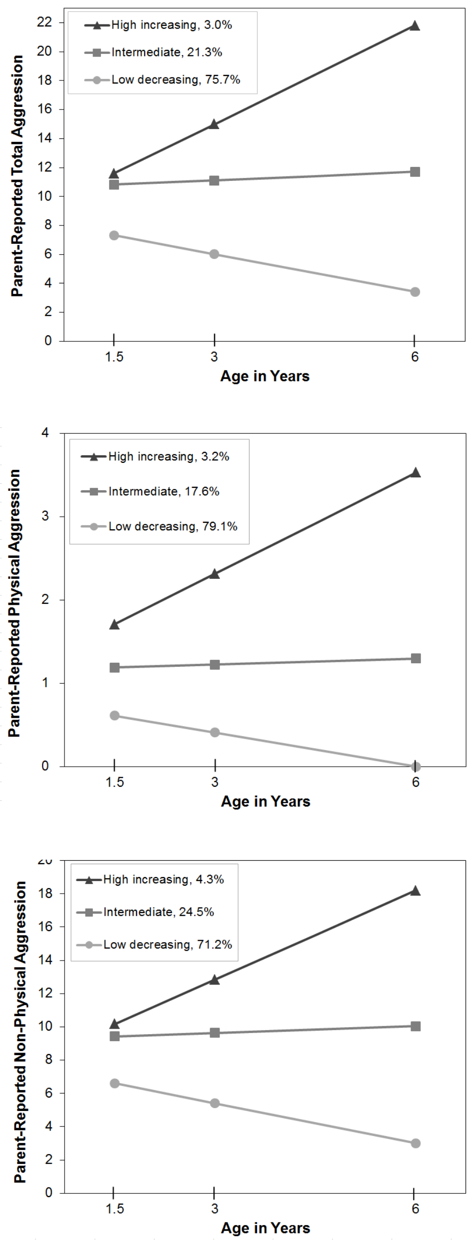

FIGURE 2.1

Trajectories of total aggression (n = 4,781), physical aggression (n = 4,778), and non-physical aggression (n = 4,771) from 1.5 to 6 years of age.

Marital status of the mother differed between classes in two out of five imputed datasets $\chi^2(2, n = 2{,}756) = 5.09\text{-}7.53$, $p = .023\text{-}.078$, $\varphi = .04\text{-}.05$. In the datasets in which the classes differed on marital status, the intermediate class included more children of mothers without a partner ($res_{adj} = 2.5\text{-}2.7$), whereas the low decreasing class contained more mothers who were married/living together as compared to the other classes ($res_{adj} = 2.5\text{-}2.7$). Maternal education differed between classes in two out of five imputed datasets $\chi^2(2, n = 2{,}756) = 8.18\text{-}9.86$, $p = .043\text{-}.085$, $\varphi = .05\text{-}.06$. In the datasets in which the classes differed on maternal education level, the intermediate class included more children of mothers with secondary education ($res_{adj} = 2.4\text{-}2.5$) and fewer children of mothers with higher education ($res_{adj} = -2.9$ - -3.0), whereas the low decreasing class contained more mothers who had higher educational levels ($res_{adj} = 2.7\text{-}2.8$) and fewer who had secondary education ($res_{adj} = -2.2$ - -2.4) as compared to the other classes. In addition, classes differed on hostility of the mother in all datasets, $F(2, 2{,}753) = 42.08$, $p < .001$, partial $\eta^2 = .03$ (the range of the five imputed datasets is reported in **TABLE S2.4**). Children in the high increasing class had more hostile mothers ($M = 0.49$, $SE = .04$, 95% CI 0.41-0.56) than the intermediate class ($M = 0.36$, $SE = .01$, 95% CI 0.34-0.39, $p < .001$, Cohen's $d = 0.41$) and low decreasing class ($M = 0.25$, $SE = .01$, 95% CI 0.24-0.26, $p < .001$, Cohen's $d = 0.77$,). The children in the intermediate class had on average more hostile mothers than the low decreasing class, $p < .001$, Cohen's $d = 0.36$. Although a trend suggested that more children in the low decreasing class had a TRF filled out by the teacher, $\chi^2(2, n = 4781) = 6.00$, $p = .050$ (the same values in all imputed datasets), the difference was not significant.

Relating trajectories of total aggression to teacher-reported problem behavior

We tested whether class membership was related to different levels of total aggressive behavior, attention problems and rule breaking behavior as reported by the teacher, adjusting for several covariates. Correlations between all variables included in the models are reported in **TABLE 2.3**. Unadjusted and untransformed means of the TRF scales per class can be found in ***FIGURE 2.2***, transformed means will be used in the analyses and are reported in text.Univariate follow-up tests from the MAN(C)OVA's are reported in **TABLE 2.4**.

TABLE 2.3

Correlations Between Outcomes, Predictors and Covariates in the Total Aggression Model

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. TRF aggression[d]	-												
2. TRF attention[d]	.68***												
3. TRF rule breaking[d]	.68***	.56***											
4. Class total aggression (intermediate)[1]	.12***	.10***	.08***										
5. Class total aggression (high decreasing)[1]	.16***	.14***	.12***	-.08***									
6. Total aggression age 6	.23***	.20***	.17***	.62***	.50***								
7. Gender[2,a]	-.20***	-.29***	-.19***	-.08***	-.06**	-.12***							
8. Age TRF[d]	.11***	.18***	.09***	.05**	.01	.03	-.01						
9. Time interval CBCL and TRF[c,d]	.10***	.15***	.07***	.06**	.01	.04*	-.01	.97***					
10. Education mother (low)[3,c]	.05*	.09***	.06**	.03	.00	.03	-.00	.04	.02				
11. Education mother (secondary)[3,c]	.09***	.10***	.09***	.04*	-.01	.05**	.01	.04*	.01	-.15***			
12. Marital status[4,c]	.12***	.12***	.13***	.05*	.00	.07***	-.03	.00	-.02	.06**	.11***		
13. Hostility[b]	.04	.03	.05*	.13***	.11***	.21***	-.01	.03	.01	.04	-.01	.09***	
14. Probability of class assignment	-.12***	-.10***	-.11***	-.34***	-.05*	-.38***	.06**	-.03	-.02	-.03	-.06**	-.05**	-.10***

n = 2,756

Note. Pooled Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable respectively. Pooled phi-coefficients were used for correlations between two dichotomous variables.

[1]Low decreasing class is reference category. [2]Gender is coded as 0 (boy) and 1 (girl). [3]Higher education is reference category. [4]Marital status is coded as 0 (married / living together) and 1 (no partner).

[a]Data collected prior to or at birth. [b]Data collected at age 3. [c]Data collected at age 6. [d]Data collected at age 6.5

*$p < .05$, ** $p < .01$, *** $p < .001$.

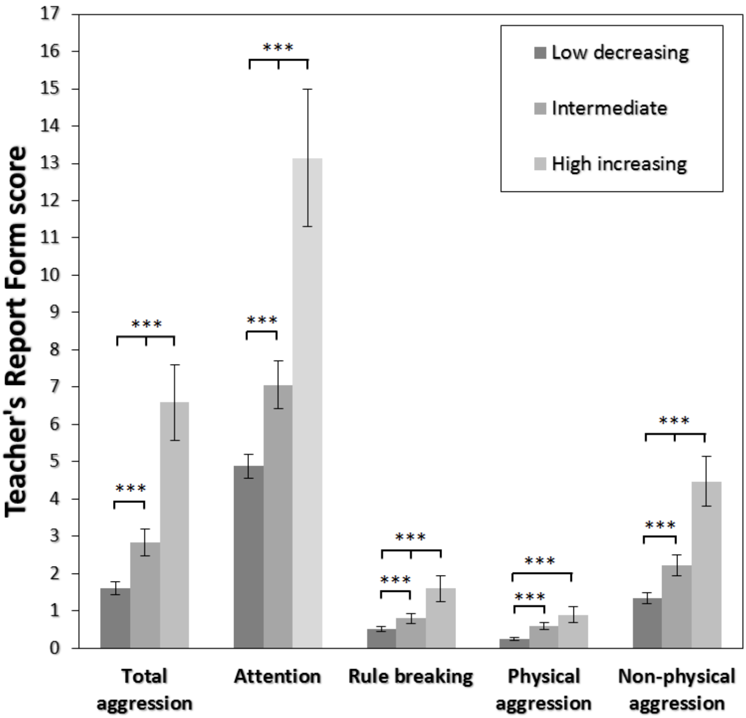

FIGURE 2.2
*Unadjusted and untransformed mean levels of total aggression, attention problems, rule breaking behavior, physical aggression, and non-physical aggression. Error bars represent confidence intervals. Significant differences in unadjusted and untransformed mean levels between classes are indicated as: *p < .05, **p < .01,*
****p < .001. n = 2,756 for total aggression, attention, and rule breaking. n = 2,753 for physical aggression.*
n = 2,749 for non-physical aggression.

The unadjusted, adjusted for probability and fully adjusted multivariate tests all showed an effect of class membership on teacher-reported problems, respectively $F(6, 5504) = 21.56$, $p < .001$, partial $\eta^2 = .02$, $F(6, 5502) = 17.20$, $p < .001$, partial $\eta^2 = .02$, and $F(6, 5490) = 14.33$, $p < .001$, partial $\eta^2 = .02$. The range of statistics over the five imputed datasets for the multivariate analyses is reported in TABLE S2.5. The fully adjusted univariate analyses showed an effect of class membership on teacher-reported total aggression ($p < .001$, partial $\eta^2 = .03$, Cohen's $d = 0.34$, 85% CI 0.28-0.39).

TABLE 2.4

Univariate Analysis of Covariance Relating Class Membership to Problem Behavior at School

	Aggression[a]		Attention[b]		Rule breaking[c]		Physical aggr.[d]		Non-physical aggr.[e]	
Model	F	partial η^2	F	partial η^2	F	partial η^2	F	partial η^2	F	partial η^2
Model 1										
Classes[1]	60.49***	.04	48.17***	.03	28.98***	.02	49.70***	.04	50.91***	.04
Model 2										
Classes[1]	47.41***	.03	38.35***	.03	21.53***	.02	49.17***	.04	42.21***	.03
Probability	16.61***	.01	11.00**	.00	15.48***	.01	6.26***	.00	10.83**	.00
Model 3										
Classes[1]	39.04***	.03	29.16***	.02	15.65***	.01	31.02***	.02	32.58***	.02
Gender	96.15***	.03	231.64***	.08	85.03***	.03	87.35***	.03	83.08***	.03
Age TRF	29.12***	.01	82.40***	.03	16.94***	.01	13.73***	.01	30.63***	.01
Education mother	10.45**	.01	21.87***	.02	12.14***	.01			10.43**	.01
Marital status	31.42***	.01	30.33***	.01	37.25***	.01	12.22***	.01	21.46***	.01
Hostility mother	0.08	.00	0.21	.00	1.02	.00			0.05	.00
Probability	12.02**	.00	6.48*	.00	10.45**	.00	5.82*	.00	7.87**	.00
Parity									2.31	.00

n = 2,756 for model [a,b,] and [c]. *n* = 2,753 for model [d]. *n* = 2,749 for model [e].
Note. The results of the first imputed dataset are reported in this table. The range of statistics over the imputed datasets of the fully adjusted analyses are reported in the Supplementary **TABLE S2.6**. The range of the model R^2_{adj} is reported below. [1]Classes = total aggression in model [a, b,] and [c]. Classes = physical aggression in model [d]. Classes = non-physical aggression in model [e].
Aggression: Model 1 all R^2_{adj} = .04; Model 2 all R^2_{adj} = .05; Model 3 all R^2_{adj} = .11. Attention: Model 1 all R^2_{adj} = .03; Model 2 all R^2_{adj} = .04; Model 3 all R^2_{adj} = .16.
Rule breaking: Model 1 all R^2_{adj} = .02; Model 2 all R^2_{adj} = .03; Model 3 all R^2_{adj} = .08. Physical aggression: Model 1 R^2_{adj} = .03; Model 2 R^2_{adj} = ..04; Model 3 R^2_{adj} = .08
Non-physical aggression: Model 1 all R^2_{adj} = .04; Model 2 all R^2_{adj} = .04; Model 3 R^2_{adj} = .09-.10
* $p < .05$, ** $p < .01$, *** $p < .001$.

Bonferroni corrected post-hoc tests revealed that the high increasing class had higher levels of teacher-reported total aggressive behavior (*M* = 0.67, *SE* = .05, 95% CI 0.58-0.76) as compared to the intermediate (*M* = 0.37, *SE* = 0.02, 95% CI 0.34-0.42, $p < .001$, Cohen's *d* = 0.85) and low decreasing class (*M* = 0.30, *SE* = .02, 95% CI 0.28-0.33, $p < .001$, Cohen's *d* = 1.05). The intermediate class had higher levels of total aggressive behavior as compared to the low decreasing class, $p < .001$, Cohen's *d* = 0.21.

Second, we tested whether class membership was related to attention problems reported by the teacher. The fully adjusted univariate analysis showed an effect of class membership on teacher-reported attention problems ($p < .001$, partial $\eta^2 = .02$, Cohen's *d* = 0.29, 85% CI 0.24-0.35). Bonferroni corrected post-hoc tests revealed that the high increasing class had higher levels of attention problems (*M* = 1.05, *SE* = 0.06, 95% CI 0.94-1.16) as compared to the intermediate (*M* = 0.71, *SE* = 0.03, 95% CI 0.66-0.76, $p < .001$, Cohen's *d* = 0.75) and low decreasing classes (*M* = 0.64, *SE* = .02, 95% CI 0.61-0.68, $p < .001$, Cohen's *d* = 0.94). Further, the intermediate class had significantly higher levels of attention problems as compared to the low decreasing class, $p = .007$, Cohen's *d* = 0.19.

Third, we tested whether class membership was related to rule breaking behavior. The fully adjusted analysis showed an effect of class membership on teacher-reported rule breaking behavior ($p < .001$, partial $\eta^2 = .01$, Cohen's *d* = 0.21, 85% CI 0.16-0.27). Bonferroni corrected post-hoc tests indicated that the high increasing class had higher levels of rule breaking behavior (*M* = 0.32, *SE* = 0.03, 95% CI 0.26-0.38) as compared to the intermediate (*M* = 0.19, *SE* = 0.01, 95% CI 0.16-0.21, $p < .001$, Cohen's *d* = 0.61) and low decreasing classes (*M* = 0.17, *SE* = 0.01, 95% CI 0.15-0.18, $p < .001$, Cohen's *d* = 0.70). Mean levels of rule breaking behavior did not differ significantly between the intermediate and low decreasing classes, $p = .296$. The range of statistics for the fully adjusted analyses of total aggression, attention problems and rule breaking behavior over the five imputed datasets are reported in the Supplementary **TABLE S2.6**.

For each class, we computed the percentages of children in the borderline, clinical and combined ranges of the three TRF scales separately, results are presented in **TABLE 2.5**. The percentages of children scoring in the borderline, clinical, or combined range were, in general, higher in the high increasing class as compared to one or both other classes. The intermediate class contained a larger percentage of children in the borderline and combined range of total aggressive behavior and attention problems as compared to the low decreasing class. The percentage of children scoring in the clinical range of rule breaking behavior did not differ between classes. However, they did differ for the borderline and combined range of rule breaking behavior, with more children in the higher classes.

We reran the analyses, including the time interval between administering the CBCL (age 6) and the TRF as a covariate, but excluding the age of the child at the TRF assessment as a covariate. For all three models (total aggressive behavior, attention problems and rule breaking behavior), effect sizes of class membership remained similar for all three scales. The effects of the covariates and the Bonferroni corrected post-hoc tests for the class differences were also comparable to the previous models.

TABLE 2.5
Untransformed Means of TRF Scales and Percentages of Children in the Borderline and the Clinical Range

TRF scales	Classes		
	Low decreasing	Intermediate	High increasing
Aggression			
M (*SD*)	1.62 (3.77)	2.84 (5.03)	6.59 (7.53)
% Borderline[1]	2.5[a]	5.7[b]	18.5[c]
% Clinical[1]	0.8[a]	1.5[a]	4.6[b]
% Borderline & clinical	3.2[a]	7.2[b]	23.1[c]
Attention			
M (*SD*)	4.89 (7.18)	7.06 (8.66)	13.14 (10.79)
% Borderline[1]	1.5[a]	3.0[b]	6.2[b]
% Clinical[1]	0.6[a]	0.8[ab]	3.1[b]
% Borderline & clinical	2.0[a]	3.8[b]	9.2[c]
Rule breaking			
M (*SD*)	0.53 (1.40)	0.80 (1.56)	1.60 (2.13)
% Borderline[1]	1.8[a]	2.3[a]	7.7[b]
% Clinical[1]	0.5[a]	0.9[a]	1.5[a]
% Borderline & clinical	2.3[a]	3.2[a]	9.2[b]

$n = 2,756$
[1]Percentages in the borderline and clinical cells do not overlap. Percentages within a TRF scale and within a row sharing a different superscript differ significantly at
$p < .05$.

Aggression at age 6 as predictor of teacher-reported total aggression

Next, we tested whether the use of total aggression trajectories was indeed more informative, in terms of explained variance, as compared to a single measure of aggression. All models were similar to the adjusted models reported in **TABLE 2.4**, except that we included parent-reported aggressive behavior at age 6 instead of class membership. Multivariate tests showed a significant effect of total aggression age 6 on the levels of teacher-reported problems, $F(3, 2745) = 30.76$, $p < .001$, partial $\eta^2 = .03$. In the univariate analyses, parent-reported total aggressive behavior at age 6 was related to teacher-reported total aggressive behavior, $F(1, 2747) = 88.33$, $p < .001$, partial $\eta^2 = .03$, Cohen's $d = 0.36$, 85% CI 0.30-0.41. Total aggressive behavior at age 6 was also related to teacher-reported attention problems and rule breaking behavior, respectively $F(1, 2747) = 54.71$, $p < .001$, partial $\eta^2 = .02$, Cohen's $d = 0.29$, 85% CI 0.23-0.34 and $F(1, 2747) = 33.38$, $p < .001$, partial $\eta^2 = .01$, Cohen's $d = 0.22$, 85% CI 0.17-0.28. These 85% confidence intervals of Cohen's d overlap with the confidence intervals of Cohen's d of the class membership analyses for total aggression, attention problems and rule breaking behavior respectively, indicating that the effect sizes are of comparable size. The range of statistics for these analyses are reported in the Supplementary **TABLE S2.6**. In Supplementary Material **TABLE S2.1** we also report on univariate analyses with total aggressive behavior at age 1.5 and 3 as predictors of teacher-reported problem behavior, including the same covariates as the former models. The partial η^2 of the models ranged between .00 and .01.

Trajectories of physical and non-physical aggression

Growth mixture models (GMM) with one to seven classes were tested for all children who had at least two measures of the physical or non-physical aggression scales available (respectively $n = 4{,}778$ and $n = 4{,}771$). Class solutions of physical and non-physical aggression are reported in **TABLE 2.2.** For similar reasons as mentioned before in case of total aggression, a three trajectory model was selected as the most optimal solution for both aggression types (***FIGURE 1***). The trajectories had comparable shapes and class sizes as the total aggression trajectories; for both physical and non-physical aggression the trajectories consisted of a low decreasing class with low levels at the start and decreasing levels of physical / non-physical aggression over time ($p < .001$ for both models), an intermediate class with intermediate levels at the start and increasing levels of physical / non-physical aggression over time ($p = .020$ and $p = 0.30$ respectively) and a high increasing class with intermediate physical / non-physical aggression levels at the start that increased over time ($p < .001$ for both models).

Data on teacher-reported physical and non-physical aggression was available for 2,753 and 2,749 children respectively, subdivided into 2,229 and 2,053 children in the low decreasing class, 450 and 598 in the intermediate class and 74 and 98 in the high decreasing class for physical and non-physical aggression respectively. There was no different attrition rate per class based on the TRF selection for either physical or non-physical aggression: χ^2 (2, n = 4,778) = 4.48, $p = .106$ and χ^2 (2, n = 4,771) = 5.24, $p = .073$ (same values in all datasets). Differences between the low decreasing, intermediate and high increasing trajectories of physical and non-physical aggression on background variables are reported in text in Supplementary Material.

Relating trajectories of physical and non-physical aggression to teacher-reported aggression

We tested whether trajectories of physical and non-physical aggression were related to teacher-reported physical and non-physical aggression. Correlations between all variables included in the physical and non-physical aggression models are reported in Supplementary Material **TABLE S2.2** and **S2.3** respectively. Unadjusted and untransformed means of the TRF physical and non-physical aggression scales per class can be found in ***FIGURE 2.2***, transformed means will be used in the analyses and are reported in text. Univariate results are reported in **TABLE 2.4**.

First, we tested the relation between physical aggression trajectories and teacher reports of physical aggression. The fully adjusted analysis showed an effect of class membership on teacher-reported physical aggression ($p < .001$, partial $\eta^2 = .02$, Cohen's $d = 0.30$, 85% CI 0.24-0.36). Bonferroni corrected post hoc test revealed that the high increasing class had higher levels of physical aggression ($M = 0.54$, $SE = .06$, 95% CI 0.42-0.65) than the intermediate ($M = 0.37$, $SE = .03$, 95% CI 0.32-0.42, $p = .022$, Cohen's $d = 0.34$) and low decreasing classes ($M = 0.21$, $SE = .02$, 95% CI 0.18-0.24, $p < .001$, Cohen's $d = 0.66$). The intermediate class had higher levels of physical aggression than the low decreasing class, $p < .001$, Cohen's $d = 0.32$.

Second, we tested whether trajectories of non-physical aggression were related to teacher-reported non-physical aggression. The fully adjusted analysis showed an effect of class membership on teacher-reported non-physical aggression ($p < .001$, partial $\eta^2 = .02$, Cohen's $d = 0.31$, 85% CI 0.25-0.36). Bonferroni corrected post hoc tests showed that the high increasing class had higher levels of non-physical aggression ($M = 0.53$, $SE = .04$, 95% CI 0.46-0.60) as compared to the intermediate ($M = 0.35$, $SE = .02$, 95% CI 0.31-0.39, $p < .001$, Cohen's $d = 0.56$) and low decreasing class ($M = 0.28$, $SE = .02$, 95% CI 0.25-0.31, $p < .001$, Cohen's $d = 0.77$). The intermediate class had higher levels of non-physical aggression than low decreasing class TRF, $p < .001$, Cohen's $d = 0.21$. The range of statistics for the fully adjusted analyses of physical and non-physical aggression over the five imputed datasets are reported in the Supplementary **TABLE S2.6**.

We reran the physical and non-physical aggression analyses, including the time interval between administering the CBCL (age 6) and the TRF as a covariate, but excluding the age of the child at the TRF assessment as a covariate. For both models (physical and non-physical aggression), effect sizes of class membership remained similar. The effects of the covariates and the Bonferroni corrected post-hoc tests for the class differences were also comparable to the previous models.

Aggression at age 6 as predictor of teacher-reported physical and non-physical aggression

Next, we tested whether the use of physical / non-physical aggression trajectories was indeed more informative, in terms of explained variance, as compared to a single measure of physical / non-physical aggression. All models were similar to the adjusted models reported in **TABLE 2.4**, except that we included parent-reported physical / non-physical aggressive behavior at age 6 instead of class membership. Parent-reported physical aggressive behavior at age 6 was related to teacher-reported physical aggressive behavior, $F(1, 2{,}747) = 72.40$, $p < .001$, partial $\eta^2 = .03$, Cohen's $d = 0.33$, 85% CI 0.27-0.38. Furthermore, parent-reported non-physical aggressive behavior at age 6 was related to teacher-reported non-physical aggressive behavior, $F(1, 2{,}739) = 84.19$, $p < .001$, partial $\eta^2 = .03$, Cohen's $d = 0.35$, 85% CI 0.30-0.41. For these models the 85% confidence intervals of Cohen's d overlap with the confidence intervals of Cohen's d of the class membership analyses for physical and non-physical aggression respectively, indicating that the effect sizes are of comparable size. The range of statistics for these analyses are reported in the Supplementary **TABLE S2.6**.

In Supplementary Material **TABLE S2.1** we also report on univariate analyses with physical and non-physical aggressive behavior at age 1.5 and 3 as predictors of teacher-reported physical and non-physical aggression, including the same covariates as the former models. The partial η^2 of the models ranged between .00 and .02.

Discussion

In the current cohort study, we tested whether trajectories of parent-reported aggression at age 1.5 to 6 were related to teacher-reported problem behavior. Using growth mixture modeling (GMM; Muthén & Shedden, 1999), we found three trajectories of total aggression in our sample of 4,781 children. Analyses on the smaller sample with teacher-reported data (n = 2,756) showed that trajectories of parent-reported total aggression were related to teacher-reported total aggressive behavior, attention problems, and rule breaking behavior. However, a single time point measure of total aggression at age 6 was an equally accurate indicator of teacher-reported problem behavior as were the trajectories, since effect sizes between models were comparable. Similar trajectories were found for physical and non-physical aggression and their relations to teacher-reported physical and non-physical aggression were comparable. Furthermore, single time point measures of the subtypes of aggression at age 6 were equally accurate indicators of teacher-reported physical and non-physical aggression as the trajectories.

We identified a group children that showed high increasing levels of aggression over the first six years of life, confirming findings from other studies (for a review see Jennings & Reingle, 2012). The patterns and levels of the three trajectories correspond to the early childhood aggression trajectories reported by Tremblay et al. (2004), Côté et al. (2006) and Côté, Boivin et al. (2007). However, in these studies the trajectory with the highest aggression levels consisted of higher percentages of children (13.9% - 17.0%) than we found in our study (3.0%). In addition, the intermediate class in our study was also smaller (21.3%) compared to those studies (50.5 % - 58.0%).

The convergence among trajectories of different types of aggression might indicate that aggression is a relatively homogeneous developmental phenomenon in early childhood. Whereas different types of aggression are present at a young age and have been suggested to show different patterns across childhood (e.g. Côté, Vaillancourt et al., 2007), we did not find evidence for such differences. Differentiation in developmental trajectories of physical and non-physical aggression might occur at a later age.

The current study showed that the high increasing trajectory was associated with more teacher-reported problem behavior, with substantial effect sizes for the mean differences with the intermediate and low decreasing class. Moreover, this high increasing total aggression trajectory contained in general a larger percentage of children scoring in the borderline and clinical range of teacher-reported problems as compared to the other classes. Children with the highest parent-reported levels of aggression over time thus have the largest risk of exhibiting problematic behaviors according to the teacher, suggesting that these children show problem behavior in multiple settings. Loeber and Hay (1997) argue that aggressive behavior occurring in multiple settings could often be considered maladaptive and pathological. Moreover, such pervasiveness across settings of aggression and related problems is considered to be a risk factor for the continuation of problem behavior and the development of other problems (Campbell, Shaw, & Gilliom, 2000; Loeber, 1990). Van Dulmen & Egeland (2011) report that when predicting externalizing problem behavior at later ages, the use of both parent- and teacher-reports is found to be more accurate than the reports of a single informant. However, this holds only when the different scores are weighted and variance sources, including informant sources of bias, in both scores are taken into account. When these are not taken into account, single informant scores are as informative as scores from multiple informants.

It should be noted that children in the intermediate class may also be at risk of higher levels of teacher-reported problem behavior. Although they did not have as high parent-reported aggression levels as the high increasing class, the intermediate class showed elevated, relatively stable levels of aggression over time. Furthermore, this class showed on average higher levels of teacher-reported problems and comprised more children scoring in the borderline range of the total aggression and attention problems scales as compared to the low decreasing class. Comparable results were found by Campbell et al. (2006) and Campbell et al. (2010) in an older age group (middle childhood). Children in the high and intermediate aggression trajectories showed increased levels of the broader construct externalizing problem behavior in a different setting. Campbell et al. (2006) also reported on the higher occurrence of ADHD and ODD symptoms in children in the higher trajectories during middle childhood.

The overall effect sizes for the associations between parent-reported aggression and teacher-reported problems in our study were small. It should however be noted that the high increasing total aggression class showed substantial effect sizes in predicting teacher-reported total aggressive behavior as compared to the intermediate (Cohen's d = 0.85) and low decreasing class (Cohen's d = 1.05). But the percentages of children in the high increasing trajectory scoring in the borderline and clinical range of teacher-reported problem behavior were low. Trajectories might, at least in our study on a rather homogeneous, non-risk sample, lack sensitivity and specificity; a large percentage of children in the higher classes did not show maladaptive levels of problem behavior at school and there was a group children in the lower classes with high ratings of teacher-reported problems. This lack of sensitivity and specificity might also point to a low agreement between informants (De Los Reyes et al., 2013), as in the Gross, Fogg, Garvey and Julion (2004) study where only a small percentage of the children had problem behavior scores in the clinical range from both parents and teachers. Other studies also found low agreement among parents and teachers in the occurrence of problem behavior (e.g. Miner & Clarke-Stewart, 2008; Winsler & Wallace, 2002; Youngstrom, Loeber, & Stouthamer-Loeber, 2000).

Disagreement among informants might be informative instead of reflecting mere measurement error. Parents and teachers may differ in their view on the severity of problem behavior. For example, Van der Ende and Verhulst (2005) and Youngstrom et al. (2000) found that teachers tend to report lower levels of problem behavior. Further, the CBCL and TRF have several unique items, which may account for lower agreement between parents and teachers. Lastly, children in our sample may have shown problem behavior mainly in one setting instead of multiple contexts (Kraemer et al., 2003; De Los Reyes, et al., 2013). Whereas pervasiveness across settings is considered the most worrisome and we identified such a group, Fergusson et al. (2009) highlight that even children with conduct problems in one setting are at risk for adverse developmental outcomes. Therefore the authors suggest that the use of both parent's and teacher's reports is important as to also include children with situational problems that could develop into serious problems later in life.

When comparing trajectories to a single assessment of aggression, our results indicate that the developmental patterns of aggression were not more informative than a concurrent level of aggression when testing its association with teacher-reported problem behavior. This is surprising, because repeated measures are thought to increase the precision of the measurements used. However in the current study, the last trajectory time point was measured approximately at the same moment as teacher-reported problem behavior, which may have diminished the additional precision that could be gained by using repeated measures. Moreover, the trajectories did not intersect. As the trajectories had the same relative position at all ages, this might also explain why the aggression score at age 6 was equally informative as the aggression trajectories. Furthermore, the supplementary analyses suggest that parent-reported measures of aggressive behavior closer in time (age 6) to teacher-reported problem behavior are more accurate indicators of teacher-reported problem behavior, as compared to measures at earlier ages (1.5 and 3 years of age). Despite the fact that the trajectories did not intersect, they showed changing levels of aggression over time. These changing levels might explain the weaker relation between earlier measures of aggressive behavior as compared to the age 6 measure. Parent-reported physical and non-physical aggression showed similar developmental trajectories as total aggression, with high increasing, intermediate and low decreasing trajectories. Further, effect sizes for the association of total, physical and non-physical trajectory class membership with respectively teacher-reported total, physical, and non-physical aggression were comparable. This makes it unlikely that replacement of physical aggression by non-physical aggression as children get older accounts for a stronger relation of the parent-reported age 6 measure with teacher-reported aggression than the trajectory.

Most studies using trajectories (e.g. Campbell et al., 2006; Campbell et al., 2010; Harachi et al., 2006;. Huijbregts, et al., 2009; Shaw, Hyde, & Brennan, 2012) did not test for the additional value of their trajectory approach. The results reported above might be specific to the current study because we measured aggression at only three occasions in a relatively short period of time and the time interval between the trajectories and teacher-reported problems was relatively small. Yet, future studies using aggression trajectories may take our finding into account and test for the incremental value of trajectory modelling, as to prevent the interpretation of findings in terms of longitudinal patterns of aggression whereas the relation between aggressive behavior and either the predictor or the outcome could have been established equally effective by a single time point measure of aggression.

Several limitations must be mentioned. First, we did not have earlier measurements of teacher-reported aggression. Moreover, parent-reported aggression at age 6 and teacher-reported problem behavior were concurrent measures. Therefore it was not possible to test whether aggression as reported by one informant preceded the manifestation of aggression as reported by a different informant in another setting, or whether it developed jointly. Second, the fact that the CBCL and TRF questionnaires were directed towards different age ranges made them potentially less comparable, and may have resulted in a lower agreement between parents and teachers. Nevertheless, the use of different informants in different settings should be considered a strength, since it diminishes shared method variance bias. According to Doctoroff and Arnold (2004) the use of multiple sources and methods yields a more accurate representation of the child's behavior.

In sum, we identified a group of children with pervasive problem behavior in early childhood, which places these children at a heightened risk to develop problems later in life. The advantages of trajectories in the identification of young children with problem behavior according to both parent and teacher were, however, limited. In our study trajectories of total, physical and non-physical aggression did not show incremental predictive validity over the latest time point measurement. Whereas in other studies trajectories might be of additional value as compared to a single assessment of aggression, our results should be taken as a warning that the value of trajectories is not always self-evident and should be empirically demonstrated.

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Chapter 3

Anxiety and social responsiveness moderate the effect of situational demands on children's donating behavior

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Abstract

Donating behavior may be partly situation specific, but may also depend upon child characteristics such as empathy and inhibition. Moreover, susceptibility to situational demands might differ depending on child characteristics, for example children's level of anxiety and social responsiveness. We examined how donating was associated with situational and child characteristics in a sample of 221 8-year-old children. Children were shown a promotional clip for a charity (UNICEF) including a call for donation. For a random half of the children, the video-fragment ended with a probe of a same-sex peer donating money to the charity. Children could decide privately whether they wanted to donate. Seeing a peer donate was associated with higher donations. Empathy and inhibition were not related to donating. Anxiety and social responsiveness moderated the effect of the situational manipulation on donating. Anxious children and children with less social responsiveness problems were more affected by the situational manipulation, and donated more after seeing the donating peer than less anxious children and children with more social responsiveness problems. Moreover, in absence of the donating peer, anxious children donated less money than less anxious children. Our results indicate that donating behavior is dependent on situational demands, and the situational effect differs depending on children's level of anxiety or social responsiveness.

Introduction

Donating behavior is one of many forms of prosocial behavior (Warneken & Tomasello, 2009a; Dunfield, Kuhlmeier, O'Connel, & Kelley, 2011). While several studies have shown a link between donating and specific child characteristics, such as empathy (e.g. Krevans & Gibbs, 1996), other studies suggest that donating behavior is largely situation-specific, with little influence of child characteristics (e.g. Van IJzendoorn, Bakermans-Kranenburg, Pannebakker, & Out, 2010). Although it is unclear whether child characteristics explain variance in donating behavior above and beyond situational demands, certain child characteristics may act as moderator and make a child more susceptible to environmental input (Belsky, Bakermans -Kranenburg, & Van IJzendoorn, 2007). Therefore, the current study examines both dispositional and situational effects as potential contributors to variation in children's donating behavior, and explores whether children differ in their sensitivity to situational cues.

Prosocial behavior can be defined as voluntary behavior intended to benefit another individual (Eisenberg, Fabes, & Spinrad, 2007). It has been related to beneficial outcomes later in life, including better social adjustment (e.g. Crick, 1996) and academic achievement (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000**).** Different forms of prosocial behavior are not necessarily related (Dunfield et al., 2011) and are shown to have different underlying mechanisms (Paulus, Kühn-Popp, Licate, Sodian, & Meinhardt, 2013). In this study we focus on donating behavior, as a type of prosocial behavior that is beneficial to society. We focus on what may be considered costly altruistic behavior, as something is given up without the expectation of anything in return (Van IJzendoorn et al., 2010).

There are two different lines of research on the precursors of donating behavior. Several studies assume that donating is driven by characteristics of the benefactor and thus stems from a dispositional trait (e.g. Eisenberg, et al., 1996; Litvack-Miller, McDougall, & Romney, 1997). Inhibition and empathy are among the most frequently identified person characteristics associated with donating. For example, young children with better performance on an inhibition task shared more candy with another participant in a dictator game and higher levels of inhibitory control were associated with higher numbers of stickers children were willing to share (Aguilar-Pardo, Martínez-Arias, & Colmenares, 2013; Moore, Baressi & Thompson, 1998;

Paulus et al., 2015). Children with higher levels of inhibition may show more moral virtuous behavior because of their ability to control their (initial) behavioral responses to keep their possessions for their own use and pleasure (Aguilar-Pardo et al., 2013; Pears, Fisher, Bruce, Kim, & Yoerger, 2011). Empathic feelings are thought to increase the altruistic motivation to help others (Batson, Duncan, Ackerman, Buckley, & Birch, 1981). Higher levels of empathy in adults have been related to higher donations (Batson & Ahmad, 2001; Verhaert & Van den Poel, 2011; Webb & Wong, 2014). In a similar vein, a positive association between self-reported empathy and prosocial behavior (including donating to a charity) was found in children (Krevans & Gibbs, 1996).

However, another line of research shows that donating behavior is mostly driven by situational demands, rather than characteristics of the benefactor. For example, being observed is found to substantially increase generosity in both adults and children (e.g. Haley & Fessler, 2005; Nettle et al., 2013; Powell, Roberts, & Nettle, 2012; Van IJzendoorn et al., 2010). Children shared more when watched by another peer than in situations in which they were alone (Engelmann, Herrmann, & Tomasello, 2012; Leimgruber, Shaw, Santos, & Olson, 2012) and adult participants who donated in pairs gave more than participants who donated alone (Reyniers & Bhalla, 2013). Reputational effects, peer pressure, or norm compliance are likely to play a role in such cases (Engelmann et al., 2012; Kallgren, Reno, & Cialdini, 2000; Powell et al., 2012; Reyniers & Bhalla, 2013). A situational effect of moral exemplars on donations was also found. After watching a video clip or reading a story on morally virtuous behavior, students donated more to a charity (Freeman, Aquino, & McFerran, 2009). Such modelling effects were also found for other types of prosocial behavior (e.g. Kallgren et al., 2000). Modelling might increase moral elevation or might make people aware of social norms which they are eager to comply to, resulting in prosocial behavior (Freeman et al., 2009; Kallgren et al., 2000). In line with social learning theory, according to which new behavior can be learned from direct observation of such behavior, modelling can also provide individuals with an example on how to act in a (new) situation (Bandura, 1977). Effects of modelling on donating behavior in children are largely unknown.

While both dispositional and situational factors are thus identified as correlates of donating behavior, these factors are often studied separately. However, one study suggests that situational factors might override the effect of personal characteristics on donating behavior in children

(Van IJzendoorn et al., 2010). For other types of prosocial behavior, it was also found that situational factors can override dispositional influences on prosocial behavior. For example, children's social responsibility influenced their helpfulness only when perceived peer pressure was low (Pozzoli & Gini, 2010).

Although the direct effect of person characteristics on donating behavior might be overridden by situational demands, other dispositional factors (not necessarily related to donating behavior) might influence a child's sensitivity to situational demands and thereby affect the amount of donated money. Two of these factors are autistic traits and anxiety. As an example, in a study on the effect of the presence of an observer during donations, typically developing adults donated more often to a charity in the presence of an observer, whereas this was not true for participants with autistic traits (Izuma, Matsumoto, Camerer, & Adolphs, 2011). In addition, in social and moral reasoning tasks, participants with autistic traits did not take situational cues into account to the same level as typically developing participants (Shulman, Guberman, Shiling, & Bauminger, 2012). Furthermore, compared to typically developing children, children with autistic traits performed poorer on tasks involving social inference, social attention skills, and the decoding of social cues, abilities which may be important for adapting behavior to situational demands (Dawson, et al., 2004; Jellema et al., 2009; Jing & Fang, 2014).

In contrast to individuals with social responsiveness problems, fearful or anxious children are found to be more strongly affected by situational factors (e.g. Gazelle, 2006). For example, anxious children who were confronted with hypothetical situations and were asked what their response would be, were more likely to change to more prosocial reactions after discussing the situation with their family as compared to their non-anxious peers (Shortt, Barrett, Dadds, & Fox, 2001). Further, fearfulness affects children's sensitivity to contextual factors, such as parenting. For example, fearfulness has been shown to moderate the impact of parenting on moral internalization and conscience development in children (Kochanska, 1997; Kochanska, Aksan, & Joy, 2007) and parenting style has been associated with problem behavior in fearful children, but not in their less fearful peers (Colder, Lochman, & Wells, 1997; Pitzer, Jennen-Steinmetz, Esser, Schmidt, & Laucht, 2011). Besides, the association between parenting and social skills in children has been found to be moderated by temperamental reactivity (including fearfulness) of the child (Smart & Sanson, 2001). Together, these findings suggest that children with autistic traits might be less sensitive to differences in (social) situations, whereas anxious children might be more sensitive to them. However, whether these characteristics make children indeed more or less sensitive to situational features in a donating paradigm is still unknown.

In the current study, we tested whether a situational factor and/or dispostional factors were associated with the amount of money donated by 8-year-old children. Around the age of 8, most children have a well-developed concept of the value of money (Berti & Bombi, 1981) and the majority of children are able to estimate the value of money and know that not everyone has similar amounts of money to spend (Nibud, 2013). Children at kidergarten age were already able to indicate that more could be bought from a dollar than from coins with a lower monetary value (Brenner, 1998). Another study showed that 8-year old children (as well as older children) profited from education in economics (Sosin, Dick, & Reiser, 1997), implying that at this age children are capable of dealing with abstract concepts such as economy and money. All participating children were shown a video clip of a charity including a call for donation. We randomly manipulated the situational factor by showing half of the children a video in which a same sex peer donated money to the same charity, while the other half of the children did not see this probe. We hypothesized that the children who were shown the probe of the moral exemplar would donate more money than the children who did not get to see the probe. Further, we examined the associations between donating behavior and child characteristics inhibition and empathy. We expected that inhibition and empathy would not be associated with donating behavior over and above the effect of the situational manipulation. In addition, we examined whether children with social responsiveness problems (autistic traits) or with higher levels of anxiety were differentially affected by the situational manipulation. We expected for children with low levels of social responsiveness that they would be *less* affected by seeing a donating peer, and for children with high anxiety levels that they would be *more* affected by seeing this probe.

Methods

Setting

The current study is embedded within the Generation R Study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012; Tiemeier et al., 2012). All mothers who had a delivery date between April 2002 and January 2006 and who resided in Rotterdam were invited to participate. At approximately 8 years of age, a subsample participated in a lab visit with detailed measures on neuropsychological and behavioral functioning. The study was approved by the Medical Ethical Committee of the Erasmus Medical Center, Rotterdam. Written informed consent was obtained from all adult participants and assent was obtained from children.

Participants

The project of which the current study was part of aimed to measure antisocial as well as prosocial behavior. To obtain large variation and avoid skewness in the distribution of the outcome variables, we preselected an aggressive, a prosocial, and a typical group, based on parent reports on the aggressive behavior scale of the Child Behavior Checklist 1½–5 (CBCL, Achenbach & Rescorla, 2000) and the prosocial scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). Trajectories of aggressive behavior were distinguished for children of Dutch origin who had at least two CBCL aggression scores available at age 1.5, 3 and/or 6. A three-trajectory solution was selected as optimal, comprising a high, intermediate and low aggression trajectory (Wildeboer et al., 2015).

Children in the high aggression trajectory were eligible for the high aggressive group. Children in the lowest aggression trajectory who had a high prosocial score on the SDQ (14 or 15, range 5-15) were eligible for the high prosocial group. Children in either the low aggression trajectory with a prosocial score < 14 or in the intermediate aggression trajectory were considered eligible for the typical group. This resulted in a total sample of 291 children who were invited to take part in the current study. Of these, fifty-nine children and/or their parents refused to participate and did not visit the research center. In another 11 children, data on the donating task was not reliable or not available, either because the child was still busy donating when the researcher entered the room (*n* = 4), due to technical difficulties (*n* = 4), misunderstanding of the task (*n* = 2) or because the parent did not allow a financial reward for the child (*n* = 1). This resulted in a final sample of 221 children who were eligible for the current study. For sample characteristics see **TABLE 3.1**.

TABLE 3.1
Sample Characteristics

Child characteristics	*M*(*SD*)/ No. (%)	Family characteristics	No. (%)
Gender, no. boys (%)	111 (50)	Education, no. (%) ≥ 1 parent higher education	188 (85)
Age donating task, *M*(*SD*)	8.59 (0.75)	Income, no. (%)	
No. donated €0.20 coins, *M*(*SD*)		€800-1,600	4 (2)
Without probe	6.97 (6.43)	€1,600-2,400	19 (9)
With probe	8.87 (7.12)	€2,400-3,200	42 (19)
Version, no. (%) without probe	115 (52)	€3,200-4,000	45 (20)
Trajectory group		€4,000-4,800	36 (16)
Prosocial, no. (%)	65 (29)	€4,800-5,600	26 (12)
Aggressive, no. (%)	73 (33)	>€5,600	49 (22)
Typical, no. (%)	83 (38)	Parity, no. (%) ≥ 1 sibling	193 (87)
Inhibition/WM, *M*(*SD*)	30.86 (3.77-3.78)		
Empathy, *M*(*SD*)	4.70 (0.93-1.02)		
Anxiety, *M*(*SD*)	1.65 (3.81-3.97)		
Social responsiveness prob., *M*(*SD*)	0.25 (0.26)		

N = 221.
Note. Reported values are untransformed, imputed data. *SD* is not available as pooled measure and therefore the range of *SD* over the five imputed datasets is reported.

Procedure

When the children were age 6, two consecutive questionnaires were sent to the parents. The first questionnaire measured anxiety as well as family income, educational level of the parents, and parity. The second questionnaire included questions on empathy and social responsiveness problems. Donating behavior and inhibition were measured at age 8 during a lab visit.

Measures

Donating behavior. Donating behavior was measured using an adapted version of the donating task by Van IJzendoorn et al. (2010). In the absence of their parent, children received 20 coins of 20 eurocents (€4.00) prior to the start of the task. The children were told that they received the money as a reward for their participation in the previous tasks. Subsequently, they were asked to watch a short UNICEF movie about a girl in Bangladesh who had to work in a stone pit and therefore could not go to school. The movie was presented as a means to raise money to help the girl go to school. When the movie ended, the children were asked by a voice-over and by a text on the computer screen whether they wanted to donate money in the money box that stood in front of them. The moneybox contained several other coins in order to enhance credibility. For a random half of the children, a video-fragment followed that showed a probe of a same-sex peer in the same research setting donating 20 eurocent coins to the charity. After starting the film clip, the experimenter left the room. Children were thus alone while watching the movie. The experimenter returned 30 seconds after the movie had ended. The amount of donated money was counted by the experimenter after the session, in absence of the child. At the end of the study, the total amount of donated money was transferred to UNICEF.

Money donations were not normally distributed, instead a distribution with several peaks was found. Therefore we distinguished four categories: donated nothing (0 coins), donated less than half (1-9 coins), donated half or more than half (10-19 coins), donated everything (20 coins). The pattern of scores then approached a normal distribution (see supplementary *FIGURE S3.1*). Final analyses were also performed with the continuous variable, to check whether the results would diverge.

Inhibition. The Response Set task from the NEPSY-II-NL (Korkman, Kirk, & Kemp, 2010; White et al., 2013) was used to measure child inhibition. The NEPSY-II-NL is a Dutch translation of the North American NEPSY-II (Brooks, Sherman, & Strauss, 2010) and is suitable to assess neuropsychological functioning in 5-to-12 year old children. The subscale used to assess inhibition also measured working memory. A paper sheet containing red, yellow, blue, and black circles was laid in front of the children. Then, children listened to a recording with sequentially spoken color and non-color words at a set frequency. The children were told to respond to the word ‘yellow’ by tapping the red circle and to the word ‘red’ by tapping the yellow circle. When the children heard the word ‘blue’, they had to tap the blue circle. All other words and colors, including the word ‘black’ had to be ignored. Tapping the correct circle within two seconds indicated a correct response. Delayed responses and tapping the wrong circles were recorded as incorrect responses.

Empathy. Empathy was measured using a shortened subscale of the My Child Questionnaire (Kochanska, DeVet, Goldman, Murray, & Putnam, 1994), a self-administered parent-report questionnaire on conscience development. Maternal reports on this questionnaire were positively associated with empathy/guilt responses of the child to moral dilemmas (Kochanska, Padavich, & Koenig, 1996) and negatively with observed rule transgressing behavior of the child (Kochanska et al., 1994). The questionnaire was shortened with approval of Kochanska (personal communication). The Empathy subscale consisted of seven items (e.g. '*My child will try to console or comfort somebody who is unhappy*') that were answered on a 7-point Likert scale ('*not applicable at all*' to '*fully applicable*'). The internal consistency of this subscale was acceptable, Cronbach's α = .67 (in the complete data).

Anxiety. Anxiety was assessed using the Child Behavior Checklist/1½–5 (CBCL, Achenbach & Rescorla, 2000), a self-administered parent-report questionnaire including 99 items concerning emotional and behavioral problems of the child. Because the majority of children were younger than age 6 during the measurement of parent-reported anxiety, we chose to use the CBCL/1½–5. The Anxiety subscale consisted of eight items (e.g. '*Too fearful or anxious*') which could be rated on a 3 point scale (0 = '*not true*', 1 = '*somewhat true or sometimes true*', 2 = '*very true or often true*'). The subscale had an acceptable internal consistency, Cronbach's = α = .70 (in the complete data).

Social responsiveness problems. To assess autistic traits, a shortened version of the Social Responsiveness Scale (SRS, Constantino, 2002; Román et al., 2013) was used for which parents reported on social responsiveness problems of their child in a naturalistic setting. The shortened scale comprised 18 items (e.g. '*Avoids eye contact, or has unusual eye contact*'). Questions could be answered on a 4-point scale ('*not true*' to '*almost always true*'). The current scale had good internal consistency, Cronbach's α = . 82 (in the complete data). SRS total scores show strong correlations with a diagnostic instrument for autism (Constantino et al., 2003).

Family characteristics. We also included several family characteristics (income, educational level of the parents, and parity), as these have previously been related to donating behavior (Van IJzendoorn et al., 2010; Van Lange, De Bruin, Otten, & Joireman, 1997; Verhaert & Van den Poel, 2011). Income was measured in categories, each comprising a range of €800 (see TABLE 1 for categories). Educational level of the parents was combined into one dichotomous measure; when either one or both of the parents obtained higher education, the variable was coded as ‘higher’, when both parents completed secondary education or lower, the variable was coded as ‘other’. Parity was dichotomized into ‘none’ and ‘one or more siblings.’

Statistical analyses

To approach normality, skewed variables were transformed. Social responsiveness problems and anxiety were square root transformed because of moderate skewness. Inhibition and age of the child during the donating task were severely skewed and therefore a log10 transformation was applied (Tabachnik & Fidell, 2007). Missing data on the predictor variables ranged between 2 and 10% and were imputed using the multiple imputation method (Markov chain Monte Carlo) with five imputations and 10 iterations in SPSS 21. All statistics were pooled by SPSS, except for the standardized regression coefficient, standard deviation, R^2 and change in R^2, for which we provide the value range over the five imputed datasets.

First, correlations between all variables in the model were computed. Partial correlations were computed for the association between the amount of donated money and the other variables in the model, correcting for the version of the donating task (with or without the probe of a donating peer). Second, a hierarchical linear regression model was used to test the relation between the amount of donated money and the version of the donating task, family characteristics, and child characteristics. In the first step of this model, we tested the effect of the version of the donating task, correcting for age and gender of the child. In the second step, family characteristics were added. The third step comprised the inclusion of child characteristics and in the fourth step we tested interactions between the version of the donating task and the moderator variables anxiety and social responsiveness problems, and also inhibition and empathy. For this fourth step, interaction terms between the version of the donating task and the moderator variables were computed. Variables included in the interaction terms were centered. In case of significant interactions, we used stratified analyses on the version of the donating task, to further investigate the nature of the interaction effect. To visually explore the possible interaction effects, histograms were used.

Results

Non-response analysis

Children in the final sample ($N = 221$) did not differ from the non-participating children ($N = 70$) on gender, family income, educational level of the parents, parity, inhibition, empathy, anxiety, social responsiveness problems, or trajectory group (aggressive, typical, and prosocial group). Furthermore, these trajectory groups were not related to the amount of money donated (corrected for age, gender, and the version of the donating task, $F(2, 215) = 0.29$, $p = .752$).

Hierarchical linear regression

Nineteen percent of the children decided not to donate any money to the charity, 47% donated between 1 and 9 coins, 20% donated 10 to 19 coins, and 14% donated all of their money. Correlations and partial correlations between the variables included in the hierarchical linear regression model are reported in TABLE 3.2. TABLE 3.3 summarizes the results of the hierarchical linear regression analysis to study the effect of situational and dispositional factors on donating behavior. In the first step we studied the situational effect of a moral exemplar on donating behavior, children who saw the probe donated more than children who did not see the probe ($B = 0.13$, 95% *CI* [0.01, 0.25], $\beta = .14$, $p = .035$). Gender and age were not predictive of the amount of money donated. In the second step, family characteristics were added to the previous model, but did not significantly increase the explained variance of the model. Educational level of the parents, parity, and income were not associated with the amount of donated money. In the third step, dispositional child characteristics were additionally included in the model to test whether these had an effect over and above the situational effect. Neither inhibition, empathy, anxiety, nor social responsiveness problems were associated with donating behavior, nor was there a significantly increase in explained variance. To test whether children differed in their sensitivity to situational demands, interactions between the version of the donating task and anxiety and social responsiveness problems were added to the model in the fourth step.This significantly increased the amount of explained variance (ΔR^2 (range) = .05-.08, $p < .01$). The interaction between the version of the donating task and anxiety was significant

TABLE 3.2
Correlations and Partial Correlations Between Variables in the Model

	1.[a]	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Donating behavior[a]													
2. Gender	.08												
3. Age	.14*	-.05											
4. Education parents	.02	-.04	.05										
5. Parity (0 or ≥ 1 siblings)	.06	.08	-.01	.19**									
6. Income	.14*	.11	.04	.37***	.18*								
7. Inhibition	.07	.06	.25**	.02	-.00	.16*							
8. Empathy	-.07	.14	.10	-.05	.00	-.03	-.15						
9. Anxiety	-.05	-.10	.08	-.02	.01	-.09	-.02	-.07					
10. Social responsiveness problems	-.10	.21**	.04	-.11	.01	-.09	-.06	-.18*	.36***				
11. Version*Inhibition	-.04	.01	.01	.09	-.01	.02	-.04	.07	.06	.05			
12. Version*Empathie	-.07	.01	-.08	-.03	-.11	.01	.07	.03	.00	-.01	-.14		
13. Version*Anxiety	.14*	-.06	.05	-.01	.08	-.07	.06	.00	.07	.05	-.01	-.07	
14. Version*Social responsiveness problems	-.13	.06	-.03	.10	.05	.02	.05	-.01	.05	-.11	-.05	-.18*	.36***

Note. Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable, respectively. Phi coefficients were used for correlations between two dichotomous variables. Versio*n* = version of the donating task.
[a] Partial correlations corrected for the version of the donating task
* $p < .05$, ** $p < .01$, *** $p < .001$

TABLE 3.3
Hierarchical Regression Predicting Donating from Version of the Donating task, Family Characteristics and Child Characteristics

	B	95% CI	β (range)	*p*	R^2 (range)	ΔR^2 (range)
Step 1 - Situation and background					.05	.05*
Version of the donating task	0.13	[0.02, 0.25]	.14- .15	.027		
Gender	0.16	[-0.09, 0.41]	.07- .10	.214		
Age	3.31	[-0.08, 6.71]	.13- .14	.056		
Step 2 – Family characteristics					.06-.07	.02
Education father and mother	-0.09	[-0.47, 0.28]	-.02- -.05	.621		
Parity (0 or ≥ 1 siblings)	0.06	[-0.32, 0.44]	.01- .04	.750		
Income (categories[a])	0.08	[-0.00, 0.16]	.12- .16	.057		
Step 3 - Child characteristics					.08-.09	.02
Inhibition	-.02	[-0.49, 0.45]	.02- -.03	.921		
Empathy	-.11	[-0.24, 0.02]	-.11- -.13	.097		
Anxiety	-.01	[-0.16, 0.15]	-.02-.01	.927		
Social responsiveness problems	-.48	[-1.04, 0.08]	-.11- -.17	.089		
Step 4 - Interactions					.15-.17	.07-.08**
Version*Inhibition	-0.16	[-0.59, 0.27]	-.03- -.07	.473		
Version*Empathy	-0.09	[-0.23, 0.05]	-.06- -.12	.188		
Version*Anxiety	0.26	[0.11, 0.42]	.21- .26	.001		
Version*Social responsiveness prob.	-0.92	[-1.46, -0.38]	-.23- -.26	.001		

N = 221 * $p < .05$, ** $p < .01$
Note. For all variables the final (step 4) statistics are reported (except for R^2 and ΔR^2, for which the statistics specific to each step are reported).
[a] See Table 1 for income categories.

(*B* = 0.26, 95% *CI* [0.11, 0.42], β_{range} = .21-.26, *p* = .001), as was the interaction between the version of the donating task and social responsiveness problems (*B* = -0.92, 95% *CI* [-1.46, -0.38], β_{range} = -.23- -.26, *p* = .001). Interactions between version of the donating task and inhibition and empathy were not significant. Results of the hierarchical regression analysis remained similar in terms of significance when the original (continuous) donating variable was used as the outcome variable.

To further investigate the nature of the significant interaction effects, we conducted stratified analyses on the two versions of the donating task, including all variables (except the interaction terms) from the previous model. In children who did not see the probe, higher levels of anxiety were associated with smaller donations (*B* = -0.26, 95% *CI* [-0.48, -0.04], β_{range} = -.20 to -.29, *p* = .020), whereas in children who did see the probe higher levels of anxiety were associated with higher donations (*B* = 0.26, 95% *CI* [0.02, 0.50], β_{range} = .20 to .26, *p* = .037). Furthermore, in children who did not see the probe, social responsiveness was not related to the amount of money donated (*B* = 0.50, 95% *CI* [-0.27, 1.19], β_{range} = .08 to .17, *p* = .217). However, in children who did see the probe lower levels of social responsiveness problems were associated with higher donations (*B* = -1.45, 95% *CI* [-2.35, -0.55], β_{range} = -.32 to -.40, *p* = .002). To visually explore the interaction effects, histograms were used. Because the data of anxiety remained slightly right skewed after transformation we divided the participants into two groups: one with low/medium levels of anxiety (bottom 75% and a group with relatively high levels of anxiety (top 25%), see ***FIGURE 3.1***. The same was done for social responsiveness problems, see ***FIGURE 3.2***. ***FIGURE 3.1*** illustrates that children in the upper quartile of anxiety problems donated more after seeing a probe, but donated less when not seeing this probe, as compared to their less anxious peers. ***FIGURE 3.2*** shows that when seeing the probe, donations were higher for children with less social responsiveness problems as compared to children with more social responsiveness problems, but that there was no difference in donations between the two groups in the no probe condition.

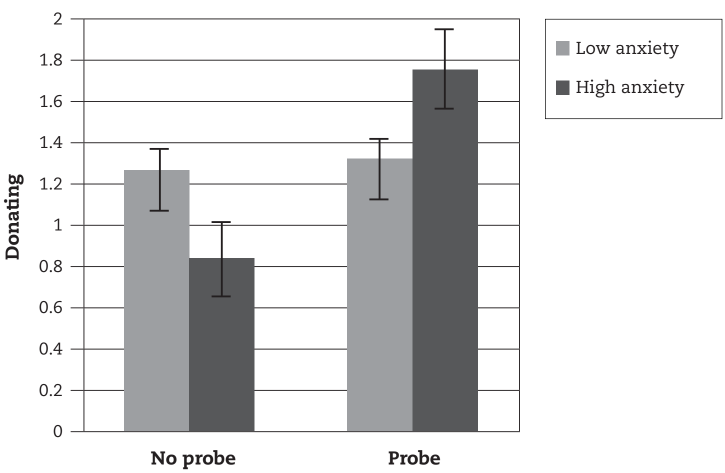

FIGURE 3.1
Mean levels of donating behavior in two groups: low anxiety (75% of the participants) and high anxiety (25% of the participants) per version of the donating task (with or without probe). The y-axis represents the recoded variable of donated money (range 0-3). Error bars are standard errors of the mean. The interaction between the version of the donating task (no probe vs. probe) and anxiety as a continuous measure was significant and is reported in Table 3 and in text.

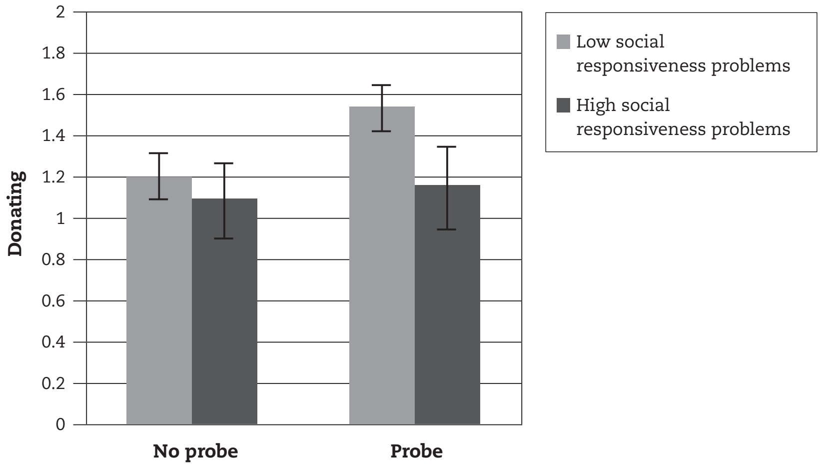

FIGURE 3.2
Mean levels of donating behavior in two groups: low social responsiveness problems (75% of the participants) and high social responsiveness problems (25% of the participants) per version of the donating task (with or without probe). The y-axis represents the recoded range of donated money (0-3). Error bars are standard errors of the mean. The interaction between the version of the donating task (no probe vs. probe) and social responsiveness problems as a continuous measure was significant and is reported in Table 3 and in text.

Discussion

While studies on distinct types of prosocial behavior often focus on either the dispositional or situational correlates of such behavior, the current study combined both factors and shows that not dispositional factors but situational demands affect donating behavior in middle childhood. However, the effect of the situation was not equal for all children. Depending on their levels of anxiety and social responsiveness problems, children were differentially affected by a situational manipulation. While children in general donated more after seeing a peer donate, this effect was particularly strong in anxious children and in children with low levels of social responsiveness problems.

Our study showed that children are willing to donate money to an unknown child in need. Whereas only a fifth of the children did not donate, the majority donated part or even all of their previously earned money. This corresponds to studies reporting that from a young age, children are motivated to help others, even when they do not receive a benefit and the person in need is a stranger (Warneken & Tomasello, 2006; 2008; 2009b).

However, the amount of money children were willing to donate differed across situations. Children who saw a peer donate money to the charity, donated on average two coins (29%) more compared to children who did not see this probe. This situational effect converges with results of earlier studies reporting that the height of donations is influenced by donations made by others (Freeman et al., 2009; Reyniers & Bhalla, 2013).

Modelling can provide individuals with an example on how to act in a (new) situation, can make people aware of a social norm, or can cause a state of moral elevation by showing moral virtuous behavior, which might underlie an increase in prosocial behavior such as donating (Bandura, 1977; Freeman et al., 2009; Kallgren et al., 2000). Peer pressure or reputational effects that predicted donating and helping behavior in previous studies (Engelmann et al., 2012; Reyniers & Bhalla, 2013) are less likely to have played a role in our case, as the peer in the video clip was a stranger and no one was present to observe the child.

The situational manipulation did not equally affect all participants. As hypothesized, children with high levels of anxiety seemed to be more influenced by a same sex peer who donated money. Anxious children who saw the probe donated more than their less anxious peers who saw the probe (an increase of 35%). Anxious children might be more eager to comply to the wishes of peers, out of fear that they otherwise might transgress a social rule or convention. For example, it is proposed that more fearful children might be more strongly motivated to adhere to a social norm, because they are more easily distressed by wrongdoing (Kochanska, 1993). Previous studies reported that anxious participants are more focused on social cues as compared to their non-anxious peers, and when more aroused, participants are found more willing to offer (financial) help (Pavey, Greitemeyer, & Sparks, 2012; Sposari & Rapee, 2007). Furthermore, anxious children and adolescents are more likely to adapt their behavior to peers and family than their less anxious peers (Cohen & Prinstein, 2006; Shortt, et al., 2001). Importantly, however, we also observed that more anxious children donated less compared to their less anxious peers when they did not see the probe. Anxious children might withdraw when confronted with new situations in which no example of how to act is provided. For instance, fearful toddlers are found to help less often when confronted with a distressed stranger as compared to their less fearful peers, possibly because they are over aroused (Liew et al., 2011). Furthermore, in a setting without the probe, anxious children may hold onto the money for greater security as anxious people are more risk-avoiding (Maner et al., 2007), also in case of monetary risks (Gambetti & Giusberti, 2012).

More anxious children may be thus more open to the environment, for better *and* for worse, that is, they make higher donations when confronted with a moral example of donating, and smaller donations than their less anxious peers in the absence of such a model. This indicates that anxious participants may indeed be more affected by the situation, in line with differential susceptibility theory (Belsky et al., 2007). According to differential susceptibility theory, temperamental reactivity or temperamental fearfulness would make some children more open to environmental input, suggesting that they would do worse than their peers in bad environments but outperform them in optimal niches (Belsky, 1997; Bakermans-Kranenburg & Van IJzendoorn, 2015; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011). However, one caveat should be noted that made a real test of differential susceptibility not feasible. Anxiety was measured using the CBCL. The CBCL is a diagnostic instrument, aimed at identifying behavior problems, rather than individual differences in temperament. We therefore believe that CBCL scales are not fit as markers for differential susceptibility. Nevertheless, associations between temperamental fearfulness and behavior problems can be rather substantial, in particular at younger ages (Goldsmith & Lemery, 2000; Kagan, Snidman, Zentner, & Peterson, 1999; Leve, Kim, & Pears, 2005).

Children with varying levels of social responsiveness were also differentially affected by the situation. For children who did not see the probe, there was no association between social responsiveness and donating behavior. However, children who did see the probe made higher donations when they had lower levels of social responsiveness problems. This is consistent with studies reporting that the presence of others or a moral exemplar was related to higher donations in typically developing participants, but not in participants with autism (e.g. Engelmann et al., 2012; Freeman et al., 2009; Izuma et al., 2011). Previous studies report that both children and adults with autistic traits show deficits in the decoding of situational cues (Shulman et al., 2012; Jing & Fang, 2014). The results from the current study might therefore indicate that children with social responsiveness problems are less sensitive to (social) situational cues, and therefore do not increase their donation when provided with a moral exemplar.

The child characteristics inhibition and empathy were not related to the level of donating. Moreover, we did not find significant associations between trajectory group (aggressive, prosocial, typical) and donating. For each of these null findings substantive or measurement issues may have prevented us from finding significant relations. For example, the inhibition task we used might have had a ceiling effect in older children (e.g. Booth et al., 2003; Mous et al., 2016). However, the positive association between donating behavior and inhibition was also not replicated in a sample with a wider age range and different inhibition tasks (Liu et al., 2016). Furthermore, different types of prosocial behavior might have different roots (Paulus et al., 2013) and previous studies also showed that specific helping behaviors, including donating, might not have an underlying empathic motivation (Dunfield & Kuhlmeier, 2013; Eisenberg, Hofer, Sulik, & Liew, 2014; Van IJzendoorn et al., 2010; Warneken, 2015). However, other studies did find associations between empathy and donating behavior (e.g. Batson & Ahmad, 2001).

The most plausible interpretation of the absence of such an association in the current study might be found in the concept of situational morality, which implies that demand characteristics of the situation override individual differences in personality and individual morality (Van IJzendoorn et al., 2010). For example in adolescents, personal characteristics such as empathy were not associated with prosocial behaviors, whereas prosocial examples provided by parents and peers were (Lai, Siu, & Shek, 2015). One study did find an effect of empathy on donations to children in need, independent of situational influences (Sierksma, Thijs, & Verkuyten, 2014). However that study asked children for *imaginary* donations. Situational effects might have a less strong influence in such instances as it is probably easier to give away imaginary than real money and the effect of empathy might therefore not be overridden.

The current study adds to the perspective of situational morality that the power of the situation in shaping donating behavior is not the same for all children: less anxious and less socially responsive children are less affected by the presence or absence of the display of a donating peer. However, it is important to note that also in the group of children who did not watch a moral exemplar, donations to the charity were made, albeit in smaller amounts. The fact that children also donated when not being nudged leaves room for dispositional factors to be of direct influence on donating behavior.

A limitation of the current study concerns the implications of the results. Although our results show that the inclusion of a moral exemplar in fund-raising video clips might have a beneficial effect on the amount of money raised, we do not know whether these results apply to real life situations. Furthermore, we made use of a videotaped peer, which is a digitalized context. This limits the generalizability to situations in which the moral exemplar is physically present. However, our set-up enabled us to standardize the situational manipulation. In addition, empathy, anxiety and social responsiveness problems were measured at the age of 5, whereas donating behavior was measured at 8 years of age. While this could have caused the lack of an association between empathy and donating behavior, empathy was found to be relatively stable over time (Davis & Franzoi, 1991; Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008). For anxiety and social responsiveness problems, the associations that were found might even be stronger when both dependent and independent variables would be measured concurrently. Lastly, several mechanisms might underlie the situational effect in the current study, and without specific tests of the modeling interpretation we cannot be certain what mechanism played a major role. And, of course, moderation of situational influences on prosocial donating behavior by level of anxiety and by social responsiveness problems should be replicated in independent studies to create a broader evidence base.

We suggest that situational factors might be more effective in shaping donating behavior than child characteristics such as inhibition and empathy. After watching a moral exemplar, children are willing to give a substantially larger amount of money to a charity. If our findings also hold true for adults, the higher donations observed in the current study after the display of the probe could provide important information to charities who would like to increase the height of donations, as such a manipulation is easily implemented in videotaped advertisements. Furthermore, these results suggest that at least certain forms of prosocial behavior are not (completely) dispositional traits, but are partly driven by situational demands. Nevertheless, dispositions such as anxiety and social responsiveness might moderate the situational impact on the child's behavior. In case of anxiety we speculate that differential susceptibility to the environment might play a role. In contrast, individuals with more autistic-like social responsiveness tendencies seem to remain indifferent for the social pressure of a child exemplifying prosocial donating.

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Chapter 4

Bystander behavior during social exclusion is independent of familiarity of the victim, child, and parenting characteristics

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Abstract

Bystanders of social exclusion, a special form of bullying, can defend the victim, they can be passive bystanders, or they can join in with the exclusion. As being bullied has many negative consequences, it is important to examine what drives bystander behavior. We examined how bystander behavior was associated with situational, background, child, and parenting characteristics in a sample of 215 children of 8 years old. Children played an online ball-tossing game, in which two players excluded a third player, who was unfamiliar to the child in one condition and familiar in the other condition. Children were assigned to one of three bystander groups, depending on whether they joined in with the bullying, remained passive, or defended the victim. None of the background, child, and parenting characteristics were associated with bystander behavior, therefore it is likely that situational factors influenced such behavior. However the situational factor that we modulated, familiarity of the excluded individual, did not affect bystander behavior. Although the three-partite bystander roles were empirically derived from behavior in the ball-tossing game, correlates and determinants of these roles remain elusive.

Introduction

While bullying always involves a bully and a victim, bystanders also have an important role in the bullying situation as they can defend the victim, passively watch, or join in with bullying (Salmivalli, Lagerspetz, Björkqvist, Österman &, Kaukiainen, 1996). Because being bullied in childhood has many negative consequences, such as a larger probability of becoming depressed, having a panic disorder, or generalized anxiety (Copeland, Wolke, Angold, Costello, 2013; Ttofi, Farrington, Lösel, & Loeber, 2011), it is important to know what drives children to join in with bullying or to defend the victim. Recent studies documented personality and background correlates of such participant roles (e.g. Pozzoli & Gini, 2010; Quirk & Campbell, 2015), but prosocial defender behavior is also known to be dependent of the specific situation (Oh & Hazler, 2009). Furthermore, participant roles have mostly been studied using self-reports or peer nominations. However, children tend to underestimate their own antisocial behavior and overestimate their prosocial responses in bullying situations (Salmivalli et al., 1996). Furthermore, peer-reports are limited by the fact that peers might not be present in every bullying situation a child is involved in (Quirk & Campbell, 2015), and they might not be able to observe more subtle bystander behaviors in children. The current study utilizes an online social exclusion setting to examine the effect of situational demands on bystander behavior, also incorporating background, personal and parenting correlates of observed bystander behavior.

Many studies on participant roles focus on bullying in general (e.g. Salmivalli et al., 1996), but bullying covers a wide range of behaviors, and it is important to distinguish different forms of bullying (Arora, 1996). In the current study we focused on social exclusion, a direct relational form of bullying. Social exclusion is associated with a decrease in feelings of belonging, control, self-esteem, meaningful existence, and enhanced aggression and anger (Chen, DeWall, Poon, & Chen, 2012; Chow, Tiedens, & Govan, 2008; Zadro, Williams, & Richardson, 2004). Direct relational bullying has the largest likelihood of peer support and reinforcement for the bully (Tapper & Boulton, 2005).

Not only the bully and victim roles are important in a bullying situation, the bystanders are important as well, as bullying in most instances takes place in a social context (Craig & Pepler, 1998). Bystanders are of major influence on the bullying situation as they can respond to bullying by reinforcing or assisting the bully, passively watch the situation, or help the victim through active defense (O'Connell, Pepler, & Craig, 1999; Salmivalli et al., 1996; Sutton & Smith, 1999). Although similar roles of bystanders can be distinguished in online bullying situations and face-to-face bullying, children often adopt different participant roles in these different contexts (Quirk & Campbell, 2015). Bystanders more often show negative bystander behavior in online bullying situations compared with face-to-face bullying (Barli ska, Szuster, & Winiewski, 2013). This might be due to the lack of, e.g., non-verbal feedback in online interactions, which in face-to-face situations facilitates empathy for the victim (Heirman & Walrave, 2008; Smith et al., 2008).

Participant roles in bullying have been associated with background variables, such as gender and age (e.g. Oh & Hazler, 2009; Pozzoli & Gini, 2010; Quirk & Campbell, 2015; Salmivalli et al., 1996), and prosocial and antisocial child characteristics such as empathy and aggression (Barli ska et al., 2013; Gini, Albiero, Benelli, & Altoè, 2008; Nickerson, Mele, & Princiotta, 2008; Nickerson & Mele-Taylor, 2014; Oh & Hazler, 2009; Pozzoli & Gini, 2010). Parenting has only rarely been studied in relation to participant roles. Parental support was found to be associated with defender behavior in one study but was unrelated with defender behavior in another study (Choi & Cho, 2013; Li, Chen, Chen, & Wu, 2015). Although harsh parenting has been associated with antisocial behavior in children (e.g. Chang, Schwartz, Dodge, & McBride-Chang, 2003; Kawabata, Alink, Tseng, Van IJzendoorn, & Crick, 2011), to our knowledge no studies have evaluated its relation with bystander behavior. Furthermore, background, child, and parenting variables have not been examined together in relation to observed bystander behavior in an online bullying environment.

Familiarity of the victim might make much of a difference for bystander responses. Children more often support friends in a conflict (Chaux, 2005), and closeness to a victim of bullying fosters prosocial responses to the bullying situation (Oh & Hazler, 2009). Likewise, students report that the likelihood of their intervening in a situation in which someone was attacked on the street was higher when this was an in-group as compared to an out-group member (Levine, Cassidy, Brazier, & Reicher, 2002). Other forms of prosocial behavior were also found to be dependent on specifics of the situation (Engelmann, Herrmann, & Tomasello, 2012; Leimgruber, Shaw, Santos, & Olson, 2012; Van IJzendoorn, Bakermans-Kranenburg, Pannebakker, & Out, 2010).

Defender behavior might even be more dependent on situational factors than on background, child or parenting characteristics. One study found that defender behavior was predicted by personal responsibility (a child characteristic) only if perceived peer pressure (a situational factor) was low. When perceived peer pressure was high, children exhibited high levels of defending behavior, independent of levels of personal responsibility (Pozzoli & Gini, 2010). Similarly, defender behavior was dependent on children's fatalistic attitude towards bullying only when they experienced low levels of parental support, whereas children with high levels of parental support showed high levels of defender behavior independent of their fatalistic attitude towards bullying (Li et al., 2015). Situational factors may thus override the effects of dispositional factors. However, dispositional factors might make children also more or less sensitive to situational cues. For anxiety and autistic traits it was shown that these dispositional factors influence a child's sensitivity to situational cues (e.g. Izuma, Matsumoto, Camerer, & Adolphs, 2011; Kochanska, 1997; Kochanska, Aksan, & Joy, 2007; Wildeboer et al., 2016). However, whether situational and dispositional factors show a similar interplay affecting bystander behavior in an online social exclusion situation is unknown.

The aim of the current study was (i) to test which background, child, and parenting variables were associated with bystander behavior during an online bullying situation; (ii) to test if situational characteristics (an unfamiliar or familiar excluded person) influence bystander behavior; and (iii) to examine whether situational effects were dependent on child characteristics. With an exploratory aim, we also examined the role of other background, child, and parenting variables in predicting the influence of victim familiarity on bystander behavior. First, we expected background, child, and parenting variables to differentiate between complicit and passive bystander behavior and between active defender and passive bystander behavior. Furthermore, we expected that children would defend the victim more often if the victim was familiar to them. Lastly, we expected that factors previously associated with sensitivity to situational cues (anxiety, autistic traits, situation dependent honesty/lying; Thijssen et al., 2016; Wildeboer et al., 2016) would be associated with a differential increase in defending unfamiliar versus familiar victims.

Methods

Setting

The current study is embedded within the Generation R Study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012; Tiemeier et al., 2012). All mothers who had a delivery date between April 2002 and January 2006 and who resided in Rotterdam were invited to participate. At approximately 8 years of age, a subsample was invited to participate in a lab visit with detailed measures on neuropsychological and behavioral functioning. The study was approved by the Medical Ethical Committee of the Erasmus Medical Center, Rotterdam. Written informed consent was obtained from all parents and assent was obtained from all children.

Participants

The project of which the current study was part aimed to measure antisocial as well as prosocial behavior. To obtain sufficient variation and avoid skewness in the distribution of outcome variables, we preselected an aggressive, a prosocial, and a typical group from the Generation R Study, based on parent reports on the aggressive behavior scale of the Child Behavior Checklist 1½–5 (CBCL, Achenbach & Rescorla, 2000) and the prosocial scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). Trajectories of aggressive behavior were distinguished for children of Dutch origin who had at least two CBCL aggression scores available at age 1.5, 3 and/or 6. A three-trajectory solution was selected as optimal, comprising a high, intermediate and low aggression trajectory (Wildeboer et al., 2015).

Children in the high aggression trajectory were eligible for the high aggressive group. Children in the lowest aggression trajectory who had a high prosocial score on the SDQ (14 or 15, range 5-15) were eligible for the high prosocial group. Children in the low aggression trajectory with a prosocial score < 14 or in the intermediate aggression trajectory were eligible for the typical group. This resulted in a total sample of 291 children who were invited to take part in the current study. Of these, 59 children and/or their parents refused to participate and did not visit the research center.

In 16 children, data on the outcome variable was not available due to technical difficulties or because the child was unmotivated. One child had an IQ < 70 and was therefore excluded from the analyses. This resulted in a final sample of 215 children, see **TABLE 4.1** for sample characteristics.

TABLE 4.1
Sample Characteristics

Child	*M*(*SD*)/*N* (%)	Family	*N* (%)
Age, *M*(*SD*)	8.58 (0.74)	Education, *n* (%) ≥ 1 parent higher	174 (81)
Gender, *n* (%) boys	108 (50)	Income, *n* (%)	
IQ, *M*(*SD*)	105.47 (13.72-14.11)	€800-1,600	5 (2)
Empathy, *M*(*SD*)	4.66 (0.94-1.00)	€1,600-2,400	18 (8)
Guilt, *M*(*SD*)	4.10 (0.89-0.92)	€2,400-3,200	40 (19)
Inhibition, *M*(*SD*)	30.91 (3.79-3.88)	€3,200-4,000	46 (21)
No. donated €0.20 coins, *M*(*SD*)	8.11 (6.79-6.95)	€4,000-4,800	38 (18)
Honesty, *n* (%)		€4,800-5,600	24 (11)
Honest	49 (23)	>€5,600	44 (20)
Situational liars	83 (38)	Parity, *n* (%) ≥ 1 sibling	192 (89)
Persistent liars	83 (39)	Harsh parenting mother, *n* (%) none	117 (54)
Groups, *n*(%)		Harsh parenting father, *n* (%) none	120 (56)
Prosocial	59 (27)		
Antisocial	71 (33)		
Typical	85 (40)		
Bullying, *n* (%) never	130 (60)		
Victimization, *n* (%) never	118 (55)		
Anxiety, *M*(*SD*)	1.61 (1.82-1.88)		
Social resp. probl., *M*(*SD*)	0.25 (0.25-0.27)		

N = 215.
Note. Reported values are untransformed, imputed data.
SD is not available as pooled measure and therefore the range of *SD* over the five imputed datasets is reported.

Participating children did not differ from the non-participating children on gender, IQ, family income and education of the parents, guilt, social responsiveness problems, anxiety, antisocial/prosocial group for which they were invited, bullying, victimization, and harsh parenting of the father and mother. However, participating children more often had one or more siblings (89%) than excluded children (77%), $\chi^2(1)= 7.04$, $p = .008$, $\varphi = .16$. Furthermore, participating children had lower levels of empathy, $t(265) = 1.97$, p .049, Cohen's d =0.28 (included $M = 4.68$ ($SD = 0.95$), excluded $M = 4.94$ ($SD = 0.85$)).

Procedure

When the children were age 3, a questionnaire was sent out to the parents including items on harsh parenting of both the father and the mother. At the age of 6, two consecutive questionnaires were sent to the parents. The first questionnaire measured anxiety as well as family income, educational level of the parents, and parity. The second questionnaire included questions on empathy, guilt, and social responsiveness problems. IQ was measured during a lab visit at age 6. When the children were 8 years old, a third questionnaire was sent to the parents that included items on bullying and victimization. Participant roles in a social exclusion situation, donating behavior, lying/honesty, and inhibition were also measured at age 8 during a lab visit.

Measures

Participant roles in a social exclusion situation. Participant roles during social exclusion were measured using an adapted version of Cyberball; the Prosocial Cyberball Game (PCG; Riem, Bakermans-Kranenburg, Huffmeijer, & Van IJzendoorn, 2013; Vrijhof et al., 2016). Cyberball is a well-known computerized task in which children are led to believe that they play a ball game in which they get excluded by the two other players (Crowley, Wu, Molfese, & Mayes, 2010; Williams, Cheung, & Choi, 2000). In the PCG, not the participating child but one of the computerized co-players gets excluded. In the PCG, there are three other players, located at the left, top, and on the right side of the computer screen, represented by a picture, name, and baseball glove. The player at the left and right were matched on age and gender with the participant. The player at the top was an unfamiliar female adult.

The game started with a fair phase (48 throws in total), in which the participant and the other three players received the ball roughly 25% of the time. The child could choose to whom to throw the ball with marked keys on a keyboard. In the following unfair phase (48 throws in total), the player at the left and right started to exclude the player at the top by not throwing the ball to this player anymore. The child was free to choose to whom to throw the ball.

When the game ended, the participant was told by a voice-over on the computer that they were going to play the game again. The second game was identical to the first, except that the player at the top was an adult who was familiar to the participant; the research-assistant. The child had spent approximately 50 minutes with the research-assistant prior to the PCG doing neuropsychological tests. Before the start of the first PCG, the child was informed that the research-assistant would be a co-player in the second game.

Participant roles were defined by deciding whether children compensated for the lack of throws from the two other players to the excluded player (active defenders), joined the exclusion by not (or hardly) throwing to the excluded player (complicit bystanders), or whether they did not chose sides (passive bystanders).

Construction of participant roles in a social exclusion situation. For each participant, a score for compensation in the unfair condition is calculated from

$$f = \frac{\text{Number of tosses to player at the top in unfair game}}{\text{Total number of tosses in unfair game}} - \frac{\text{Number of tosses to player at the top in fair game}}{\text{Total number of tosses in fair game}}$$

f is a measure of the increase (or decrease) of tossing to the excluded player in the unfair phase, compared to the fair phase. Thresholds for categorizing the participants in three groups can be extracted from the distribution of all values. A probability density function (PDF) consisting of three Gaussians was fitted to the distribution. The intersections of the Gaussians mark the values of the transition where it becomes more likely that a participant belongs to one group than another, and these intersections can therefore be used as thresholds (developed by JB, based on Cowan, 1998; Dulin, Berghuis, Depken, & Dekker, 2015).

Fitting a probability density function to the distribution is done by Maximum Likelihood Estimation (MLE) using Matlab. In an MLE fit, the parameters of the probability density function $A,B,C,\mu_1, \mu_2, \mu_3, \sigma_1, \sigma_2, \sigma_3$ of the probability density function $PDF\ (f|\ A,B,C,\mu_1, \mu_2, \mu_3, \sigma_1, \sigma_2, \sigma_3) = A * norm\ (\mu_1, \sigma_1) + A * norm\ (\mu_2, \sigma_2) + C * norm(\mu_3, \sigma_3)$ are varied such that the likelihood of obtaining the actual data by drawing from that PDF is maximized. In other words, based on three groups of values, each described by a Gaussian, the MLE fit describes the most likely way that these groups yield the measured data. For the values at the intersection of the Gaussians, the probability of belonging to the group left of the intersection is equal to that of belonging to the group right of the intersection. A participant with a lower value is more likely to belong to the group left of the intersection, a participant with a higher value is more likely to belong to the group on the right of the intersection. For the familiar condition, the group of children to the right of the intersection at 0.20 is defined as the group of active defenders (showing an increase of tosses to the excluded player in the unfair phase), children with scores lower than -0.13 are considered complicit bystanders (showing a decrease of tosses to the excluded player in the unfair phase), and the middle group is the group of passive bystanders (showing no large increase or decrease of tosses to the excluded player in the unfair phase; see ***FIGURE 4.1***). For the unfamiliar condition, only two groups could be distinguished (corresponding with the complicit bystander and passive bystander groups of the familiar condition; see ***FIGURE 4.2***). Although no curve for an active defender group was found, the distribution of unfamiliar scores also included children with high scores (corresponding to the defender group in the familiar condition). Therefore, we used the same intersection points to create the three participant role groups in the unfamiliar condition.

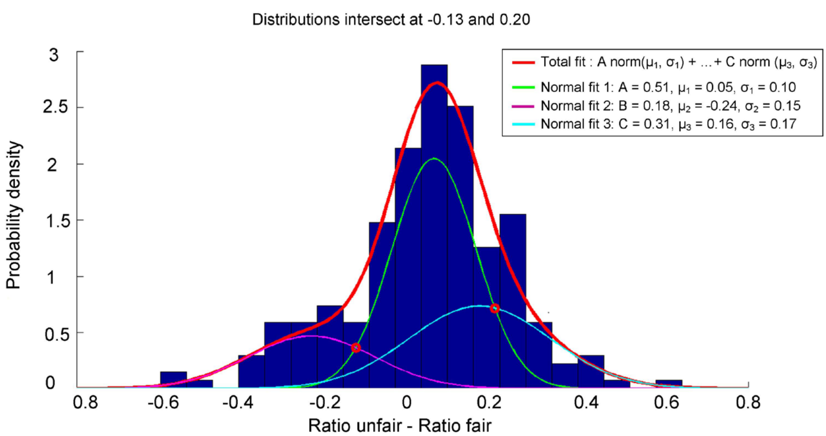

FIGURE 4.1
Distribution familiar difference score including Gaussians and their intersection points.

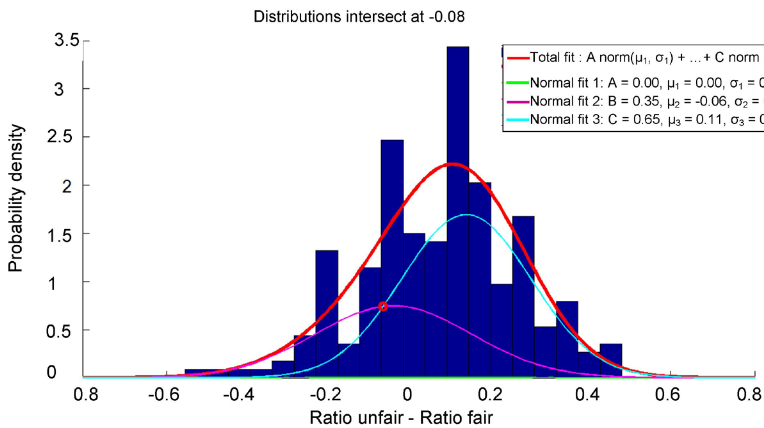

FIGURE 4.2
Distribution unfamiliar difference score including Gaussians and their intersection points

Empathy and guilt. Empathy and guilt were measured using a shortened subscale of the My Child Questionnaire (Kochanska, DeVet, Goldman, Murray, & Putnam, 1994), a parent-report questionnaire on conscience development. The questionnaire was shortened with approval of Kochanska (personal communication). Questions were presented on a 7-point Likert scale (‘*not applicable at all*’ to ‘*fully applicable*’). The Empathy subscale consisted of seven items (e.g. ‘*My child will try to console or comfort somebody who is unhappy*’) and internal consistency of this subscale was questionable/acceptable, Cronbach’s α = .66 (in the complete data). The Guilt/Remorse subscale consisted of 8 items (e.g. ‘*My child continues to feel bad even after he/she has already been forgiven for his/her lapse or blunder*’) and the internal consistency was acceptable, Cronbach’s α = .70 (in the complete data).

Inhibition. Using the Response Set task from the NEPSY-II-NL (Korkman, Kirk, & Kemp, 2010; White et al., 2013), inhibition was measured. The NEPSY-II-NL is a Dutch translation of the North American NEPSY-II (Brooks, Sherman, & Strauss, 2010) and is suitable to assess neuropsychological functioning in 5- to 12-year-old children. The subscale used to assess inhibition also measured working memory.

Donating behavior. Donating behavior was measured during the same lab visit as the PCG using an adapted version of the donating task by Van IJzendoorn and colleagues (2010). In the absence of their parent, children received 20 coins of 20 eurocents (€4.00) prior to the start of the task. The children received the money as a reward for their participation in the previous tasks. Subsequently, they were asked to watch a short UNICEF movie about a girl in Bangladesh who had to work in a stone pit and therefore could not go to school. The movie was presented as a means to raise money to help the girl go to school. When the movie ended, the children were asked by a voice-over and by a text on the computer screen whether they wanted to donate money in the moneybox that stood in front of them. The experimenter returned 30 seconds after the movie had ended. Though not the focus of the current study, for a random half of the children, a video-fragment followed after the movie that showed a probe of a same-sex peer in the same research setting donating 20 eurocent coins to the charity. We included the version of the task (with or without probe) as a covariate in all analyses including donating behavior.

Money donations were not normally distributed, instead a distribution with several peaks was found. Therefore we distinguished four categories: donated nothing (0 coins), donated less than half (1-9 coins), donated half or more than half (10-19 coins), donated everything (20 coins). The pattern of scores then approached a normal distribution.

Anxiety. Anxiety was assessed using the Child Behavior Checklist/1½–5 (CBCL, Achenbach & Rescorla, 2000), a self-administered parent-report questionnaire including 99 items concerning emotional and behavioral problems of the child. Because the majority of children were younger than age 6 during the measurement of parent-reported anxiety, we chose to use the CBCL/1½–5. The Anxiety subscale consisted of eight items (e.g. '*Too fearful or anxious*'), which could be rated on a 3 point scale (0 = '*not true*', 1 = '*somewhat true or sometimes true*', 2 = '*very true or often true*'). The subscale had an acceptable internal consistency, Cronbach's $\alpha = .69$ (in the complete data).

Social responsiveness problems. To assess autistic traits, a shortened version of the Social Responsiveness Scale (SRS, Constantino, 2002; Román et al., 2013) was used. Parents reported on their child's social responsiveness problems in a naturalistic setting. The shortened scale comprised 18 items (e.g. '*Avoids eye contact, or has unusual eye contact*'). Questions could be answered on a 4-point scale ('*not true*' to '*almost always true*'). The current scale had good internal consistency, Cronbach's $\alpha = .82$ (in the complete data). SRS total scores show strong correlations with a diagnostic instrument for autism (Constantino et al., 2003).

Lying/honesty. Lying/honesty was measured using a child-friendly adaptation of Greene and Paxton (2009). The task was performed in a scanner (Thijssen et al., 2016), but in the current study only behavioral data will be used. During the task, children were asked to predict a random computerized event. Children were not asked for their prediction, only for their accuracy after each trial. When children indicated that they were correct, they were rewarded with €0.05. The task was done twice: once in a low perceived lie-detectability situation and again in a high-perceived lie-detectability situation. The only difference between these conditions was that at the start of the latter condition, children were told that the research-assistant who operated the MRI machine could tell whether they were being honest or not. Children with unlikely high self-reported accuracy levels (one-tailed binomial test, $p < .05$; more than 13 correct guesses (72%) in 18 trials) were classified as dishonest. Children were divided into three groups: persistently honest (honest in both conditions), low lie-detectability lie-tellers (dishonest in the low lie-detectability condition only), and persistent lie-tellers (dishonest in both conditions).

Bullying and victimization. Bullying and victimization were measured using a parent-report questionnaire (Alsaker & Valkanover, 2000). Both scales consisted of three items, covering verbal and physical bullying/victimization, and exclusion. Items could be answered on a 5-point Likert scale ('*never*' to '*several times a week*'). After transformation of the skewed variables, skewness remained severe and therefore the variables were dichotomized into children who had never bullied/children who were never a victim of bullying and children who had bullied/children who had been a victim of bullying.

Harsh parenting. Maternal and paternal harsh parenting was measured separately using self-report questionnaires. A harsh discipline scale was constructed for both parents, consisting of six items of the Parent-Child Conflict Tactics scale (Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). The items were selected in an earlier study within the same cohort, based on factor analysis (Jansen et al., 2012). Mothers and fathers reported on their use of harsh discipline (e.g. '*shook my child*') during the past two weeks on a 6-point Likert scale ('*never*' to '*five times or more*'). Due to low internal consistency of the scales, we dichotomized the variables for father- and mother-report separately into children who never experienced harsh parenting and children who experienced one or more acts of harsh parenting one or more times in the past two weeks. As one item ("*I shouted or screamed* *angrily at my child*") was experienced by almost all children, this item was deleted before we dichotomized this variable (for a similar approach see Jansen et al., 2012).

Covariates. We included the following covariates: gender, age of the child, IQ, family income, educational levels of the parents, and parity. IQ was assessed using Mosaics and Categories, two subtests from the Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams, & Laros, 2005). Family income was measured in categories, each comprising a range of €800 (see **TABLE 4.1** for categories). When either one or both of the parents obtained higher education, educational level was coded as 'higher', when both parents completed secondary education or lower, the variable was coded as 'other'. Parity was dichotomized into 'none' and 'one or more siblings'.

Data analysis

Correlations between all variables were computed, using passive bystanders as the reference category for participant roles. Paired *t*-tests were used to test whether the proportion of throws to the excluded player (number of throws to the excluded player divided by the total number of participant throws) was different in the fair versus the unfair phase in both the unfamiliar and the familiar condition.

To approach normality, skewed predictor variables were transformed. Anxiety and social responsiveness problems were moderately skewed and therefore a square root transformation was applied. Because of severe skewness, inhibition, bullying, and victimization were transformed using a log10 transformation (Tabachnik & Fidell, 2007). Missing data on the predictor variables ranged between 0 and 15% and was imputed using the multiple imputation method (Markov chain Monte Carlo) with five imputations and 10 iterations in SPSS 21. For statistics that could not be pooled by SPSS 21.0 (e.g. R^2), the value range over the five imputed datasets is provided.

To test associations with the participant roles, we used multinomial logistic regression analyses for the unfamiliar and familiar condition separately with the passive bystanders as the reference group. Variables were included in the multinomial logistic regression in a hierarchical way.

Variables remained in a next step if the *p*-value of their contribution to the prediction was $< .10$ (as we did not want to be too stringent in our selection of variables for which we controlled the analyses). In the first model we included the covariates gender, age, IQ, educational level of the parents, income, and parity. In the second model, we included variables associated with prosocial behavior; empathy, guilt, inhibition, and donating (including the version of the donating task as a covariate). The third model comprised variables associated with problem behavior; the honesty/lying grouping, the antisocial/prosocial grouping on the basis of which children were selected to take part in the study, parent-reported bullying and victimization, anxiety, and social responsiveness problems. For the honesty/lying groups we made dummy variables with the honest children as the reference category. The same was done for the antisocial/prosocial groups with the typical group as the reference category. The fourth (and last) model included harsh parenting of both father and mother. The order in which variables were entered into the models was the same for the unfamiliar and familiar condition.

As a sensitivity analysis we explored associations with the continuous PCG score (proportion of throws to the excluded player in the unfair condition minus proportion of throws to the excluded player in the fair condition). We conducted hierarchical linear regression analyses controlling for the proportion of throws to the player at the top in the fair phase, in order to control for a preference of symmetry (which might already in the fair phase lead to a higher proportion of throws to the player at the top; the later excluded player). The order in which variables were entered into the models was similar to the multinomial logistic regression analyses described above.

Last, we tested whether there was an effect of the familiarity of the excluded player. A paired *t*-test was used to examine if the continuous PCG score in the unfamiliar condition differed from the continuous PCG score in the familiar condition. In a repeated measures analysis we tested which variables were associated with the familiarity effect; the change between the unfamiliar and familiar condition.

Results

Univariate associations

In the unfamiliar condition, 34 (16%) of the children were identified as complicit bystander, 134 (62%) as passive bystander, and 47 (22%) as active defender. In the familiar condition, 33 (15%) of the children were identified as complicit bystander, 144 (67%) as passive bystander, and 38 (18%) as active defender.

Correlations between all variables in the models are reported in **TABLE S4.1**. In the unfamiliar condition, there was a 5% increase (SD = 18.80) in mean proportion of throws to the excluded player from the fair to the unfair phase, $t(214) = -4.11$, $p < .001$, Cohen's $d = -0.37$ (fair M = 0.38 (SD = 0.14), unfair M = 0.43 (SD = 0.15)). In the familiar condition, there was a 4% increase (SD = 19.11) in mean proportion of throws to the excluded player from the fair to the unfair phase, $t(214) = -2.74$, $p = .007$, Cohen's $d = -0.24$ (fair M = 0.41 (SD = 0.15), unfair M = 0.44 (SD = 0.17)). See **TABLE 4.2**, **TABLE 4.3**, **TABLE 4.4**, and **TABLE 4.5** for frequencies and means of the predictor variables per group in the unfamiliar and familiar conditions, respectively.

Associations with participant roles in the unfamiliar condition

First, we tested the multinomial logistic regression model associating background variables with participant roles (**TABLE S4.2**). Passive bystanders were older than complicit bystanders, $B = -0.93$ (SE = 0.34), $p = .007$, OR = 0.40 (95% CI 0.20 – 0.77). There were fewer girls in the complicit bystander group as compared to the passive bystander group, $B = -1.15$ (SE = 0.43). p = .007. OR = 0.32 (95% CI 0.14 – 0.74). No other background variable was associated with participant roles. In the second model (**TABLE S4.3**) we found that guilt levels of complicit bystanders were higher than those of passive bystanders, $B = 0.56$ (SE = 0.28), $p = .041$, OR = 1.75 (95% CI 1.02 – 3.01). Age and gender were also associated with participant roles (same contrast and direction of effect as in the first model, see **TABLE S4.2**). No other prosocial variable was associated with participant roles. None of the variables in the third model (**TABLE S4.4**) was associated with participant roles, except for age and gender (same contrast and direction of effect as in the first model, see **TABLE S4.2**). Guilt showed a trend ($p < .10$) for the passive bystander vs. active defender contrast and was included in the next model. In the last model, harsh parenting of the father and mother were not associated with participant roles (see **TABLE S4.5**). For the results of the hierarchical regression analyses on the continuous PCG score, see Supplementary material and **TABLE S4.10**. In short, except for a positive association with gender (girls showing more bystander behavior), no associations with bystander behavior in the unfamiliar condition using the continuous PCG score were found.

TABLE 4.2
Frequencies per Group in the Unfamiliar Condition

	Complicit	Passive	Defender	
	N (%[a])	N (%[a])	N (%[a])	χ^2
Gender				7.86*
Boy	24 (22)[b]	59 (55)[b]	25 (23)	
Girl	10 (9)[b]	75 (70)[b]	22 (21)	
Education				1.89
Secondary/lower	4 (10)	29 (71)	8 (20)	
Higher	30 (17)	105 (60)	39 (22)	
Parity				1.62-3.27
No siblings	2 (9)	18 (78)	3 (13)	
≥1 siblings	32 (17)	116 (60)	44 (23)	
Anti-/Prosocial groups				2.60
Prosocial	8 (14)	40 (68)	11 (19)	
Antisocial	9 (13)	45 (63)	17 (24)	
Typical	17 (20)	49 (58)	19 (22)	
Honesty/lying groups				2.02-3.91
Persistent liar	13 (16)	50 (60)	20 (24)	
Situational liar	16 (19)	52 (63)	15 (18)	
Honest	5 (10)	32 (65)	12 (24)	
Bully				0.30-3.44
No	20 (15)	79 (60)	32 (24)	
Yes	14 (17)	55 (65)	15 (18)	
Victim				0.08-2.51
No	18 (15)	71 (60)	29 (25)	
Yes	16 (16)	63 (65)	18 (19)	
Harsh parenting father				0.74-2.95
No harsh parenting	19 (16)	71 (59)	30 (25)	
Harsh parenting	15 (16)	63 (66)	17 (18)	
Harsh parenting mother				0.49-2.01
No harsh parenting	21 (18)	72 (62)	23 (20)	
Harsh parenting	13 (13)	62 (63)	24 (24)	

$N = 215$
Note. χ^2 range over 5 imputed datasets.
[a]Percentages over rows
[b]Numbers sharing the same superscript in the same column (participant role) differ significantly
*$p < .05$

TABLE 4.3
Means per Group in the Unfamiliar Condition

	Complicit	Passive	Defender	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*
Age	8.31[a] (0.56)	8.67[a] (0.73)	8.55 (0.83)	3.33*
Income	4.40 (1.57-1.71)	4.55 (1.72-1.80)	4.85 (1.48-1.64)	0.57-1.68
IQ	102.52 (16.65-17.37)	105.76 (13.26-13.86)	106.77 (12.48-12.97)	0.78-1.96
Guilt	4.26 (1.08)	4.05 (0.89-0.93)	4.14 (0.70-0.75)	0.60-1.09
Empathy	4.63 (1.00)	4.64 (0.94-1.02)	4.73 (0.88-0.93)	0.12-0.28
Donating	1.28 (0.90-0.95)	1.38 (0.95-0.96)	1.17 (0.88-.91)	0.71-0.96[b]
Inhibition	0.21 (0.27)	0.33 (0.29-0.30)	0.30 (0.29)	2.17-2.42
Bully	0.56 (0.11-0.15)	0.55 (0.11-0.14)	0.55 (0.14-0.15)	0.15-0.38
Social resp. prob.	0.44 (0.25)	0.41 (0.22-0.23)	0.47 (0.29-0.31)	0.40-1.34

N = 215
Note. *SD* & *F* range over 5 imputed datasets.
[a]Means sharing the same superscript differ significantly at at $p < .05$ (Bonferroni corrected post hoc test)
[b]Corrected for version of the donating task
*$p < .05$

Associations with participant roles in thefamiliar condition

The same models were used for the familiar condition. In the first model (**TABLE S4.6**), family income was higher for passive bystanders as compared to complicit bystanders, $B = -0.42$ ($SE = 0.15$), $p = .004$, $OR = 0.66$ (95% *CI* 0.49 – 0.87). No other background variable was associated with participant roles. IQ and parity showed a trend ($p < .10$) for the passive bystander vs. complicit bystander contrast and the passive bystander vs. active defender contrast respectively and were therefore included in the next model. In the second model (**TABLE S4.7**), no variable was associated with the participant roles except for income and parity (same contrast and direction of effect as in the first model, see **TABLE S4.6**). IQ and donating behavior showed a trend ($p < .10$) for the passive bystander vs. complicit bystander contrast. All four variables were therefore included in the next model. In the third model (**TABLE S4.8**), children who were a victim of bullying were more likely to show active defender behavior as compared to passive bystander behavior, $B = 1.26$ ($SE = 0.485$), $p = .009$, $OR = 3.53$ (95% *CI* 1.38 – 9.02). IQ, income and parity also showed an effect (same contrast and direction of effect as in the first model, see **TABLE S4.6**) and donating behavior showed a trend ($p < .10$) for the passive bystander vs. complicit bystander contrast. All four variables were therefore included in the next model.

TABLE 4.4
Frequencies per Group in the Familiar Condition

	Complicit	Passive	Defender	
	N (%[a])	*N* (%[a])	*N* (%[a])	χ^2
Gender				3.43
Boy	20 (19)	66 (61)	22 (20)	
Girl	13 (12)	78 (73)	16 (15)	
Education				2.96
Secondary/lower	6 (15)	24 (59)	11 (27)	
Higher	27 (16)	120 (69)	27 (16)	
Parity				4.94-8.90*
No siblings	4 (17)	11 (46)[b]	9 (38)[b]	
≥1 siblings	29 (15)	133 (70)[b]	29 (19)[b]	
Anti-/prosocial groups				1.97
Prosocial	10 (17)	41 (69)	8 (14)	
Antisocial	10 (14)	45 (63)	16 (23)	
Typical	13 (15)	58 (68)	14 (16)	
Honesty/lying groups				0.78-2.57
Persistent liar	14 (17)	52 (63)	17 (20)	
Situational liar	12 (14)	58 (70)	13 (16)	
Honest	7 (14)	33 (67)	9 (18)	
Bully				0.38-2.44
No	19 (15)	91 (69)	21 (16)	
Yes	14 (17)	53 (63)	17 (20)	
Victim				7.89-11.65**
No	20 (17)	86 (73)[b]	12 (10)[b]	
Yes	13 (13)	58 (60)[b]	26 (27)[b]	
Harsh parenting father				1.40-2.58
No harsh parenting	20 (17)	82 (68)	18 (15)	
Harsh parenting	13 (14)	62 (65)	20 (21)	
Harsh parenting mother				0.74-2.02
No harsh parenting	17 (15)	82 (70)	18 (15)	
Harsh parenting	16 (16)	62 (63)	20 (20)	

N = 215
Note. χ^2 range over 5 imputed datasets.
[a]Percentages over rows
[b]Numbers sharing the same superscript in the same column (participant role) differ significantly
*$p < .05$, ** $p < .01$

In the final model (**TABLE S4.9**) harsh parenting of the father and mother were not associated with participant roles. Income was associated with the passive bystander vs. complicit bystander contrast. IQ and donating behavior showed a trend ($p < .10$) for the passive bystander vs. complicit bystander contrast and parity and income showed a trend for the passive bystander vs. active defender contrast. For the results of the hierarchical linear regression analysis on the continuous PCG score, see Supplementary material and **TABLE S4.11**. In short, except for a negative association with IQ, no associations with bystander behavior in the familiar condition using the continuous PCG score were found.

TABLE 4.5
Means per Group in the Familiar Condition

	Complicit	Passive	Defender	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*
Age	8.43 (0.71)	8.59 (0.71)	8.67 (0.88)	1.03
Income	3.85 (1.66-1.76)[a]	4.88 (1.58-1.67)[a]	4.14 (1.57-1.66)	5.02-9.51**
IQ	109.67 (12.91-13.70)	104.93 (14.05-14.64)	103.88 (12.54-13.41)	1.68-2.57
Guilt	4.09 (0.97-1.04)	4.06 (0.85-0.90)	4.24 (0.92-0.98)	0.41-0.77
Empathy	4.76 (1.04-1.07)	4.59 (0.89-0.96)	4.83 (0.98-1.14)	1.02-2.18
Donating	0.99 (0.87-0.93)	1.41 (0.92-0.93)	1.26 (0.95)	2.23-2.67[b]
Inhibition	0.26 (0.32)	0.33 (0.30)	0.24 (0.21-0.22)	1.50-1.85
Anxiety	0.92 (0.87-0.89)	0.92 (0.83-0.84)	1.05 (0.78-0.83)	0.15-0.86
Social resp. prob.	0.41 (0.26)	0.42 (0.22-0.23)	0.50 (0.30-0.32)	1.73-3.09

N = 215
Note. *SD* & *F* range over 5 imputed datasets.
[a]Means sharing the same superscript differ significantly at at $p < .05$ (Bonferroni corrected post hoc test)
[b]Corrected for version of the donating task
** $p < .01$

Situational effect

There was no difference in the average continuous PCG score between the two conditions (unfamiliar vs. familiar excluded player), $t(214) = -0.94$, $p = .349$. Neither were the distributions of participants across the three bystander groups different in the unfamiliar versus the familiar condition, $\chi^2(4) = 4.64$, $p = .327$. The continuous PCG scores in the unfamiliar and familiar conditions were associated (corrected for the proportion of throws to the player at the top in the fair phase of both conditions), partial $R = .21$, $p = .003$. The repeated measures analysis showed that the effects of familiarity were not associated with any of the background, child, or parenting variables, except for IQ, $F(1, 209) = 4.13\text{-}6.29$, $p = .013\text{-}.043$, *partial* $\eta^2 = .02\text{-}.03$.

Discussion

On average, children compensated for the exclusion of another person by their peers but their prosocial tossing to the excluded individual was rather modest compared to similar studies (e.g. Riem et al., 2013). We were not able to identify variables associated with participant roles during online social exclusion – complicit bystanders, passive bystander, and active defenders – that would survive a correction for multiple testing. Familiarity of the excluded player did not significantly affect the children's prosocial compensating behavior.

The current study is the first to examine background, child, and parenting variables as well as a situational factor potentially associated with observed participant roles during online social exclusion. In both the unfamiliar and familiar condition children tossed on average more often to the player at the top when this person was excluded by others. Despite our finding of a significant difference in the mean continuous PCG scores of the fair versus unfair phases in both conditions, the increase in tosses to the excluded player was low (5% (SD = 18.80) in the unfamiliar condition and 4% (SD = 19.11) in the familiar condition) as compared to other studies (showing a rough 15-19% increase; Riem et al., 2013; Sellaro, Steenbergen, Verkuil, Van IJzendoorn & Colzato, 2015; Vrijhof et al., 2016). This might be due to the overrepresentation of antisocial children in our sample. Although this is not reflected in an association between bystander behavior and parent-reported antisocial scores, there might be unmeasured external factors underlying both forms of behavior, such as genetics or peer relationship quality (Ball et al., 2008; Dishion, Patterson, Stoolmiller, & Skinner, 1991; Pappa et al., 2015; Salmivalli et al., 1996). Surprisingly, a substantial proportion of the children in the current study did show complicit bystander behavior towards the excluded victim as they joined in with the bullying. This might be an indication that although the PCG has previously been used to specifically measure prosocial behavior compensating for exclusion (Vrijhof et al., 2016), this paradigm also allows for the measurement of antisocial, complicit bystander behavior, at least in samples with an over representation of children with high aggression levels.

The majority of children in the current study were passive bystanders (62% and 67% in the unfamiliar and familiar condition respectively). Furthermore, 15% and 16% were complicit bystanders and 18% and 22% were active defenders in the familiar and unfamiliar condition, respectively. The direct comparison of these percentages with those in other studies on participant roles during bullying is impossible because of the use of questionnaire data in most studies (e.g. Salmivalli et al., 1996). Although we found differences on some variables (age, gender, IQ, income, parity, being victimized, and guilt) between passive and complicit bystanders or between passive bystanders and active defenders in the unfamiliar or the familiar condition, these associations would not survive a correction for multiple testing. Gender and IQ were associated with the continuous PCG score in the unfamiliar and familiar condition respectively and IQ was associated with the familiarity effect, but again these associations would not survive correction for multiple testing.

Other studies did find associations between participant roles and background and child characteristics (e.g. Oh & Hazler, 2009; Pozzoli & Gini, 2010). What distinguishes these studies from the current study is that they made use of self- or other-reports of bystander behavior during bullying, whereas the current study used observed participant roles. Common method variance may result in stronger associations between concepts when measured with similar methods as compared with associations between observed behavior and questionnaire reports about behavior, attitudes, or feelings. It should be noted that the power of our study ($N = 215$) to find significant associations with prosociality amounted to 0.99 (based on a meta-analytic expected effect size by Card, Stucky, Sawalani, & Little, 2008, combined $R = .29$). For associations with antisocial behaviors our power was 0.55 (based on the meta-analysis of Reijntjes et al., 2011, $R = .14$). The absence of variables differentiating between complicit and passive bystander behavior might also be a result of the shared correlates of complicit and passive bystander behavior, since doing nothing in a social rejection situation may encourage a bully and may be considered antisocial behavior as well (Salmivalli et al., 1996). In another PCG study on adolescents the authors did find associations between bystander behavior and gender and bullying, but not with empathy, externalizing, or prosocial behavior (Vrijhof et al., 2016).

The lack of variables differentiating between passive and complicit bystanders and between passive bystanders and active defenders might also be an indication that bystander behavior strongly depends on the situation. Situational influences have been demonstrated to affect prosocial behavior (e.g. Van IJzendoorn et al., 2010), and also antisocial behavior can be dependent on the situation (e.g. Anderson & Carnagey, 2009; Zimbardo, 2004). Situational dependency of participant roles was also found in an earlier study showing that children adopt different and even contrasting roles in online bullying compared to face-to-face bullying (Quirk & Campbell, 2015).

In the current study we also examined the effect of a situational factor; familiarity with the excluded person. Previous studies have shown that familiarity and being an in-group member may increase defending behavior towards a victim (Levine et al., 2002; Oh & Hazler, 2009). However, in the current study children did not show more defender behavior when the excluded person was a familiar adult (the research- assistant), compared to an unfamiliar excluded person. Although the research-assistant had spent approximately 50 minutes doing neuropsychological tests with the child, this might have been too short for developing an in-group feeling. However, in a previous study the in-group /out-group effect was even evident when participants were confronted with unfamiliar people from their own university (in-group) versus another university (out-group) (Levine et al., 2002).

Yet, in-group preference increases with age (Fehr, Bernhard, & Rockenbach, 2008). Possibly in-group preference is not fully developed around the age of 8, which might have led to the absence of an effect of the familiarity of the excluded person during the PCG game. Furthermore, the excluded person may have been considered an out-group member in both the familiar and unfamiliar condition, as this person was an adult, whereas the two bullies who excluded the top player were children. We chose the research-assistant to be the familiar person, because she was equally familiar to all participating children, but this might have limited the establishment of in-group feelings. Besides, as the bullies were the same in both conditions and the excluded person was not, some children may have felt more familiar with the bullies in the second condition than with the excluded person, which may have resulted in the absence of an increase in defender behavior.

Children showed on average, as a group, similar behavior in the unfamiliar and familiar condition, but the correlation between the continuous PCG scores of both conditions was small (*partial* $R = .21$). This indicates that children adopted different participant roles in the two conditions and that they showed different patterns of change over the two conditions. As the differential change of children over the two conditions could not be explained in the current study, it is likely that other situational factors than familiarity might also have played a role. Some defenders of the excluded person in the first game might have been afraid to stand up for the victim a second time, as this would decrease their reputation among the bullies who remained the same individuals across the two games. Relatedly, witnessing multiple types of bullying was found to decrease prosocial bystander behavior (Oh & Hazler, 2009), as children might become afraid of the bully. Furthermore, the bullies could have felt more strongly as in-group than the excluded research-assistant to some participants.

The present study has some limitations. First, a number of predictor variables used in the current study were parent-report questionnaire data. Parents are not always reliable reporters on their children's behavior (Seifer, Sameroff, Dickstein, Schiller, & Hayden, 2004), especially when it concerns behavior that takes place outside of the home setting, such as bullying and victimization (Holt, Kaufman Kantor, & Finkelhor, 2008). The use of observational data for participant roles is a strength of the current study. Second, the research-assistant may not have been familiar enough to the participants to create an in-group effect. However, the advantage of using the research-assistant was the standardization of familiarity; all children were equally familiar to the research-assistant. Third, the lack of associations may be due to specifics of the task. The exclusion of the top player in the unfair phase may be unclear as the later bullies did toss the ball to the top player in the fair phase. However, the fact that some children showed strong defender behavior towards the excluded player, whereas others joined the exclusion by throwing more balls to the excluders and fewer to the excluded player than they did in the fair phase, might suggest that they took note of the exclusion. Last, due to the set-up of the PCG, only three bystander roles could be distinguished; complicit bystanders, passive bystanders, and active defenders. Children could not leave the game, as they might do in real life. Furthermore, where many studies on participant roles distinguish between reinforcers and assistants of the bully (Salmivalli et al., 1996), such a distinction could not be made in the current study. We think that 'complicit bystander' covers the most important aspect of the antisocial participant roles, namely strengthening and approving the bully's behavior by doing the same.

The present study did not find background, child, or parenting variables significantly associated with participant roles in an online social exclusion setting. The absence of such associations might indicate that children's bystander behaviors may be more strongly dependent on situational factors. We tested one situational variation, familiarity of the excluded person, but this did not change defender behavior in the current study. As social exclusion can be detrimental to the victim, it is important to continue searching for dispositional and situational factors outside the realm of the 'usual suspects' that enhance defender behavior and might be used in developing preventive interventions.

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Chapter 5

Neuroanatomical correlates of donating behavior in middle childhood

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Abstract

The neurobiological correlates of prosocial behavior are largely unknown. We examined brain structure and functional connectivity correlates of donating to a charity, a specific, costly, form of prosocial behavior. In 163 children, donating was measured using a promotional clip for a charity including a call for donations. Children could decide privately whether and how much they wanted to donate from money they had received earlier. Whole brain structural MRI scans were obtained to study associations between cortical thickness and donating behavior. In addition, resting state functional MRI scans were obtained to study whole brain functional connectivity and to examine functional connectivity between regions identified using structural MRI. In the lateral orbitofrontal cortex/pars orbitalis and pre-/postcentral cortex, a thicker cortex was associated with higher donations. Functional connectivity with these regions was not associated with donating behavior. These results suggest that donating behavior is not only situationally driven, but is also related to brain morphology. The absence of functional connectivity between the clusters that was associated with donating behavior might imply that these cortical thickness clusters are involved in different underlying mechanisms of donating.

Introduction

Prosocial behavior is voluntary behavior intended to benefit another individual (Eisenberg, Fabes, & Spinrad, 2007), and can already be observed in young children (Warneken & Tomasello, 2006). While prosocial behavior is often assumed to be situationally driven (e.g. Van IJzendoorn, Bakermans-Kranenburg, Pannebakker, & Out, 2010), several studies showed an association between brain morphology and prosocial behavior (e.g. Thijssen et al., 2015), which may indicate that variation in prosocial behavior is also (partially) inherent to individuals. As distinct neurobiological mechanisms might underlie different types of prosocial behavior, differentiating between the various types of prosocial behavior is important (Paulus, 2014; Paulus, 2015). Therefore, the current study focuses on the neurobiological correlates of a specific, costly type of observed prosocial behavior: donating to a charity. We will focus on middle childhood, as children this age have a well-developed concept of the value of money (Berti & Bombi, 1981) and the neurobiological correlates underlying donating behavior in children are largely unknown.

Although prosocial behavior can be observed in children as young as 18 months old (Warneken & Tomasello, 2006), to our knowledge only two studies examined neurobiological correlates of prosocial behavior in children. A thicker cortex in the left superior frontal and rostral middle frontal cortex has been shown to be associated with more parent-reported prosocial behavior in typically developing 6-9-year-old children, whereas a smaller bifrontal diameter in preterm infants at term equivalent postmenstrual age (37-43 weeks) was related to lower levels of parent-reported prosocial behavior at age 5 (Rogers et al., 2012; Thijssen et al., 2015). These studies focused on parental reports of child prosocial behavior, covering the broad range of helpful, empathic, costly and non-costly prosocial behaviors. However, various types of child prosocial behavior can be distinguished, such as helping, sharing, donating, and comforting (e.g. Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Warneken & Tomasello, 2009). It has been suggested that such distinct types of prosocial behavior have different underlying social-cognitive mechanisms which are reflected in distinct neurobiological correlates (Dunfield & Kuhlmeier, 2013; Paulus, 2014; Paulus, Kühn-Popp, Licate, Sodian, & Meinhardt, 2013). In the adult literature on the neurobiological correlates of prosocial behavior, an important distinction has been made between non-costly types of prosocial behavior (e.g. Masten, Eisenberger, Pfeifer, & Dapretto, 2010; Masten, Morelli, & Eisenberger, 2011) and costly prosocial behavior (e.g. Moll et al., 2006). Costly prosocial behavior is thought to be a predictor of consistent altruistic behavior, whereas non-costly donations are not (Gneezy, Imas, Brown, Nelson, & Norton, 2012). Donating to a charity represents a costly type of prosocial behavior. While prosocial behavior can be self-serving (Batson & Shaw, 1991), donating to a charity can be considered altruistic, since no compensation or benefit in return is expected (Van IJzendoorn et al., 2010). It is thought to result from higher levels of perspective taking, empathic concern, and moral reasoning (Brehm, Powell, & Coke, 1984; Eisenberg & Shell, 1986; Fishman, 2006; Verhaert & Van den Poel, 2011).

Research on the neurobiological correlates of donating behavior has mainly focused on functional magnetic resonance imaging (fMRI) studies in adults, and to date have mainly shown associations with increased activity in prefrontal brain regions. For example, a monetary donation to a family member was associated with increased brain activity in the dorsolateral prefrontal cortex (DLPFC) and dorsomedial prefrontal cortex (DMPFC) (Telzer, Masten, Berkman, Lieberman, & Fuligni, 2011). Others found a positive association between activation of the DMPFC during a social judgment task and later donating (Wyatz, Zaki, & Mitchell, 2012). Activity in the anterior prefrontal cortex during costly donating was associated with engagement in real-life charitable activities (Moll et al., 2006). Increased activity during donating was also found in reward areas of the brain such as the ventral striatum and the nucleus accumbens (Harbaugh, Mayr, & Burghart, 2007; Kuss et al., 2013; Moll et al., 2006).

While studies on brain activity patterns during donating are informative on the function of certain brain areas, studies on brain morphology may help to understand the long-term neurobiological associations of donating behavior. Studies on brain morphology are especially interesting since prosocial behavior is thought to be at least partly situationally determined (e.g. Van IJzendoorn et al., 2010). While differences in brain activity associated with donating do not exclude the possibility of situational morality, differences in brain morphology might indicate that donating behavior is not only situationally determined but also (partially) inherent to the child itself. Several studies indeed show that brain structure is associated with donating behavior in adults. For example, grey matter volume in the temporo-parietal junction was positively associated with the amount of money given to another person, whereas lesions in the ventromedial prefrontal cortex were negatively associated with monetary donations (Krajbich, Adolphs, Tranel, Denburg, & Camerer, 2009; Morishima, Schunk, Bruhin, Ruff, & Fehr, 2012).

To the best of our knowledge, no study to date has examined the neurobiological correlates of costly prosocial behavior such as donating in children. To study whether variance in donating behavior is not only situationally driven, but also has a neuroanatomical component, we examined brain morphology, more specifically cortical thickness, in relation to donating behavior in middle childhood. Furthermore, we utilized resting state fMRI to examine whether functional connectivity with clusters identified using structural MRI was associated with donating behavior and whether the structural clusters share a functional organization related to donating behavior. Such analysis might shed light on a network of brain areas involved in donating behavior and might also provide more insight into whether brain areas identified in the structural analyses work in cooperation when it involves donating behavior. We conducted a hypothesis-free whole-brain analysis of structural MRI data, and we used the resulting clusters for the resting state fMRI analyses. Gender differences in prosocial behavior (Ladd & Profilet, 1996), cortical thickness (Luders et al., 2006), and functional connectivity (Tomasi & Volkow, 2012) have been reported. Therefore, we test a priori whether results are similar for boys and girls.

Methods

Setting

The current study is embedded within the Generation R Study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012; Tiemeier et al., 2012). All mothers who had a delivery date between April 2002 and January 2006 and who were resident in Rotterdam were invited to participate. At age 8, a subsample participated in detailed measures on (f)MRI, neuropsychological, and behavioral functioning. The study was approved by the Medical Ethics Committee of the Erasmus Medical Centre in Rotterdam. Written informed consent was obtained from all adult participants.

Study population

In order to ensure the sample contained sufficient variation in prosocial behavior, three groups of children were recruited from the larger Generation R cohort: highly aggressive, highly prosocial, and typical children. These selections were based on parental reports on the aggressive behavior scale of the Child Behavior Checklist/1½–5 (CBCL, Achenbach & Rescorla, 2000) and the prosocial scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). Trajectories of aggressive behavior were distinguished for children of Dutch origin who had at least two CBCL aggression scores available at 1.5, 3, and/or 6 years of age. A three-trajectory solution was selected as optimal, comprising a high, intermediate, and low aggression trajectory (Wildeboer et al., 2015). Children in the high aggression trajectory were eligible for the highly aggressive group. Children in the lowest aggression trajectory with high prosocial SDQ scores (14 or 15, potential range 5-15) were eligible for the high prosocial group. Children in either the low aggression trajectory with a prosocial score < 14 or in the intermediate aggression trajectory were considered eligible for the typical group. This resulted in a total sample of 291 children who were invited to take part in the current study.

Fifty-nine children and/or their parents refused to participate. Two hundred thirty-two children visited our research center, 43 of whom had no (f)MRI data because of time constraints, because they did not feel at ease to go into the scanner, or due to technical problems with the scanner. For the remaining 189 children, an MRI T_1-weighted scan was obtained. For 18 children, data quality was insufficient. Another seven children had missing data on the donating task, because the child was still busy donating when the researcher entered the room (n = 3), due to technical difficulties (n = 2), misunderstanding of the task (n = 1), or because their parent did not want a financial reward for the child (n = 1). One child had an IQ score < 70 (IQ = 56) and was therefore excluded. This resulted in a final sample of 163 children, with 58 children in the aggressive, 50 in the prosocial and 55 children in the typical group. See **TABLE 5.1** for sample characteristics. Children who were included in the structural analyses (n =163) did not differ from the eligible but non-participating or excluded children (n = 128) on gender, age, IQ, maternal education, family income, parity, or handedness. Data on resting state fMRI was missing for 14 children, five children were excluded because of excessive movement (described below) and 14 children were excluded because of registration (spatial normalization) problems. This resulted in a sample of 130 children who were eligible for the resting state fMRI analyses.

TABLE 5.1
Sample characteristics

Child characteristics	*M*(*SD*/range) / No. (%)	Family characteristics	*M*(*SD*/category) / No. (%)
Gender, no. girls (%)	87 (53)	Education mother, no. (%) higher	128 (79)
Age MRI, *M*(*SD*)	8.62 (0.75)	Income, *M* category, €	4,000-4,800
No. donated €0.20 coins, *M*(*SD*)		Parity, *M*(*SD*)	1.13 (0.66)
Without probe	7.07 (6.55)		
With probe	9.60 (7.01)		
Trajectory group			
Prosocial, no. (%)	50 (31)		
Aggressive, no. (%)	58 (36)		
Typical, no. (%)	55 (34)		
IQ, *M*(range)	106.13 (70-135)		
Handedness, no. right (%)	146 (90)		

N = 163

Measures

Donating behavior. Donating behavior was measured using an adapted version of the donating task by Van IJzendoorn et al. (2010) when the children were on average 8.59 years of age (*SD* = 0.75). Children received 20 coins of 20 eurocents (€4.00) prior to the start of the task and in the absence of their parent. It was made explicit that they received the money because of their participation in previous tasks. Subsequently they were left alone and watched a short UNICEF movie about a girl in Bangladesh who had to work in a stone pit and therefore could not go to school. The movie was presented as a means to raise money to help the girl go to school. When the movie ended, the children were asked by a voice-over and by a text on the computer screen whether they wanted to donate money to the charity via a money box that was placed in front of them. The money box contained several other coins, to enhance the credibility. Though not the focus of the current study, for a random half of the children a video-fragment followed after the movie that showed a probe of a same-sex peer in the same research setting donating money to the charity. Children were left alone for the duration of the movie and for the 30 seconds immediately following the movie.

The amount of donated money was counted by the experimenter after the session, in absence of the child. At the end of the study, the total amount of donated money was transferred to UNICEF.

Money donations were not normally distributed, but showed multiple peaks in the distribution. Therefore we distinguished four categories: donated nothing (0 coins; n = 27), donated less than half (1-9 coins; n = 76), donated half or more than half (10-19 coins; n = 34), donated everything (20 coins; n = 26).

Covariates. Gender, age at MRI scanning, version of the donating task and IQ were included in all analyses as covariates. IQ was assessed at age 6 using Mosaics and Categories, two subtests from the Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams, & Laros, 2005). Other covariates (educational level of the mother, income, parity, total brain volume, and handedness) were included when they generated a 5% change in predictor effect estimate. Data on educational level of the mother was assessed when the children were 6 years of age using a questionnaire, and missing data were replaced by data from an earlier assessment. Educational level was divided into the categories only secondary and higher education. Income and parity were assessed using a questionnaire at age 6. In 11 cases, data on income was missing. For four children, missing values could be replaced by an earlier measure of income (at birth). In the remaining seven children, missing values were replaced by the mean income category (€4,000-4,800 per month). Due to moderate skewness, this variable was square root transformed and reflected to approach normality (Tabachnik & Fidell, 2007). Data on parity was missing for six children. Missing values were replaced by an earlier measure of parity (at birth). Total brain volume (TBV) was measured at the same time as cortical thickness, using a T_1-weighted scan (see below). Handedness was measured after the scanning session using the Edinburgh Handedness Inventory (Oldfield, 1971).

MR-Image acquisition. An extensive description of the (f)MRI data collection procedure is given elsewhere (White et al., 2013). In brief, before being scanned, children were familiarized with the scan environment in a mock scanning session. MRI data collection took place on a 3 Tesla scanner (General Electric Discovery MR750, Milwaukee, MI, USA) using an 8-channel head coil for signal reception. T_1-weighted inversion recovery fast spoiled gradient recalled (IR-FSPGR) sequence was obtained with the following parameters:

TR = 10.3 ms, TE = 4.2 ms, TI = 350 ms, NEX = 1, flip angle = 16°, readout bandwidth = 20.8 kHz, matrix 256 × 256, imaging acceleration factor of 2, and an isotropic resolution of 0.9 × 0.9 × 0.9 mm^3.

Echo planar imaging was used for the resting state fMRI session with the following parameters: TR = 2000 ms, TE = 30 ms, flip angle = 85°, matrix = 64 x 64, FOV = 230 mm x 230 mm, slice thickness = 4 mm. A total of 160 volumes (acquisition time = 5min 20 seconds) were collected for the functional connectivity analyses, which has been shown to have adequate time to provide stable resting-state networks (White et al., 2014). During the structural MRI acquisition, children were allowed to watch a movie or listen to music. For the resting state fMRI scan, children were asked to keep their eyes closed and not to think about anything in particular.

Image processing

Preprocessing structural data. *Cortical reconstruction and volumetric segmentation was* performed with the Freesurfer image analysis suite (http://surfer.nmr.mgh.harvard.edu/). The technical details of these procedures are described in prior publications (Dale, Fischl, & Sereno, 1999; Jovichich et al., 2006; Reuter, Schmansky, Rosas, & Fischl, 2012). Briefly, this process included the removal of non-brain tissue, automated Talairach transformation into standard space, intensity normalization, tessellation of the gray/white matter boundary, automated topology correction, and surface deformation. Once the cortical models were complete, the images underwent surface inflation (Fischl, Sereno, & Dale, 1999), registration to a spherical atlas (Fischl, Sereno, Tootell, & Dale, 1999), and the parcellation of the cerebral cortex into units based on gyral and sulcal structure (Desikan et al., 2006). Cortical thickness was calculated as the closest distance from the gray/white boundary to the gray/CSF boundary at each vertex on the tessellated surface (Fischl & Dale, 2000). The thickness map was smoothed with a 10 mm full-width half-maximum Gaussian kernel prior to the surface based analyses. Several studies using Freesurfer in typical and atypical developing school-age children are available (El Marroun et al., 2014; Juuhl-Langseth et al., 2012). Cortical segmentation of the anterior part of the temporal lobes in Freesurfer can be unreliable where small regions of grey matter are excluded from the cortical thickness measure. This is a problem that has been previously reported by a number of users of the software. As the cortical thickness in this region is unreliable, any findings in this region of the brain will be ignored.

Preprocessing resting state fMRI data. Resting state fMRI data were preprocessed using a combination of tools from the Analysis of Functional NeuroImages package (AFNI) (Cox, 1996), the Functional MRI of the Brain Software Library (FSL) (Jenkinson, Beckmann, Behrens, Woolrich, & Smith, 2012), and in-house software written in Python. Preprocessing of the resting state fMRI included slice-timing correction, motion correction, removing the first four volumes, and applying a high-pass temporal filter at a frequency of 0.01Hz. Next, the six motion correction parameters, the mean white matter signal, and mean cerebral spinal fluid (CSF) signal were regressed out of each voxel's time course (Fox, Zhang, Snyder, & Raichle, 2009). Finally, in order to further ameliorate the impact of motion, the FSL motion outlier tool was used to compute the "DVARS" metric (Power, Barnes, Snyder, Schlaggar, & Petersen, 2012).

Volumes which were flagged as having increased motion were scrubbed from the time series data (Power et al., 2012). Even with the scrubbing procedure, data severely corrupted by motion are not suitable for analysis and thus any subjects with greater than 0.5 mm relative root mean square motion were excluded altogether. Using a two-step approach, resting state fMRI datasets were then aligned to a study specific child template created according to the method described by (Muetzel et al., *in press*). For registration to the template, the resting state fMRI datasets were first aligned to their respective T_1-weighted image, using a 6 degrees of freedom linear transformation. Then, the T_1-weighted image was aligned to the child template using a 12 degrees of freedom affine transformation.

Image quality

The rating of the structural MR-image quality involved two steps. First, raw images were visually checked at the scan site for movement or other artifacts. Image quality was rated on a 6-point scale (usable, poor, fair, good, very good, excellent). Second, after the image was processed through the Freesurfer pipeline, a visual inspection of the segmentation quality took place and all images were rated on a 7-point scale (not reconstructed, poor, fair, sufficient, good, very good, excellent). Images rated as unusable or poor at the scan site, images that could not be processed by Freesurfer, and images with a poor segmentation quality were excluded from the analyses. For the resting state fMRI images, the subjects with major registration problems, excessive motion, or incomplete data were excluded.

Data analysis

Chi-square tests, *t*-tests, and analysis of variance were used for non-response analyses and analyses on demographic characteristics of the sample. A data-driven vertex-wise GLM analysis of cortical thickness and donatingbehavior was performed across the entire cortex using Freesurfer's Qdec (www.surfer.nmr.mgh.harvard.edu). Age, gender, IQ, and version of the donating task were used as covariates in this whole-brain surface-based analysis. Monte Carlo Null-Z Simulation analyses using 10,000 iterations ($p < .05$) was used to correct for the effect of multiple comparisons. In addition, a moderation effect of gender on the relation between cortical thickness and donating was tested in Qdec. For significant clusters, mean cortical thickness was extracted for each participant and exported to SPSS 21.0. Then, linear regression models including additional covariates were run to further investigate the association between donating behavior and cortical thickness.

To co-register cortical thickness clusters with the resting state data and obtain region-specific time-series of the clusters, the surface-based cluster from Freesurfer was first converted into a 3D nifti volume for each individual. The Freesurfer template brain was aligned to the study specific child template. The resulting transformation matrix was applied to the cluster volume, resulting in the morphologically defined clusters being coregistred to all functional datasets. Whole brain functional connectivity of the cluster was assessed with FSL FEAT (FMRI Expert Analysis Tool) in FSL (FMRIB's Software Libray; Smith et al., 2004), using general linear model (GLM) at the single-subject level. The time-series of the cluster (obtained using the FSL tool fslmeants) was used as the design matrix without convolution with a HRF. This resulted in subject-level, whole-brain maps representing the connectivity between the morphological clusters and the rest of the brain. These whole-brain, subject-level maps were then supplied to higher-level analyses to test for group differences in connectivity using FSL's FLAME I module (FMRIB's local analysis of mixed effects). In a similar fashion we tested whether there is any evidence for a gender specific association between donating behavior and whole brain functional connectivity per cluster. The statistical maps were thresholded using clusters determined by $Z > 2.3$ and a cluster corrected significance threshold of $p < .05$. An ANCOVA design was utilized, with donating behavior as the independent variable and analyses were adjusted for age, gender, IQ, and version of the donating task. All variables were centered.

In case we observed associations between donating and several cortical thickness clusters, functional connectivity between these clusters was computed using the average correlation between the time-series of one of the clusters (the seed cluster) and the voxels of the other cluster(s) in FSL's Featquery. The resulting mean z-scores were used as a predictor of donating behavior in linear regression models including age, gender, IQ, and version of the donating task as covariates. We tested the change in predictor effect estimate for the same covariates as selected for the structural analyses (except TBV) and included those covariates that caused ≥ 5% change.

Results

Univariate associations

We tested whether the amount of donated money was dependent on (prosocial, antisocial, or typical) group membership and version of the task (with or without probe). The three groups did not differ on the amount of donated coins, $F(2, 160) = 0.39$, $p = .676$, partial $\eta^2 = .01$. Therefore, group membership was not taken into account in further analyses. However, children who saw a same-sex peer donating money to the charity donated more coins than children who did not watch the probe, $t(161) = -2.50$, $p = .013$, Cohen's $d = -0.39$. To control for this difference, we included the version of the donating task as a confounder in further analyses.

Association between cortical thicknessand donating behavior

Analyses in Qdec revealed three significant clusters in the right hemisphere after Monte Carlo correction for multiple testing (***FIGURE 5.1***). The first cluster was located in regions overlapping with the lateral orbitofrontal cortex (lOFC) and pars orbitalis. The second cluster covered parts of the precentral and postcentral cortex. For cluster statistics and coordinates see **TABLE 5.2**. An additional cluster was found in the anterior part of the temporal lobe. The results of this cluster are however not reported, because of concerns with the reliability in the measurement (see Image processing). Gender did not moderate the relation between cortical thickness and donating behavior. Correlations between all variables in the models, including both clusters, are reported in **TABLE 5.3**.

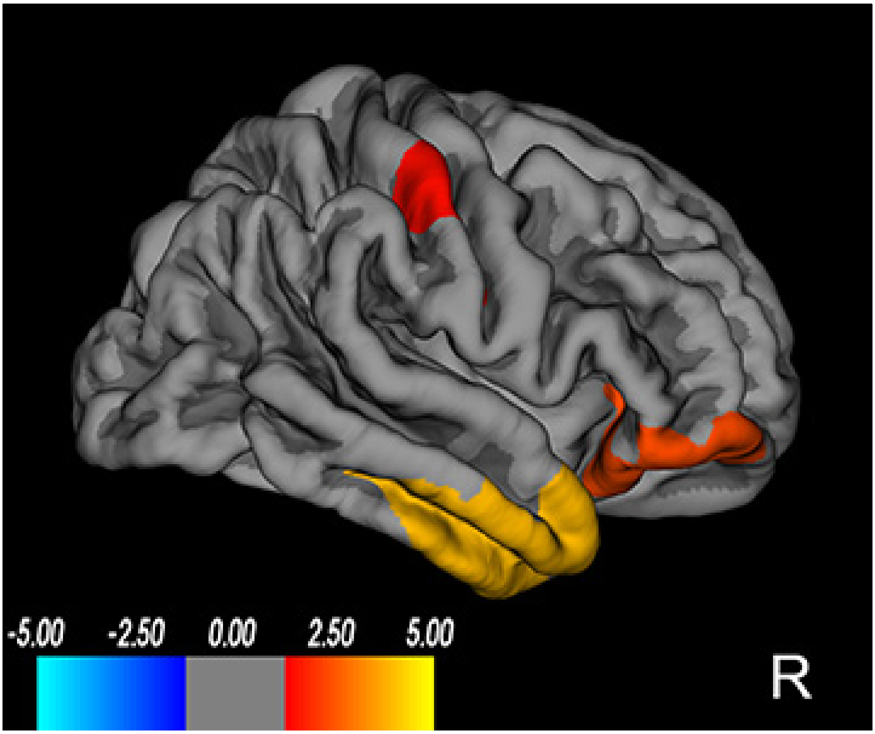

FIGURE 5.1
Cortical thickness clusters in the right hemisphere associated with donating, corrected for age, gender, IQ, and version of the donating task and Monte Carlo correction for multiple testing (p < .05). Colors represent – log10 p-value. R = right hemisphere. N = 163.

TABLE 5.2
Cortical Thickness Clusters Related to Donating Behavior

Cluster	Cluster size (mm2)	Talairach coordinates			No. of vertices within cluster	Clusterwise *p*-value
		TalX	TalY	TalZ		
lOFC/pars orbitalis (RH)	1229.08	33.2	51.0	-11.6	1976	.0040
Pre-/postcentral (RH)	913.78	46.3	-14.1	32.0	2252	.0313

N = 163
Note. Analyses were corrected for age, gender, IQ, and version of the donating task. An additional cluster was found in the anterior part of the temporal lobe. The results of this cluster are however not reported due to reasons mentioned in the Methods section.

To control for the effect of potential confounding covariates and to estimate the effect size of each cluster, we performed linear regression analyses in SPSS 21.0, predicting donating behavior from the two clusters in separate models. The baseline adjusted analysis (adjusted for age, gender, IQ, version of the donating task) revealed an association between cortical thickness in the lOFC/pars orbitalis cluster and donating,

TABLE 5.3
Correlations Between Variables in the Cortical Thickness Model

	1.[a]	2.	3.	4.	5.	6.
1. Donating[a]	-					
2. lOFC/pars orbitalis	.28***					
3. Pre-/postcentral	.34***	.32***				
4. Age	.14	-.06	-.05			
5. Gender[b]	.04	.03	.10	-.03		
6. IQ	.04	-.08	.04	-.07	-.04	
7. Total brain volume	.14	.27**	.09	.07	-.37***	.20*

N = 163
Note. Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable respectively. lOFC = lateral orbitofrontal cortex.
[a]Partial correlations: controlled for version of the donating task
[b]Gender is coded as 0 (boy) and 1 (girl).
*$p < .05$, **$p < .01$, ***$p < .001$.

B = 1.14 (95% CI 0.57-1.71), β = .30, $p < .001$. The association between cortical thickness in the lOFC/pars orbitalis cluster and donating remained comparable in size, B = 1.07 (95% CI 0.47-1.68), β = .34, $p = .001$, after additionally including total brain volume as a covariate (no other covariate caused an effect estimate change ≥ 5%). The baseline adjusted analysis (adjusted for age, gender, IQ, version of the donating task) also revealed an association between cortical thickness in the pre-/postcentral cluster and donating, B = 1.65 (95% CI 0.95-2.36), β = .34, $p <$ .001. None of the covariates accounted for a 5% change in the predictor effect estimate. Version of the donating task did not moderate the relation between donating and cortical thickness of the two clusters.

Association between resting state, functional connectivity and donating behavior

Due to more pronounced susceptibility artifacts in some of the children, the lOFC/pars orbitalis cluster extracted from the cortical thickness analysis did not completely overlap with the resting state image. Therefore, we excluded all children with < 90% overlapping data between the FreeSurfer based cluster and their mean resting state fMRI image (n = 4), resulting in a final sample of 126 children for the resting state analysis. To correct for differences in the amount of overlap, we included the percentage of overlap (range 90%-100%) as a covariate in all models.

There was no association between donating behavior and resting state functional connectivity of the lOFC/pars orbitalis cluster to any region of the brain, corrected for age, gender, IQ, version of the donating task, and percentage overlap for the lOFC/pars orbitalis cluster. Also, the pre-/postcentral cluster did not show resting state functional connectivity to any region of the brain associated with donating behavior, corrected for age, gender, IQ, and version of the donating task. Gender did not moderate these results. The partial correlation between the connectivity of the two clusters and donating was $R = .06$, $p = .503$, corrected for version of the donating task. In the baseline adjusted hierarchical regression analysis (adjusted for age, gender, IQ, version of the donating task, and percentage overlap lOFC/pars orbitalis cluster) connectivity between the two clusters and donating behavior were not associated, $B = 0.03$ (95% CI -0.06 – 0.12), $\beta = .05$, $p = .554$. Education of the mother, income, and handedness affected the effect estimate ≥ 5% and were therefore included in the model. Again, no effect of connectivity between the two clusters on donating behavior emerged, $B = 0.03$ (95% CI -0.06 – 0.12), $\beta = .06$, $p = .496$. Gender did not moderate the relation between connectivity of the two clusters and donating.

Discussion

The current study examined the neurobiological correlates of donating behavior in middle childhood. A thicker cortex in a cluster covering regions of the right lateral orbitofrontal cortex and pars orbitalis and in a cluster comprising parts of the right pre- and postcentral cortex was related to higher donations. No gender differences in the association between cortical thickness and donating behavior were found. Whole brain resting state functional connectivity with the lOFC/pars orbitalis and the pre-/postcentral cluster was not associated with donating behavior. Furthermore, resting state functional connectivity between these two clusters was not associated with donating behavior. Lastly, there was no moderating effect of gender.

The current study focused on donating behavior, an altruistic type of prosocial behavior as one has to give up something without expecting anything in return. While several studies examined the association between brain function and donating, we are the first to show that variance in children's donating behavior is associated to a measure of brain morphology, namely cortical thickness. Several studies report donating behavior to be largely influenced by situational factors (e.g. Van IJzendoorn et al., 2010; Van IJzendoorn & Bakermans-Kranenburg, 2014), the current results however suggest that part of the variance in donating behavior can be explained by characteristics inherent to the child. This is in line with the finding that there is consistency to costly prosocial behavior (Gneezy et al., 2012).

The presence of neuroanatomical correlates of donating behavior is in line with a study on a partly overlapping sample, showing an association between cortical thickness and the broad construct of prosocial behavior as measured by parent-reports. In a frontal cluster covering parts of the left superior frontal and rostral middle frontal cortex, a thicker cortex was associated with higher levels of prosocial behavior (Thijssen et al., 2015). As this cluster does not overlap with the current results, the findings suggest that different types of prosocial behavior might have distinct neurobiological correlates. This is consistent with a study in infants showing distinct neural activation patterns for specific types of prosocial behaviors (helping and comforting) (Paulus et al., 2013).

In the current study we found no association in resting state functional connectivity between the two morphological clusters and donating behavior, suggesting that these clusters do not share a functional organization related to donating behavior. Independent mechanisms seem to play a role in donating to a charity. Further, we did not find an association between donating behavior and resting state functional connectivity of the two clusters with the rest of the brain. As donating to a charity is a complex task, possibly involving multiple cognitive and affective abilities (e.g. Aguilar-Pardo, Martínez-Arias, & Colmenares, 2013; Krevans & Gibbs, 1996), the lack of an association between our task and resting state functional connectivity between these clusters might suggest that these clusters represent different underlying mechanisms of donating behavior, which do not work in close cooperation when it involves donating. The lack of connectivity related to donating behavior could also be due to the fact that we had to limit our resting state fMRI analyses to the clusters emerging in our structural analyses, due to limited statistical power. As a result, we may have missed connections between brain regions for which connectivity might play a role in donating behavior.

Previous studies, mainly on task-based brain activity, reported on the lOFC/pars orbitalis and the pre-/postcentral to be involved in several types of emotional and social behavior and cognition, which might reflect the different mechanisms underlying donating behavior. Prior work has shown that activity in the lOFC was associated with participants withholding donations because they felt the cause was unjust (Moll et al., 2006). Furthermore, the (l)OFC has been implicated in the processing of rewards, such as money (Izuma, Saito, & Sadato, 2008; Kringelbach, 2005; Sescousse, Redouté, & Dreher, 2010) and processing threats of punishment (Kringelbach & Rolls, 2004; O'Doherty, Kringelbach, Rolls, Hornak, & Andrews, 2001). Such activity is suggested to lead to changes in emotional and social behavior (O'Doherty et al., 2001). Activity in the lOFC was also found to prevent involvement in inappropriate behavior (Berthoz, Armony, Blair & Dolan, 2002), and adults with damage to the OFC lack the awareness of social norm violation (Beer, John, Scabini, & Knight, 2006).

The pars orbitalis, also part of the prefrontal cluster, has been associated with empathy. Intentionally and passively empathizing increased brain activity in this region, as compared to a control (cognitive load) condition (Rameson, Morelli, & Lieberman, 2012). Further, the pars orbitalis is part of a network associated with empathy for pain experienced by others (Lamm, Decety, & Singer, 2011). Moreover, the pars orbitalis is involved in decisions about moral dilemmas, and in interpersonal guilt after causing harm to another person (Majdandžić et al., 2012; Yu, Hu, Hu, & Zhou, 2014).

An association between brain activity and empathy, as well as mentalizing, was also found for the regions comprising our second cluster, the pre- and postcentral cortex (Decety, Michalska, & Akitsuki, 2008; Lombardo et al., 2009). More specifically, the precentral cortex was found to be associated with affective empathy, such as feeling sympathy, and the postcentral cortex to cognitive empathy, such as perspective taking (Hooker, Verosky, Germine, Knight, & D'Esposito, 2010). The pre- and postcentral cortex are also involved in emotion processing and self-reported social skills (Ferri et al., 2013; Lawrence et al., 2006; Ruby & Decety, 2004). The involvement of these brain areas in social behaviors and cognitions is thought to be related to the presence of the mirror neuron system in these regions (e.g. Beyer, Münte, & Krämer, 2014). Mirror neurons, involved in the understanding of actions of others, are found in the pre- and postcentral region (Dushanova & Donoghue, 2010; Rizzolatti & Craighero, 2004). Lastly, the precentral gyrus was found to be active during costly donations in adults (Telzer, Fuligni, Lieberman, & Galván, 2013).

We found cortical thickness clusters in the right hemisphere related to donating behavior. The fact that we did not find clusters in the left hemisphere does not imply that similar regions on the left side are not involved in donating behavior. For example, for the OFC it was not the hemispheric distinction, but rather the lateral and medial areas of the OFC that showed differential effects in a study on reward and punishment (O'Doherty et al., 2001). In larger samples, similar brain areas in the left hemisphere might be identified. Furthermore, we did not find an effect of gender on the association between cortical thickness and donating behavior, whereas gender moderated the association between cortical thickness and parent-reported prosocial behavior (Thijssen et al., 2015). This discrepancy might be due to the different measures and types of prosocial behavior involved, or to the smaller sample size of the present study. Moreover, there was no association between gender and donating behavior (partial $R = .04$, $p = .601$) in the current study.

Several limitations should be mentioned. As we studied donating behavior and structural brain measures at the same time, we cannot infer any causal relation between these constructs and the direction of effects remains uncertain. While we suggest that brain morphology might influence donating behavior of the child, the reverse effect cannot be excluded. However, the current results provide important information in light of the paucity of studies exploring the neurobiological correlates of donating behavior in children. Furthermore, we based the functional interpretation of our structural findings mostly on studies involving brain *activity* related to several behavioral and cognitive constructs. As the relation between brain function and structure is only rarely studied (Sui, Huster, Yu, Segall, & Calhoun, 2014), such interpretations remain speculative. Besides, the cortical clusters found in the current study have been associated to a variety of cognitive and behavioral outcomes and reverse inference cannot be excluded. Lastly, we identified a third cluster in the right temporal lobe for which a thicker cortex was related to higher donations, but we could not interpret this finding due to concerns about the accuracy of surface segmentation in this area. Future studies with different MRI approaches are needed to assess this region in relation to donating behavior.

In sum, we identified two clusters, covering parts of the lOFC/pars orbitalis and the pre-/postcentral cortex, in which a thicker cortex was related to children's willingness to share or even give up their well-deserved monetary resources. This indicates that donating to a charity is not only dependent upon the specifics of the situation, but also on child characteristics. The pertinent effect was found in regions that have previously been associated with social norm compliance and the processing of threats of punishment. The locations of these clusters have also been implicated in several forms of empathy and being able to understand the actions of others. As donating behavior was not associated with resting state functional connectivity between the lOFC/pars orbitalis and the pre-/postcentral cluster, these two clusters might indicate distinct underlying mechanisms of donating behavior.

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Chapter 6

General discussion

General discussion

This thesis examined the dispositional and situational correlates of prosocial and antisocial behavior in children. In Chapter 2, three trajectories of parent-reported aggression were distinguished, and were shown to be associated with several types of antisocial behavior at school. However, the trajectories did not show incremental predictive validity in explaining antisocial behavior at school as compared to a single time point measure of aggression. The results in Chapter 3 indicate that donating behavior is influenced by characteristics of the situation, but the effect of the situation may depend on characteristics of the child. In Chapter 4 we found no dispositional or situational correlates of bystander behavior during a virtual social exclusion game. Other situational or dispositional factors than the ones measured in our study might have played a role. In Chapter 5 we showed that donating behavior is not only dependent on the situation, but may also have an identifiable neuroanatomical basis. In the following sections, the findings from these chapters will be reviewed. Limitations and directions for future research will be discussed.

The effect of the situation on prosocial and antisocial behavior

This thesis showed that both prosocial and antisocial behavior are dependent on the situation. In Chapter 3 we found that donating behavior in children was predicted by a situational effect: donations were higher for children who observed a moral exemplar of a donating peer. Donating behavior in children had earlier been shown to be affected by a situational factor: the encouragement of a researcher to donate (Van IJzendoorn, Bakermans -Kranenburg, Pannebakker, & Out, 2010). The current study shows that even a more subtle and less intrusive situational factor, modelling of prosocial behavior in a film clip instead of being probed in real life (and thus observed) by an adult, can substantially increase donations in middle childhood.

Earlier studies (in adults) also showed effects of modelling on prosocial behavior. Being confronted with donations of others increased charitable giving among students (Frey & Meier, 2004). Witnessing someone picking up garbage from the ground decreased littering among people who found a handbill attached to the windshield of their car (Kallgren, Reno, & Cialdini, 2000). Also, seeing someone else offering help to a victim of an accident increased helping among bystanders (Wilson & Petruska, 1984) and reading about or seeing moral virtuous behavior by others in a video clip also led to an increase in donations (Freeman, Aquino, & McFerran, 2009). A moral exemplar can thus bring about the good in people, possibly because modelling causes a state of moral elevation, can provide an example on how to act in (new) situations, or because individuals want to adhere to social norms (Bandura, 1977; Freeman et al., 2009; Kallgren et al., 2000).

Familiarity of a victim can also increase prosocial behavior. Closeness to a victim of bullying increases prosocial behavior in a bullying situation (Oh & Hazler, 2009) and children more often support friends in conflicts (Chaux, 2005). However, in Chapter 4 the effect of familiarity on prosocial defending behavior during the Prosocial Cyberball Game (PCG) was absent. Although children varied greatly in their response to social exclusion of another person, their bystander responses were independent of the familiarity with the victim. Yet, some children became more prosocial whereas others became more antisocial or showed stable levels of their behavior over the two conditions in Chapter 4. Other situational factors than the one measured might have influenced these divergent patterns. For example, modelling could also have affected the behavior of some participants. Speculatively, the bullies might have served as a model to some children, overriding the effects of familiarity of the excluded victim, resulting in the absence of prosocial compensating behavior. Affiliation with antisocial peers was indeed found to increase adolescents' antisocial behavior (Monahan, Steinberg, & Cauffman, 2009). Bystander behavior might thus partly depend on situational modelling. Other participants might however been more strongly affected by the presence of an (familiar) adult.

The lack of association between defender behavior during the PCG and donating behavior, and between these two paradigms and the prosocial group, to which some children belonged according to the high prosociality ratings by their parents, may also demonstrate the situational dependency of prosocial behavior. Whether children donate to a good cause, defend a victim from bullying, or are rated by their parents as high on prosocial (and low on antisocial behavior) seems independent of each other, which makes it less likely that these distinct forms of prosocial behavior have an underlying prosocial trait. This leaves room for situational factors to play a role. The absence of associations is congruent with the finding that several other prosocial behaviors (helping, sharing, and comforting) are not related either (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011) and that the underlying motivations of various prosocial behaviors can differ greatly (Eisenberg & Spinrad, 2014).

Although less often discussed and studied, antisocial behavior can also be a state, dependent on the situation. In a review, Zimbardo (2004) demonstrates through examples such as the Stanford prison experiment (Zimbardo, Maslach, & Haney, 2000) and the Milgram experiments (Milgram, 1974) that situational factors can influence people to act more antisocial than would be predicted from their personal characteristics. Also, violent video games are thought to enhance aggression and state hostility (Anderson & Carnagey, 2009; Anderson & Ford, 1986). In Chapter 2 we showed that, although significantly associated, the agreement of parent and teacher report on antisocial behavior was low. Even though these reporters are not completely bound to one setting, this result may implicate that children act differently at home and at school. Apart from informant characteristics and perspective, situational dependency is suggested as an important factor influencing discrepancies between raters (Dirks, De Los Reyes, Briggs-Gowan, Cella, & Wakschlag, 2012). Such situational variability of children's antisocial behavior and corresponding discrepancies between parent and teacher ratings of such behavior was also found in another study (De Los Reyes, Henry, Tolan, & Wakschlag, 2009). If the rater discrepancy in the current study is indeed due to situational dependency of aggression, we still do not know what situational factors might have influenced the discrepancy between parent and teacher reports in Chapter 2. Speculatively, children can be influenced by antisocial peers at school (Monahan et al., 2009), whereas siblings or parents can be antisocial models at home (Snyder, Bank, & Burraston, 2005; Sousa et al., 2011). The results of Chapter 4 might converge with the idea of antisocial behavior being (partly) situationally driven. No dispositional factors could be identified that distinguish children who joined in with bullying from those who acted as passive bystanders. Yet, children did show changes in bystander behavior across the two conditions, which illustrates the somewhat volatile nature of children's behavior in the PCG.

Dispositional correlates of prosocial and antisocial behavior

While the results of Chapter 2, 3, and 4 might provide support for the hypothesis of situational influences on both prosocial and antisocial behavior, the results of Chapter 5 indicate that donating behavior also has neuroanatomical correlates, implying that prosocial behavior is not only situationally determined. A thicker cortex in the lateral orbitofrontal/pars orbitalis and the pre-/postcentral was associated with higher donations. Although the cortex changes over time (Gogtay et al., 2004; Sowell et al., 2004), such changes are relatively slow. The neuroanatomical correlate may thus indicate that donating behavior is also a result of dispositional factors. However, we must be cautious with drawing causal inferences, as behavior can also influence brain structure. For example, learning how to juggle over the course of three months resulted in an increase in grey matter in several areas of the brain (Draganski et al., 2004). Still, even when prosocial behavior would affect a child's neuroanatomy, this would be a long-term and potentially transactional process, showing that prosocial behavior is more present in some children than others.

Many other studies report on dispositional factors such as perspective taking, internalized moral reasoning, and empathy associated with prosocial behavior (e.g. Batson & Ahmad, 2001; Carlo & Randall, 2002), implying that prosocial behavior stems from a trait. Furthermore, teacher-reported prosocial behavior remained stable from middle childhood to adolescence (Flynn, Ehrenreich, Beron, & Underwood, 2015). Studies on whether prosocial behavior also has a genetic component show mixed results so far (e.g. Knafo-Noam, Uzefovsky, Israel, Davidov, & Zahn-Waxler, 2015; Krueger, Hicks, & McGue, 2001). Prosocial behavior may be a mixed bag of various traits and states that if incorporated in one phenotype may elude consistent genetic or personality-related explanations.

A dispositional dimension of antisocial behavior was found in Chapter 2. Children with high levels of parent-reported aggression showed higher levels of antisocial behavior at school, as compared to children with lower aggression levels according to their parents. For some children, antisocial behavior thus shows pervasive forms across settings. We also found a stable trajectory of intermediate levels of aggressive behavior over time, which also implies that children in this trajectory show similar levels of aggressive behavior over time. These results converge with other studies that show that antisocial behavior can be a stable and heritable trait (e.g. Porsch et al., 2016).

The interplay of dispositional and situational factors

We found both dispositional and situational factors associated with prosocial behavior. In Chapter 3 we also showed the interplay of such factors on prosocial behavior. Anxious children and children with less social responsiveness problems were more affected by the moral exemplar, and donated more after seeing the donating peer than less anxious children and children with higher levels of social responsiveness problems. In absence of the moral exemplar, anxious children donated less money than their less anxious peers. Anxiety and social responsiveness thus influence a child's sensitivity to situational demands. Whether this also holds for other dispositional factors is not examined in the current study. However, others found that, for example, being observed increased prosocial behavior in people with a high need for approval or high public self-awareness, but not for people lower on these traits (Pfattheicher & Keller, 2015; Van Rompay, Vonk, & Fransen, 2008). These studies showed a similar interplay for different dispositional *and* situational factors on prosocial behavior. We however did not find dispositional factors that influenced the sensitivity to the effect of familiarity of the excluded player on bystander behavior in Chapter 4.

The current set of studies shows both dispositional and situational influences on prosocial and antisocial behavior. As described above, they can have interactive effects, but this does not explain the finding of dispositional and situational main effects on prosocial and antisocial behavior, as reported in many studies (e.g. Batson & Ahmad, 2001; Van IJzendoorn et al., 2010). A likely explanation might be that dispositional factors are of major influence on prosocial and antisocial behavior when situational factors are absent or weak. But, when robust situational factors are present, they may largely override the effects of dispositional factors. For example, personal responsibility of a child was of influence on prosocial behavior, but only when peer pressure was low. When perceived peer pressure was high, children showed high levels of prosocial behavior, independent of their levels of personal responsibility (Pozzoli & Gini, 2010). Also, when people were socially excluded, their empathy levels were much lower than those of not-excluded participants, and in turn they showed lower levels of prosocial behavior (Twenge, Baumeister, DeWall , Ciarocco, & Bartels, 2007).

Associations between prosocial and antisocial behavior

We did not find associations between prosocial and antisocial behavior in this thesis. In Chapter 3 and 4 the high increasing aggression trajectory (Chapter 2) was not associated with donating or defending behavior. Furthermore, the prosocial group in the low aggression trajectory did not show lower levels of complicit bystander behavior in Chapter 4. However, in the sample used for Chapter 3, 4, and 5 higher prosocial scores on the Strength and Difficulties Questionnaire (Goodman, 1997) were associated with lower parent-reported aggression on the Child Behavior Checklist both measured at age 6 (Achenbach & Rescorla, 2000; $R = -.48$, $p < .001$). Although, other studies report on children with both high levels of antisocial and low levels of prosocial behavior as well (Flynn et al., 2015; Kokko, Tremblay, Lacourse, Nagin, & Vitaro, 2006; Nantel-Vivier, Pihl, Côté, & Tremblay, 2014), the association in the current thesis might be (partly) a result of our selection process: all children selected for the prosocial group were screened for low parent-reported aggression levels, and the aggressive group consisted of children with relatively high levels of aggression, which must have inflated the correlation. Also, common method variance might have led to a stronger association, as both questionnaires were parent reports, assessed at the same moment in time.

Speculatively, associations between the broad constructs of prosocial and antisocial behavior, measured with questionnaires, might be stronger than associations with specific types of observed prosocial or antisocial behavior, such as donating or bystander behavior during social exclusion. Specific types of prosocial and antisocial behavior might be more situationally determined than global measures, resulting in the absence of associations with trait-like personality measures. For example, specific, in behavior-genetics studies observed types of prosocial behavior showed a smaller heritable component than broad constructs of prosocial behavior measured with a questionnaire (Fortuna & Knafo, 2014).

Methodological considerations

The Generation R study and sample. The current thesis was embedded within the Generation R Study, a population-based prospective cohort from early fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2012;

Tiemeier et al., 2012). This provided us with measures on child behavior, cognition, parenting, and socioeconomic factors from the prenatal phase up to the age of 8. For example, repeated measurements of child aggressive behavior were available between the age of 1.5 and 6, which enabled us to model developmental trajectories of early childhood aggression, see Chapter 2. These trajectories combined with measures of parent-reported prosocial behavior were then used for the sample selection in Chapter 3, 4, and 5. With this smaller sample we were able to obtain more in depth measures of prosocial and antisocial behavior, as well as to collect extensive neuroimaging data. Especially the prevalence of antisocial behavior in population based studies is relatively low (e.g. Baillargeon et al., 2007). By selecting children with high levels of aggressive behavior on the one hand and children with high prosocial scores on the other hand, we obtained large variation in such behavior and skewness of the variables was reduced. Thereby, we maximized the change of finding replicable associations between precursors of prosocial and antisocial behavior. This selection of course might imply that prevalences of and associations with prosocial and antisocial behavior found in the studies reported in the current thesis diverge from associations in the population. As a result of the oversampling, associations found in Chapter 3 and 5 might be stronger than in the population. Furthermore, the small increase in prosocial defender behavior from the fair to the unfair phase in the PCG in Chapter 4 might have been a result of the sampling method. The overrepresentation of antisocial children might have resulted in lower average compensating levels than reported in other studies (e.g. Vrijhof et al., 2016).

Measurement of prosocial behavior. Many studies rely onself- or other reports of prosocial behavior (e.g. Kokko et al., 2006; Viding, Simmonds, Petrides, & Frederickson, 2009). Such questionnaires often measure global prosocial behavior covering a wide range of prosocial acts, for example, helping, comforting, and sharing (Goodman, 1997; Kokko et al., 2006). However, prosocial behavior is a multidimensional construct (Padilla-Walker & Carlo, 2014), including behaviors which are not necessarily correlated (e.g. Dunfield et al., 2011). Furthermore, self-reports of prosocial behavior often diverge from prosocial acts (Bonnefon, Shariff, & Rahwan, 2016; Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). For the current thesis we made use of two observational measures of prosocial behavior. An advantage of the virtual PCG game is that we could adapt the environment of social exclusion in such a manner that we were able to manipulate the situation and observe bystander behavior. Moreover, as the money in the donating task was given away to UNICEF, children really contributed to a good cause by donating their own money. This goes beyond perceptions of one's own prosocial behavior or intentions measured using questionnaires and hypothetical prosocial dilemma's. In the end, people in need are only helped by prosocial acts that are executed, and not by intentions or perceptions of one's prosocial deeds.

An increase in costs decreases the likelihood that people will act prosocially (Bonnefon et al., 2016). As the costs of prosocial behavior in our two paradigms were high (monetary loss, reputational damage, and risk of social exclusion) it is even more remarkable that we identified children who were prosocial towards another child in need or a victim of bullying. In the donating task, some children gave up more than half or even all of their money. What made the occurrence of prosocial behavior in both paradigms even more special was that the gains of acting prosocially were low. A reputational benefit towards the excluded familiar adult could have been of influence, however, we did not observe more prosocial behavior in the familiar condition. Furthermore, donations were made in private and no (reputational) benefits could be obtained from this task. In a previous study, public prosocial behavior and private prosocial behavior were inversely related (Carlo & Randall, 2002).

Also, both the donating task and the first condition of the PCG included unknown people in need. Whereas prosocial behavior towards a familiar individual in need can be motivated by for example inclusive fitness or reciprocity (Hamilton, 1964a, 1964b; Trivers, 1971; Zhang & Epley, 2009), such effects cannot play a role with prosocial behavior towards a stranger. Last, adhering to social norms can motivate people to act prosocially (Kallgren et al., 2000). While this preference for norm adherence might have been a factor of influence for children who were confronted with the donating peer, children who were not shown such a moral exemplar donated as well. Taken together this may indicate that children's motivations to act prosocially in both paradigms were truly altruistic. Of course, feeling good about oneself following prosocial behavior could be a rewarding factor, but monetary donations were less strongly motivated by warm glow feelings than donations of time (Lilley & Slonim, 2014).

Trajectories of aggression. While the longitudinal measurement of behavior can be of great importance, in Chapter 2 we showed that it is vital to critically evaluate the additive value of approaches such as trajectory modelling, based on longitudinal data. The aggression trajectories in Chapter 2 had no added predictive validity for antisocial behavior at school as compared to a single time-point assessment of aggressive behavior. Even though many studies use a trajectory approach when examining distinct behavioral phenotypes (e.g. Campbell, Spieker, Burchinal, & Poe, 2006; Kokko et al., 2006), they do not examine what longitudinal measures add to the prediction of their outcome over and above a single assessment of their behavior of interest. Especially when behavior is stable over time, one should test what trajectories add to a prediction model, in particular when trajectories do not cross over across time.

In Chapter 2 we also demonstrated that the disagreement between reporters about levels of children's aggressive behavior was rather large. Other studies also present greater discrepancy between reports on children's antisocial behavior from distinct settings compared with reports from settings which are more alike (Achenbach, McConaughy, & Howell, 1987; Hinshaw, Han, Erhardt, & Huber, 1992). More general statements about a child's trait-like behavior should therefore stem from reports of multiple informants in various settings. This converges with Kraemer et al. (2003) who suggest that the right set of informants should be based on the settings and perspectives that influence the behavior at interest, in order to correct for rater biases. Furthermore, as parent-reported trajectories of aggression did not relate to children's observed complicit bystander behavior during the PCG (Chapter 4), it may be important to include standardized observations of a child's specific antisocial behavior, preferably in multiple settings, to complement global ratings.

Limitations

This thesis had some limitations. First, within the Generation R Study, no longitudinal measures of prosocial behavior were available. As the current study also showed a dispositional factor of prosocial behavior (Chapter 5), it would have been interesting to test the stability of prosocial behavior over time. Furthermore, the results of the current set of studies are mainly correlational, with the exception that we can infer the direction of effect with the experimentally induced situational effects in the donating paradigm and the PCG.

Although a large cohort study offers a wealth of information, we often have to rely on questionnaire data, as it is practically impossible to measure all types of behavior and cognition of interest using observations or standardized tests in such a large cohort. Questionnaire data suffer from some limitations such as a focus on more global aspects of the behavior of interest (e.g. Kokko et al., 2006), while such aspects are not always related (e.g. Dunfield et al., 2011). Also, questionnaires can have low correspondence with observed behavior, due to self-perception bias (e.g. Salmivalli et al., 1996). For example, people assume that others are more strongly biased than they are themselves on self-reports (Pronin, Gilovich, & Ross, 2004), and they credit themselves for their above-average (prosocial) intentions on questionnaires (Kruger & Gilovich, 2004). This possibly also applies to the reports of parents about their child's behavior as parents were found to report more positively about their children than did independent observers (Seifer, Sameroff, Dickstein, Schiller, & Hayden, 2004).

The sample sizes of the studies presented in Chapter 3, 4, and 5 were relatively small, which limits statistical power. The lack of power prevented us from conducting a whole brain resting state functional connectivity analysis in the study described in Chapter 5. Furthermore, a replication of the results within the same sample in Chapter 3, 4, and 5 was not possible. Nevertheless, especially for neuroimaging analyses in childhood, the sample was rather large compared to other studies, and enabled us to discover neuroanatomical correlates of donating behavior.

Recommendations for future research and interventions

Although many studies focus on the dispositional correlates of prosocial behavior, the current set of studies shows that situational factors can be of major influence as well. Future studies focusing on prosocial behavior should therefore take into account situational demands next to dispositional factors and also test for the mutual influence of dispositional and situational factors on prosocial behavior.

We studied only two types of situational factors and their influence on prosocial acts measured with a donating paradigm and the PCG . As other situational factors were also found to affect prosocial behavior (e.g. Engelmann, Herrmann, & Tomasello, 2012; Powell, Roberts, & Nettle, 2012) it should be studied whether such divergent situational factors have an equally strong influence on every type of prosocial behavior to give directions to interventions targeting increases in prosocial behavior. For example, a moral exemplar during the PCG may affect defending behavior. Whereas in the paradigm in Chapter 4 only antisocial behavior was modelled by the two bullies, prosocial defending behavior by a co-player might lead to an increase in defending behavior by children, as modelling of prosocial behavior has shown to be of influence (e.g. Kallgren et al., 2000). Also, whether some types of prosocial behavior may be more affected by situational demands and others by dispositional factors, should be subject to further research.

As prosocial and antisocial behavior were found to be unrelated in the current set of studies, but also in previous research (e.g. Krueger et al., 2001; Veenstra et al., 2008), the mere reduction of antisocial behavior does not automatically lead to an increase of prosocial behavior. Therefore, both have to be targeted in interventions aiming at a decrease in antisocial behavior as well as an increase in prosocial behavior. Furthermore, as children can show both prosocial and antisocial behavior it would be of interest which situational factor would prevail in instances where both prosocial and antisocial behavior are encouraged by different situational demands and whether such effects would be similar across children. As dispositional factors were shown to influence sensitivity to situational demands (Chapter 3), a child's response to situational factors promoting either prosocial or antisocial behavior might differ depending on their specific traits and interventions aiming to increase prosocial or decrease antisocial behavior could benefit from taking such sensitivity into account.

For both future research and interventions it would be of interest to study how situational factors that promote prosocial behavior can be implemented in real life. For example nudges, subtle changes in the environment, can already bring about changes in behavior in real life settings. By using indirect suggestions, changing social norms, and framing, people can be nudged into a certain direction (Thaler & Sunstein, 2008). For example, default options on forms are often strong nudges (Thaler & Sunstein, 2008) and implementing such options on donation forms might increase charitable giving. As shown in Chapter 3, modelling is effective to increase prosocial behavior as well and public figures could be used for modelling prosociality, as their behavior is highly visible.

Furthermore, the fact that we and others (e.g. Van IJzendoorn et al., 2010) did not find an effect of parenting on prosocial behavior, does not imply that parents are of no influence on their child's prosocial and antisocial behavior. The results of a prosocial model in Chapter 3 suggest that parents should be made aware (for example through interventions) that by setting a good example they can influence their child's prosocial behavior.

Concluding remarks

The current thesis shows that 8-year-old children are capable of acting altruistically to others in need, by helping them at high costs and without any gains. While many children act prosocially towards others, we also observed antisocial tendencies at this age, and younger. However, we could hardly identify children who consistently act prosocially or antisocially across settings, which highlights the situational dependency of these behaviors. Still, dispositional factors should not be ignored in the study of prosocial and antisocial behavior, especially since we showed that their interplay with situational factors can lead to divergent outcomes between children. Besides, a neuroanatomical correlate of donating behavior was identified, stressing that at least one type of prosocial behavior in childhood may at least partly be 'embodied'. In future studies it is important to use standardized paradigms and observations of prosocial behavior, and to be less dependent of self-reported perceptions of (intended) prosociality, as only real prosocial behaviors truly benefit others.

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Chapter 7

Supplementary material

Supplementary material
Chapter 2

Differences between the classes of physical and non-physical aggression trajectories on background variables

Physical aggression classes did not differ on maternal age, ethnicity, maternal educational level, and birth weight in all imputed datasets. Classes differed on gender, $\chi^2(2, n = 2753) = 109.92$, $p < .001$ (the range of the five imputed datasets is reported in **TABLE S2.4**), $\varphi = .20$ with more girls in the low decreasing class ($res_{adj} = 10.4$) and more boys in the intermediate ($res_{adj} = 9.2$) and high increasing class ($res_{adj} = 4.4$). Marital status of the mother differed between classes in two out of five imputed datasets $\chi^2(2, n = 2753) = 4.43\text{-}8.15$, p .017-.109, $\varphi = .04\text{-}.05$. In the datasets in which the classes differed on marital status, the high increasing class included more children of mothers without a partner ($res_{adj} = 2.2\text{-}2.5$), whereas the low decreasing class contained more mothers who were married/living together as compared to the other classes ($res_{adj} = 2.2\text{-}2.5$). Classes differed on hostility of the mother, $F(2, 2750) = 27.49$, $p < .001$, partial $\eta^2 = .02$ (the range of the five imputed datasets is reported in **TABLE S2.4**). Children in the low decreasing class ($M = 0.26$, $SE = .01$, 95% CI 0.24-0.27) had less hostile mother than the intermediate class ($M = 0.36$, $SE = .02$, 95% CI 0.33-0.38, $p < .001$, Cohen's $d = 0.31$) and the high increasing class ($M = 0.43$, $SE = .04$, 95% CI 0.0.36-0.50, $p < .001$, Cohen's $d = 0.56$). The intermediate and high increasing class did not differ on maternal hostility. Last, classes differed on parity, $\chi^2(2, n = 2753) = 7.30$, $p = .026$, $\varphi = .05$ (the range of the five imputed datasets is reported in **TABLE S2.4**). The low decreasing class contained more children without a sibling ($res_{adj} = 2.7$), whereas the intermediate class contained more children with one or more sibling ($res_{adj} = 2.4$) as compared to the other classes.

Non-physical aggression classes did not differ on maternal age, ethnicity, and birth weight in all imputed datasets. Classes differed on gender, $\chi^2(2, n = 2749) = 22.13$, $p < .001$, $\varphi = .09$ (the range of the five imputed datasets is reported in **TABLE S2.4**), with more girls in the low decreasing class ($res_{adj} = 4.5$) and more boys in the intermediate ($res_{adj} = 3.5$) and high increasing class ($res_{adj} = 2.8$). Furthermore, marital status of the mother differed between classes, $\chi^2(2, n = 2749) = 10.43$, $p = .005$, $\varphi = .06$ (the range of the five imputed datasets is reported in **TABLE S2.4**). The low decreasing class included more children of mothers who were married / living together (re-

s_{adj} = 3.2), besides the intermediate class contained more mothers without a partner (res_{adj} = 2.8) as compared to the other classes. Classes differed on hostility of the mother, $F(2, 2746) = 48.74$, $p < .001$, partial $\eta^2 = .03$ (the range of the five imputed datasets is reported in **TABLE S2.4**). Children in the high increasing class had more hostile mothers (M = 0.47, SE = .03, 95% CI 0.41-0.53) than the intermediate (M = 0.36, SE = .01, 95% CI 0.33-0.38, p = .002, Cohen's d = 0.37) and low decreasing class (M = 0.25, SE = .01, 95% CI 0.23-0.26, $p < .001$, Cohen's d = 0.73). The children in the intermediate class had more hostile mothers than the low decreasing class, $p < .001$, Cohen's d = 0.35. The classes also differed on maternal education, $\chi^2(4, n = 2749) = 12.36$, $p = .015$, $\varphi = .07$ (the range of the five imputed datasets is reported in **TABLE S2.4**). Children in the low decreasing class had more often mothers who were higher educated (res_{adj} = 3.1) and fewer with secondary education (res_{adj} = -2.6) whereas children in the intermediate class more often had mothers with none / primary (res_{adj} = 2.5) or secondary education (res_{adj} = 2.9) and less often mothers with higher education (res_{adj} = -3.4) as compared to the other classes. Last, parity differed between classes in four out of five imputed datasets $\chi^2(2, n = 2749) = 5.46\text{-}6.96$, $p = .031\text{-}.065$, $\varphi = .05$. Children in the high increasing class had more often no siblings (res_{adj} = 2.2-2.4) as compared to the other classes.

Supplementary results of five imputed datasets

In case all five imputed datasets provided significant results, we provided tables including the range of the statistics from these five datasets (**TABLE S2.4**, **S2.5,** and **S2.6**). The results of the first imputed dataset are mentioned in text. In case that the significance differed between datasets, we provided the range of the statistics in the text.

TABLE S2.1

Analysis of Covariance Relating Aggressive Behavior age 1.5, 3 and 6 to Teacher-reported Problem Behavior

	Aggression[a]		Attention[b]		Rule breaking[c]	
Model	*F*	partial η^2	*F*	partial η^2	*F*	partial η^2
Aggression[1] age 1.5	6.34*	.00	0.96	.00	3.33	.00
Aggression[1] age 3	27.40***	.01	20.02***	.01	14.04***	.01
Aggression[1] age 6	88.33 ***	.03	54.71***	.02	33.38***	.01
	Physical aggression[d]		Non-physical aggresion[e]			
Model	*F*	partial η^2	*F*	partial η^2		
Aggression[1] age 1.5	22.95***	.01	6.69*	.00		
Aggression[1] age 3	44.09***	.02	22.27***	.01		
Aggression[1] age 6	72.40***	.03	84.19***	.03		

Note. All models were adjusted for the same covariates as reported in Table 2.
[1]Aggressio*n* = total aggression in model [a,b,] and [c]. Aggressio*n* = physical aggression in model [d]. Aggressio*n* = non-physical aggression in model [e].
The results of the first imputed dataset are reported in this table. The range of the statistics over all imputed datasets is reported in Supplementary **TABLE S2.6**. When results were significant in some but not all imputed datasets, we provided the range of the statistics below. The range of all the model R^2_{adj} over the five imputed datasets are also reported below.
Model TRF rule breaking - aggression age 1.5: range $F = 2.78\text{-}5.50$, range $p = .019\text{-}.096$, all partial $\eta^2 = .00$.
[a]Effect size aggression model including covariates: 1.5 years all $R^2_{adj} = .08$; 3 years all $R^2_{adj} = .09$; 6 years all $R^2_{adj} = .11$
[b]Effect size attention model including covariates: 1.5 years all $R^2_{adj} = .14$; 3 years all $R^2_{adj} = .15$; 6 years all $R^2_{adj} = .16$
[c]Effect size rule breaking model including covariates: 1.5 years all $R^2_{adj} = .07$; 3 years all $R^2_{adj} = .08$; 6 years all $R^2_{adj} = .08$
[d]Effect size physical aggression model including covariates: 1.5 years $R^2_{adj} = .06\text{-}.07$; 3 years all $R^2_{adj} = .07$; 6 years all $R^2_{adj} = .08$
[e]Effect size non-physical aggression model including covariates: 1.5 years $R^2_{adj} = .07\text{-}.08$; 3 years all $R^2_{adj} = .08$; 6 years all $R^2_{adj} = .10$
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

TABLE S2.2

Correlations Between Outcomes, Predictors and Covariates in the Physical Aggression Model

	1.	2.	3.	4.	5.	6.	7.	8.
1. TRF physical aggression[c]								
2. Class physical aggression (intermediate)[1]	.14***							
3. Class physical aggression (high increasing)[1]	.11***	-.07***						
4. Physical aggression age 6	.20***	.56***	.66***					
5. Gender[2,a]	-.21***	-.17***	-.08***	-.18****				
6. Age TRF[c]	.07**	.01	.03	.03	-.01			
7. Time interval CBCL and TRF[b.c]	.06**	.01	.03	.03	-.01	.97***		
8. Marital status[3,b]	.08***	.03	.04	.04*	-.03	.00	-.02	
9. Probability of class assignment	-.10***	-.20***	-.03	-.14***	.06**	-.03	-.02	-.05**

$n = 2{,}753$.
Note. Pooled Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable respectively.
Pooled phi-coefficients were used for correlations between two dichotomous variables.
[1]Low decreasing class is reference category. [2]Gender is coded as 0 (boy) and 1 (girl). [3]Marital status is coded as 0 (married/living together) and 1 (no partner).
[a]Data collected prior to or at birth. [b]Data collected at age 6. [c]Data collected at age 6.5
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

TABLE S2.3

Correlations Between Outcomes, Predictors, and Covariates in the Non-physical Aggression Model

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. TRF non-physical aggression[d]												
2. Class non-physical aggression (intermediate)[1]	.11***											
3. Class non-physical aggression (high increasing)[1]	.15***	-.10***										
4. Non-physical aggression age 6	.22***	.58***	.55***									
5. Gender[2,a]	-.18***	-.07**	-.05**	-.10***								
6. Age TRF[d]	.11***	.03	.02	.03	-.01							
7. Time interval CBCL and TRF[c,d]	.10***	.03	.03	.04	-.01	.97***						
8. Education mother (low)[3,c]	.05**	.03	.02	.03	-.00	.03	.02					
9. Education mother (secondary)[3,c]	.09**	.05**	-.01	.06**	.01	.04*	.01	-.15***				
10. Marital status[c,4]	.12***	.05**	.02	.07***	-.03	.00	-.02	.06**	.11***			
11. Hostility[b]	.04*	.13***	.12***	.21***	-.01	.03	.01	.04	-.01	.09***		
12. Probability of class assignment	-.12***	-.49***	-.08***	-.39***	.06**	-.03	-.02	-.02	.06**	-.05**	-.10***	
13. Parity[d]	-.07***	-.02	-.04*	-.07**	.00	-.02	-.02	.03	-.10***	-.26***	-.02	-.02

n = 2,749.

Note. Pooled Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable respectively. Pooled phi-coefficients were used for correlations between two dichotomous variables.

[1]Low decreasing class is reference category. [2]Gender is coded as 0 (boy) and 1 (girl). [3]Higher education is reference category. [4]Marital status is coded as 0 (married/living together) and 1 (no partner). [a]Data collected prior to or at birth. [b]Data collected at age 3. [c]Data collected at age 6. [d]Data collected at age 6.5

*p < .05, **p < .01, ***p < .001.

TABLE S2.4

Range of Statistics of the Analyses on Class Differences for Total, Physical, and on-physical Aggression When all Five Imputed Datasets Showed Significant Results

Differences between classes	F / χ^2	p	partial η^2 / φ
Total aggression class membership			
Gender[a]	30.74	< .001	.11
Hostility[b]	40.42 - 47.20	< .001	.03
Physical aggression class membership			
Gender[a]	109.92	< .001	.20
Hostility[b]	26.15 - 31.98	< .001	.02
Parity[a]	6.63 - 9.20	.036 - .010	.05 - .06
Non-physical aggression class membership			
Gender[a]	22.13	< .001	.09
Marital status[a]	7.95 - 11.55	.003 - .019	.06 - .07
Maternal education[a]	10.79 - 13.15	.011 - .029	.06 - .07
Hostililty[b]	44.30 - 52.15	< .001	.03 - .04

n = 2,756 for total aggression. n = 2,753 for physical aggression. n = 2,749 for non-physical aggression.
[a] χ^2 and φ are reported
[b] F and partial eta squared are reported

TABLE S2.5

Range of Statistics of the Multivariate Analyses on Total Aggression Class Membership and Teacher-Reported Total Aggression, Attention Problems and Rule Breaking Behavior of the Five Imputed Datasets

Multivariate analyses class membership	F	p	partial η^2
Unadjusted analysis total aggression class membership	21.56-21.57	< .001	.02
Partly adjusted analysis total aggression class membership	17.19-17.21	< .001	.02
Fully adjusted total aggression class membership	14.17-14.56	< .001	.02
Fully adjusted total aggression age 6	28.83-31.67	< .001	.03

n = 2,756.

TABLE S2.6 I/2

Range of Statistics of the Univariate Analyses on Total, Physical and Non-physical ggression of the Five Imputed Datasets

Univariate analyses	*F*	*p*	partial η^2	*M* (*SE*) low decreasing	*M* (*SE*) intermediate	*M* (*SE*) high increasing
Class membership						
Fully adjusted total aggression						
Total aggression	39.00 - 39.35	< .001	.03	0.30 - 0.31 (.02)	0.37 - 0.38 (.02)	0.67 - 0.68 (.05)
Attention	28.55 - 29.16	< .001	.02	0.64 - 0.65 (.02)	0.71 - 0.72 (.03)	1.04 - 1.05 (.06)
Rule breaking	15.49 - 15-78	< .001	.01	0.16 - 0.17 (.01)	0.18 - 0.19 (.01)	0.32 (.03)
Fully adjusted physical aggression	30.54 - 31.02	< .001	.02	0.21 (.02)	0.37 (.03)	0.53 - 0.54 (.06)
Fully adjusted non-physical aggression	32.15 - 33.44	< .001	.02	0.28 - 0.29 (.02)	0.35 - 0.36 (.02)	0.53 - 0.54 (.04)
Aggression age 6						
Fully adjusted total aggression						
Total aggression	81.24 - 90.76	< .001	.03			
Attention	54.71 - 57.54	< .001	.02			
Rule breaking	32.19 - 36.14	< .001	.01			
Fully adjusted physical aggression	66.69 - 77.98	< .001	.02 - .03			
Fully adjusted non-physical aggression	78.72 - 87.58	< .001	.03			

n = 2,756 for total aggression.
n = 2,753 for physical aggression.
n = 2,749 for non-physical aggression.

TABLE S2.6 2/2

Range of Statistics of the Univariate Analyses on Total, Physical and Non-physical ggression of the Five Imputed Datasets

Univariate analyses	*F*	*p*	partial η^2	*M* (*SE*) low decreasing	*M* (*SE*) intermediate	*M* (*SE*) high increasing
Aggression age 3						
Fully adjusted total aggression						
Total aggression	27.40-32.69	< .001	.01			
Attention	20.02-22.54	< .001	.01			
Rule breaking	13.75-15.32	< .001	.01			
Fully adjusted physical aggression	44.09-56.28	< .001	.02			
Fully adjusted non-physical aggression	22.27-26.91	< .001	.01			
Aggression age 1.5						
Fully adjusted total aggression						
Total aggression	6.31-10.06	.002-.012	.00			
Attention	0.96-2.29	.131-.326	.00			
Rule breaking	2.78-5.50	.019-.096	.00			
Fully adjusted physical aggression	17.17-26.31	.001	.01			
Fully adjusted non-physical aggression	6.69-10.08	.002-.010	.00			

n = 2,756 for total aggression.
n = 2,753 for physical aggression.
n = 2,749 for non-physical aggression.

Supplementary material
Chapter 3

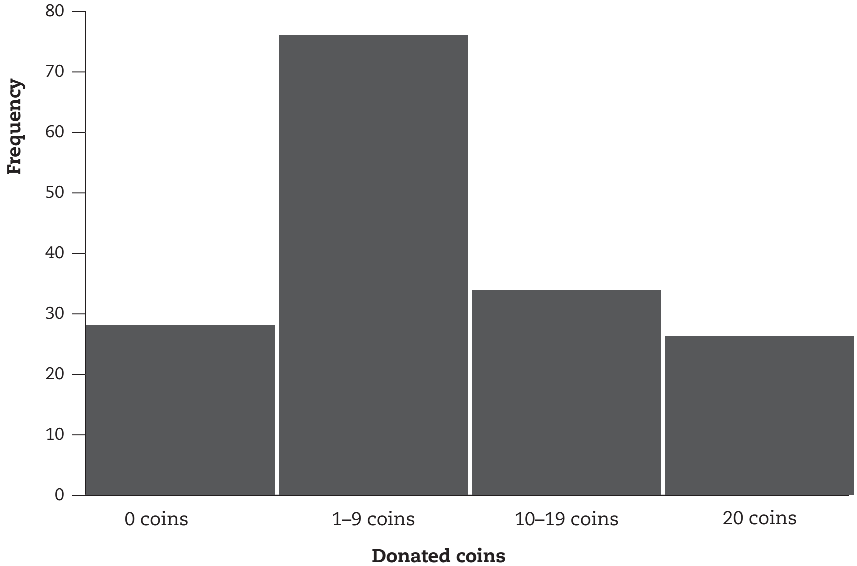

FIGURE S3.1
Distribution of donated coins after recoding the original variable (range 0-20).

Supplementary material
Chapter 4

TABLE S4.1 1/3
Correlations Between all Variables in the Models

	1.	2.	3.	4.	5.	6.	7.	8.
1. Unfamiliar - defender vs. rest[a]								
2. Unfamiliar - complicit vs. rest[a]	-.23**							
3. Familiar - defender vs. rest[a]	.11	.03						
4. Familiar - complicit vs. rest[a]	-.07	.06	-.20**					
5. Gender	-.03	-.18**	-.07	-.09				
6. Age	-.02	-.16*	.06	-.09	-.08			
7. IQ	.05	-.09	-.05	.13	.02	-.05		
8. Education parents	.03	.08	-.12	.01	-.09	.09	.06	
9. Income	.08	-.05	-.12	-.19**	.11	-.01	.05	.37***
10. Parity	.06	.06	-.18**	-.02	.02	-.03	.03	.21**
11. Empathy	.04	-.01	.08	.05	.16*	.11	.04	.00
12. Guilt	.02	.08	.07	-.00	.09	.10	.16*	-.01
13. Inhibition	.00	-.14*	-.09	-.06	.03	.23**	.05	.04
14. Donating[b]	-.08	-.02	-.03	-.14*	.14	.05	.03	.05
15. Persistent liars vs. rest[c]	.04	.00	.05	.04	-.18**	-.16*	-.20*	-.20*
16. Situation liars vs. rest[c]	-.07	.07	-.05	-.03	.19*	-.01	.10	.10
17. Prosocial vs. rest	-.05	-.04	-.07	.03	.03	-.04	.06	.06
18. Antisocial vs. rest	.04	-.06	.09	-.03	-.07	.21**	-.09	-.06
19. Bully	-.08	.03	.06	.03	.08	.03	-.11	-.06
20. Victim	-.06	-.01	.21**	-.04	.01	.02	-.13	-.06
21. Anxiety	.01	.01	.07	-.01	-.11	.13	-.10	-.02
22. Social responsiveness problems	.09	.02	.14	-.04	-.22**	.08	-.08	-.20*
23. Harsh parenting father	-.09	.01	.09	-.05	-.08	.09	-.08	-.17*
24. Harsh parenting mother	.05	-.06	.08	.01	-.12	.06	-.13	-.07

N = 215
Note. Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable, respectively. Phi coefficients were used for correlations between two dichotomous variables.
* $p < .05$, ** $p < .01$, *** $p < .001$
[a] Passive bystander is reference category
[b] Partial correlation controlling for the version of the donating task
[c] Honest is reference category

TABLE S4.1 2/3

Correlations Between all Variables in the Models

	9.	10.	11.	12.	13.	14.	15.	16.
1. Unfamiliar - defender vs. rest[a]								
2. Unfamiliar - complicit vs. rest[a]								
3. Familiar - defender vs. rest[a]								
4. Familiar - complicit vs. rest[a]								
5. Gender								
6. Age								
7. IQ								
8. Education parents								
9. Income								
10. Parity	.15*							
11. Empathy	-.05	.06						
12. Guilt	.00	.07	.45***					
13. Inhibition	.17*	-.06	-.17*	-.01				
14. Donating[b]	.13	.03	-.02	.13	.06			
15. Persistent liars vs. rest[c]	-.10	.01	-.13	-.11	-.01	-.04		
16. Situation liars vs. rest[c]	.16*	.08	.11	.05	-.01	.02	-.63***	
17. Prosocial vs. rest	.02	-.09	.14*	-.04	-.02	.03	-.04	.06
18. Antisocial vs. rest	.02	.14	-.12	.03	-.01	-.03	.04	-.01
19. Bully	.08	.03	-.04	.05	.12	.04	-.05	.01
20. Victim	.04	-.07	-.03	.06	.03	.05	.07	-.07
21. Anxiety	-.06	.05	.03	.26***	-.05	-.03	.06	-.04
22. Social responsiveness problems	-.12	.10	-.15*	.07	-.06	-.07	.11	-.14
23. Harsh parenting father	-.10	-.02	.01	.02	.02	-.06	.12	-.08
24. Harsh parenting mother	.00	.01	-.06	.03	-.01	-.01	.11	-.02

N = 215

Note. Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable, respectively. Phi coefficients were used for correlations between two dichotomous variables.

* $p < .05$, ** $p < .01$, *** $p < .001$

[a] Passive bystander is reference category

[b] Partial correlation controlling for the version of the donating task

[c] Honest is reference category

TABLE S4.1 3/3
Correlations Between all Variables in the Models

	17.	18.	19.	20.	21.	22.	23.
1. Unfamiliar - defender vs. rest[a]							
2. Unfamiliar - complicit vs. rest[a]							
3. Familiar - defender vs. rest[a]							
4. Familiar - complicit vs. rest[a]							
5. Gender							
6. Age							
7. IQ							
8. Education parents							
9. Income							
10. Parity							
11. Empathy							
12. Guilt							
13. Inhibition							
14. Donating[b]							
15. Persistent liars vs. rest[c]							
16. Situation liars vs. rest[c]							
17. Prosocial vs. rest							
18. Antisocial vs. rest	-.43**						
19. Bully	-.10	.17*					
20. Victim	-.09	.03	.40***				
21. Anxiety	.33***	.53***	.08	.03			
22. Social responsiveness problems	-.39***	.48***	.12	.02	.42***		
23. Harsh parenting father	-.23**	.28***	.02	.01	0.15	.24**	
24. Harsh parenting mother	-.17*	.41***	.11	.08	.22**	.22**	.25***

N = 215
Note. Pearson and point-biseral correlations were used in case of two continuous or one continuous and one dichotomous variable, respectively. Phi coefficients were used for correlations between two dichotomous variables.
* $p < .05$, ** $p < .01$, *** $p < .001$
[a] Passive bystander is reference category
[b] Partial correlation controlling for the version of the donating task
[c] Honest is reference category

Multinomial logistic regression models for the unfamiliar condition

TABLE S4.2

Multinomial Logistic Regression Associating Background Variables with Bystander Roles in the Unfamiliar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	Age	-0.93	0.34	.007	0.40	0.20	0.77
	Gender	-1.15	0.43	.007	0.32	0.14	0.73
	IQ	-0.02	0.01	.190	0.98	0.95	1.01
	Education	0.92	0.66	.159	2.52	0.70	9.12
	Income	-0.10	0.14	.468	0.90	0.69	1.19
	Parity	0.63	0.82	.446	1.87	0.37	9.40
Defender[a]	Age	-0.24	0.24	.318	0.79	0.49	1.26
	Gender	-0.46	0.35	.196	0.63	0.32	1.26
	IQ	0.00	0.01	.775	1.00	0.98	1.03
	Education	0.05	0.50	.920	1.05	0.39	2.82
	Income	0.10	0.13	.468	1.10	0.85	1.43
	Parity	0.59	0.69	.393	1.81	0.46	7.04

N = 215
Note. Nagelkerke R^2 = .12-.14 (range over imputed datasets).
[a]Passive bystander is reference category

TABLE S4.3

Multinomial Logistic Regression Associating Prosocial Variables with Bystander Roles in the Unfamiliar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	Age	-0.85	0.35	.014	0.43	0.22	0.84
	Gender	-1.29	0.44	.004	0.27	0.11	0.65
	Empathy	-0.15	0.25	.566	0.86	0.53	1.42
	Guilt	0.56	0.28	.041	1.75	1.02	3.01
	Inhibition	-1.24	0.80	.122	0.29	0.06	1.39
	Donating[b]	-0.06	0.23	.793	0.94	0.60	1.48
Defender[a]	Age	-0.24	0.25	.340	0.79	0.48	1.29
	Gender	-0.45	0.35	.200	0.64	0.32	1.27
	IQ	0.09	0.22	.687	1.09	0.71	1.68
	Education	0.15	0.24	.531	1.16	0.73	1.85
	Income	-0.07	0.63	.906	0.93	0.27	3.22
	Donating[b]	-0.21	0.20	.280	0.81	0.55	1.19

N = 215
Note. Nagelkerke R^2 = .13-.14 (range over imputed datasets).
[a]Passive bystander is reference category
[b]Corrected for version of the donating task

TABLE S4.4

Multinomial Logistic Regression Associating Problem Behavior Variables with Bystander Roles in the Unfamiliar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	Age	-0.92	0.37	.012	0.40	0.20	0.82
	Gender	-1.42	0.46	.002	0.24	0.10	0.60
	Guilt	0.45	0.26	.085	1.56	0.94	2.60
	Persistent liars vs. rest[b]	0.35	0.76	.653	1.41	0.30	6.63
	Situational liars vs. rest[b]	0.75	0.64	.242	2.13	0.60	7.53
	Prosocial vs. rest[c]	-0.45	0.52	.390	0.64	0.23	1.78
	Antisocial vs. rest[c]	-0.51	0.60	.397	0.60	0.18	1.96
	Bully	0.29	0.58	.619	1.34	0.41	4.35
	Victim	-0.25	0.48	.596	0.78	0.30	1.99
	Anxiety	-0.03	0.31	.923	0.97	0.53	1.77
	Social responsiveness problems	0.06	1.03	.957	1.06	0.14	7.89
Defender[a]	Age	-0.30	0.26	.252	0.75	0.45	1.23
	Gender	-0.35	0.37	.353	0.71	0.34	1.47
	Guilt	0.20	0.22	.365	1.22	0.79	1.87
	Persistent liars vs .rest[b]	-0.05	0.53	.927	0.95	0.34	2.71
	Situational liars vs. rest[b]	-0.18	0.50	.718	0.84	0.31	2.23
	Prosocial vs. rest[c]	-0.26	0.46	.574	0.77	0.31	1.90
	Antisocial vs. rest[c]	0.08	0.50	.870	1.09	0.40	2.92
	Bully	-0.37	0.50	.466	0.69	0.26	1.89
	Victim	-0.24	0.47	.615	0.79	0.30	2.05
	Anxiety	-0.17	0.27	.532	0.85	0.50	1.43
	Social responsiveness problems	0.91	0.92	.326	2.48	0.40	15.27

N = 215
Note. Nagelkerke R^2 = .14-.18 (range over imputed datasets).
[a] Passive bystander is reference category
[b] Honest is reference category
[c] Typical is reference category

TABLE S4.5

Multinomial Logistic Regression Associating Parenting Variables with Bystander Roles in the Unfamiliar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	Age	-1.02	0.36	.004	0.36	0.18	0.73
	Gender	-1.43	0.44	.001	0.24	0.10	0.57
	Guilt	0.48	0.24	.047	1.62	1.01	2.61
	Harsh parenting father	-0.07	0.43	.872	0.93	0.40	2.17
	Harsh parenting mother	-0.56	0.46	.220	0.57	0.23	1.40
Defender[a]	Age	-0.25	0.24	.305	0.78	0.48	1.25
	Gender	-0.46	0.35	.192	0.63	0.31	1.26
	Guilt	0.18	0.21	.391	1.20	0.79	1.82
	Harsh parenting father	-0.56	0.39	.153	0.57	0.26	1.23
	Harsh parenting mother	0.26	0.36	.477	1.29	0.64	2.64

N = 215
Note. Nagelkerke R^2 = .12-.15 (range over imputed datasets).
[a]Passive bystander is reference category

Multinomial logistic regression models for familiar condition

TABLE S4.6

Multinomial Logistic Regression Associating Background Variables with Bystander Roles in the Familiar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
	Age	-0.38	0.30	.208	0.69	0.38	1.24
	Gender	-0.48	0.42	.251	0.62	0.27	1.40
	IQ	0.03	0.02	.085	1.03	1.00	1.06
	Education	0.59	0.59	.315	1.80	0.57	5.70
	Income	-0.42	0.15	.004	0.66	0.49	0.87
	Parity	-0.51	0.68	.452	0.60	0.16	2.27
Defender[a]	Age	-0.11	0.25	.653	1.11	0.69	1.82
	Gender	-0.44	0.39	.257	0.64	0.30	1.38
	IQ	-0.00	0.01	.947	1.00	0.97	1.03
	Education	0.29	0.52	.575	0.75	0.27	2.08
	Income	-0.20	0.16	.231	0.82	0.59	1.15
	Parity	-1.10	0.56	.050	0.34	0.11	1.00

N = 215
Note. Nagelkerke R^2 = .13-.18 (range over imputed datasets).
[a]Passive bystander is reference category

TABLE S4.7

Multinomial Logistic Regression Associating Prosocial Variables with Bystander Roles in the Familiar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	IQ	0.03	0.02	.067	1.03	1.00	1.06
	Income	-0.37	0.14	.009	0.69	0.52	0.91
	Parity	-0.39	0.68	.569	0.68	0.18	2.57
	Empathy	0.19	0.26	.459	1.21	0.73	2.02
	Guilt	-0.08	0.27	.786	0.93	0.54	1.60
	Inhibition	-0.50	0.76	.511	0.61	0.14	2.69
	Donating[b]	-0.44	0.26	.088	0.64	0.39	1.07
Defender[a]	IQ	-0.00	0.01	.792	1.00	0.97	1.03
	Income	-0.21	0.15	.169	0.81	0.60	1.10
	Parity	-1.34	0.48	.021	0.26	0.08	0.82
	Empathy	0.18	0.25	.481	1.19	0.73	1.95
	Guilt	0.23	0.26	.384	1.26	0.75	2.12
	Inhibition	-0.88	0.71	.214	0.41	0.10	1.66
	Donating[b]	-0.15	0.22	.485	0.86	0.56	1.31

N =215

Note. Nagelkerke R^2 = .17-.21 (range over imputed datasets).

[a]Passive bystander is reference category

[b]Corrected for version of the donating task

TABLE S4.8

Multinomial Logistic Regression Associating Problem Behavior Variables with Bystander Roles in the Familiar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	IQ	0.04	0.02	.040	1.04	1.00	1.07
	Income	-0.41	0.15	.007	0.66	0.50	0.89
	Parity	-0.33	0.70	.642	0.72	0.18	2.85
	Donating[b]	-0.45	0.26	.078	0.64	0.38	1.05
	Persistent liars vs .rest[c]	0.57	0.60	.343	1.77	0.54	5.76
	Situational liars vs. rest[c]	0.25	0.59	.672	1.28	0.41	4.06
	Prosocial vs. rest[d]	0.13	0.54	.812	1.14	0.40	3.27
	Antisocial vs. rest[d]	0.12	0.59	.833	1.13	0.36	3.59
	Bully	0.61	0.54	.258	1.85	0.63	5.37
	Victim	-0.12	0.55	.832	0.89	0.30	2.67
	Anxiety	0.05	0.35	.881	1.05	0.53	2.11
	Social responsiveness problems	-0.62	1.08	.571	0.54	0.07	4.53
Defender[a]	IQ	0.01	0.02	.631	1.01	0.98	1.04
	Income	-0.25	0.15	.103	0.78	0.58	1.05
	Parity	-1.32	0.65	.047	0.27	0.07	0.98
	Donating[b]	-0.15	0.22	.510	0.87	0.56	1.33
	Persistent liars vs .rest[c]	0.31	0.59	.598	1.37	0.42	4.41
	Situational liars vs. rest[c]	0.25	0.65	.699	1.29	0.35	4.76
	Prosocial vs. rest[d]	0.05	0.55	.924	1.05	0.36	3.08
	Antisocial vs. rest[d]	0.46	0.55	.402	1.59	0.54	4.66
	Bully	-0.13	0.48	.793	0.88	0.34	2.29
	Victim	1.26	0.48	.009	3.53	1.38	9.02
	Anxiety	-0.06	0.30	.847	0.94	0.53	1.69
	Social responsivenessprobl.	1.18	1.01	.241	3.25	0.45	23.45

N =215

Note. Nagelkerke R^2 = .23-.28 (range over imputed datasets).

[a]Passive bystander is reference category

[b]Corrected for version of the donating task

[c]Honest is reference category

[d]Typical is reference category

TABLE S4.9
Multinomial Logistic Regression Associating Parenting Variables with Bystander Roles in the Familiar Condition

		B	*SE*	*p*	*OR*	95% CI Low	95% CI High
Complicit[a]	IQ	0.03	0.02	.054	1.03	1.00	1.07
	Income	-0.40	0.14	.004	0.67	0.51	0.88
	Parity	-0.32	0.67	.630	0.73	0.20	2.69
	Donating[b]	-0.45	0.25	.077	0.64	0.39	1.05
	Victim	0.12	0.47	.801	1.13	0.45	2.85
	Harsh parenting father	-0.25	0.49	.612	0.78	0.30	2.05
	Harsh parenting mother	0.39	0.44	.378	1.48	0.62	3.53
Defender[a]	IQ	0.01	0.02	.702	1.01	0.98	1.04
	Income	-0.25	0.14	.077	0.78	0.59	1.03
	Parity	-1.08	0.59	.068	0.34	0.11	1.08
	Donating[b]	-0.16	0.22	.467	0.85	0.55	1.31
	Victim	1.19	0.42	.005	3.29	1.44	7.53
	Harsh parenting father	0.30	0.43	.492	1.35	0.58	3.14
	Harsh parenting mother	0.31	0.43	.477	1.36	0.58	3.19

N =215
Note. Nagelkerke R^2 = .20-.25 (range over imputed datasets).
[a]Passive bystander is reference category
[b]Corrected for version of the donating task

Variables associated with the continuous Prosocial Cyberball Game score in the unfamiliar condition

In the hierarchical linear regression analysis of the unfamiliar condition with the continuous Prosocial Cyberball Game (PCG) score (proportion of throws to the excluded player in the unfair phase minus proportion of throws to the excluded player in the fair phase) as dependent variable, predictor variables were entered in the same order and steps as in the multinomial logistic regression analyses. We also included the proportion of throws to the player at the top in the fair phase as a covariate in all steps. According to the collinearity diagnostics VIF and Tolerance there was no multicollinearity in any of the models. Results of each step are reported in **TABLE S4.10**. None of the variables in any of the steps was associated with the continuous PCG score, except for gender in step 4 and 5. Being a girl was associated with more prosocial (compensation) behavior. Furthermore, the proportion of throws to the player at the top in the fair phase was also significant in all models. None of the models showed a significant R^2 change.

Variables associated with the continuous Prosocial Cyberball Game score in the familiar condition

In the hierarchical linear regression analysis of the familiar condition with the continuous PCG score (proportion of throws to the excluded player in the unfair phase minus proportion of throws to the excluded player in the fair phase) as dependent variable, predictor variables were entered in the same order and steps as in the multinomial logistic regression analyses. According to the collinearity diagnostics VIF and Tolerance there was no multicollinearity in any of the models. Results of each step are reported in **TABLE S4.11**. None of the variables in any of the steps were associated with the continuous Cyberball score, except for IQ in step 1-5; higher IQ was associated with more antisocial (exclusion) behavior. Furthermore, the proportion of throws to the player at the top in the fair phase was also significant in all models. None of the models showed a significant R^2 change.

Hierarchical linear regression model for the unfamiliar condition

TABLE S4.10

Background, Prosocial, Problem Behavior, and Parenting Variables Associated with the Continuous PCG Score in the Unfamiliar Condition

	B	*SE*	β	*p*
Step 1				
Proportion throws fair	-0.83	0.08	-.60 - -.61	.000
Step 2				
Age	-0.01	0.02	-.01 - -.03	.758
Gender	0.05	0.02	.13	.030
IQ	0.00	0.00	-.00 - .03	.779
Education	-0.03	0.03	-.05 - -.07	.431
Income	0.01	0.01	.03 - .07	.412
Parity	-0.01	0.04	-.01 - -.04	.695
Step 3				
Empathy	0.02	0.01	.10 - .12	.107
Guilt	-0.02	0.02	-.05 - -.12	.289
Inhibition	0.04	0.04	.03 - .07	.383
Donating[a]	-0.01	0.01	-.02 - -.05	.508
Step 4				
Persistent liars vs rest	-0.02	0.04	-.01 - -.12	.650
Situational liars vs rest	-0.05	0.03	-.07 - -.15	.141
Prosocial vs rest	-0.02	0.03	-.02 - -.05	.552
Antisocial vs rest	0.01	0.03	.01 - .05	.708
Bully	-0.01	0.04	.02 - .08	.870
Victim	-0.01	0.03	.00 - -.11	.676
Anxiety	0.01	0.02	.01 - .05	.763
Social responsiveness problems	0.05	0.06	.03 - .08	.376
Step 5				
Harsh parenting father	-0.02	0.03	-.01 - -.07	.429
Harsh parenting mother	0.02	0.02	.05 - .08	.313

N = 215
Note. For all variables the final (step 5) statistics are reported.
[a]Corrected for version of the donating task.
Step 1: R^2 (range) = .37; Step 2: R^2 (range) = .39, R^2 Δ (range) = .02; Step 3: R^2 (range) = .40, R^2 Δ (range) = .01; Step 4 R^2 (range) = .42-.43, R^2 Δ (range) = .02-.03; Step 5: R^2 (range) = .43-.44, R^2 Δ (range) = .00-.01

Hierarchical linear regression model for familiar condition

TABLE S4.11

Background, Prosocial, Problem Behavior, and Parenting Variables Associated with the Continuous PCG Score in the Familiar Condition

	B	*SE*	β	*p*
Step 1				
Proportion throws fair	-0.69	0.08	-.54	.000
Step 2				
Age	-0.00	0.02	.01	.955
Gender	0.03	0.03	.08 - .10	.194
IQ	-0.00	0.00	-.14 - -.17	.018
Education	-0.02	0.04	-.03 - -.07	.555
Income	0.00	0.01	.00 - .06	.667
Parity	-0.03	0.04	.00 - -.07	.552
Step 3				
Empathy	0.00	0.02	-.03 - .05	.918
Guilt	0.00	0.02	.00 - .05	.952
Inhibition	0.00	0.04	-.01 - .02	.940
Donating[a]	0.01	0.01	.03 - .08	.397
Step 4				
Persistent liars vs rest	0.01	0.03	.00 - .05	.768
Situational liars vs rest	0.01	0.03	-.02 - .06	.709
Prosocial vs rest	0.03	0.03	.05 - .08	.413
Antisocial vs rest	0.01	0.04	.01 - .05	.691
Bully	-0.01	0.03	-.02 - -.09	.737
Victim	0.04	0.03	.06 - .16	.262
Anxiety	0.00	0.02	-.03 - .05	.991
Social responsiveness problems	0.08	0.06	.06 - .13	.212
Step 5				
Harsh parenting father	0.02	0.03	.02 - .07	.500
Harsh parenting mother	-0.02	0.03	.00 - .06	.581

N = 215

Note. For all variables the final (step 5) statistics are reported.

[a]Corrected for version of the donating task.

Step 1: R^2 (range) = .27; Step 2: R^2 (range) = .31-.32, R^2 Δ (range) = .04-.05; Step 3: R^2 (range) = .31-.33, R^2 Δ (range) = .00-.01; Step 4 R^2 (range) = .32-.34, R^2 Δ (range) = .01-.03; Step 5: R^2 (range) = .32-.35, R^2 Δ (range) = .00-.01.

Appendices

Nederlandse samenvatting

(*Summary in Dutch*)

Dankwoord

(*Acknowledgements*)

Curriculum Vitae

Lijst van publicaties

(*List of publications*)

Nederlandse samenvatting *(Summary in Dutch)*

Dit proefschrift beschrijft studies over prosociaal en antisociaal gedrag bij kinderen en de hieraan gerelateerde situationele en dispositionele factoren. Of prosociaal en antisociaal gedrag hun oorsprong vinden in karaktertrekken van het kind en dus dispositionele factoren de oorzaak ervan zijn, of dat specifieke kenmerken van de situatie ten grondslag liggen aan prosociaal en antisociaal gedrag is al in verschillende studies eerder onderzocht. In deze onderzoeken zijn dispositionele en situationele factoren echter bijna altijd apart bekeken. Op welke wijze deze factoren gezamenlijk prosociaal en antisociaal gedrag beïnvloeden is slechts in een enkele studie onderzocht. Dit proefschrift beschrijft daarom de samenhang van zowel situationele als dispositionele factoren met prosociaal en antisociaal gedrag met bijzondere aandacht voor het samenspel van deze factoren.

Prosociaal en antisociaal gedrag

Prosociaal gedrag is gedrag ten behoeve van andermans welzijn dat door de persoon zelf geïnitieerd wordt (Eisenberg, Fabes, & Spinrad, 2007) en het manifesteert zich in handelingen als helpen, troosten en doneren (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Van IJzendoorn, Bakermans-Kranenburg, Pannebakker, & Out, 2010). Naast het positieve effect van prosociaal gedrag op de omgeving van het kind, heeft prosociaal gedrag ook gunstige gevolgen voor het kind zelf, zoals betere schoolprestaties en betere sociale vaardigheden (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Crick, 1996).

In eerder onderzoek zijn diverse dispositionele voorspellers van prosociaal gedrag gevonden, zoals een beter ontwikkelde zelfcontrole en hogere niveaus van empathie (Aguilar-Pardo, Martínez-Arias, & Colmenares, 2013; Batson & Ahmad, 2001). Daarnaast kunnen ouders het prosociale karakter van hun kind beïnvloeden (Carlo, McGinley, Hayes, Batenhorst, & Wilkinson, 2007). In dergelijk onderzoeken wordt prosociaal gedrag benaderd als karaktertrek van een individu. Een andere groep studies gaat uit van de situationele afhankelijkheid van prosociaal gedrag. Dit wil zeggen dat prosociaal gedrag niet wordt gezien als eigenschap van het individu, maar als gedrag dat afhankelijk is van de specifieke situatie waarin iemand zich bevindt. Prosociaal gedrag komt bijvoorbeeld vaker voor wanneer mensen geobserveerd worden door anderen en wanneer mensen een goed voorbeeld van anderen zien of wanneer de begunstigde een bekende is (Engelmann, Herrmann, & Tomasello, 2012; Kallgren, Reno, & Cialdini, 2000; Oh & Hazler, 2009). Dergelijke situationele factoren zijn misschien zelfs belangrijker dan dispositionele factoren voor het ontstaan van prosociaal gedrag (Van IJzendoorn et al., 2010). Er zijn daarnaast echter ook aanwijzingen dat dispositionele factoren van invloed kunnen zijn op de gevoeligheid voor situationele factoren (o.a., Izuma, Matusmoto, Camerer, & Adolphs, 2011).

Antisociaal gedrag zoals agressie of pesten wordt, in tegenstelling tot prosociaal gedrag, vaak in verband gebracht met negatieve uitkomsten voor het kind, zoals slechtere schoolprestaties en relatieproblemen (Pouwels & Cillessen, 2013; Van Lier & Crijnen, 2005). Antisociaal gedrag wordt meestal beschouwd als karaktertrek van het kind, maar er zijn ook studies die aantonen dat kenmerken van de situatie van invloed kunnen zijn op antisociaal gedrag (Milgram, 1974; Zimbardo, 2004; Zimbardo, Maslach, & Haney, 2000). Antisociaal en prosociaal gedrag worden soms gezien als de uiteinden van eenzelfde continuüm zijn. Er zijn inderdaad negatieve verbanden gevonden tussen prosociaal en antisociaal gedrag bij kinderen en adolescenten (o.a., Carlo et al., 2014; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000). In andere studies was de samenhang tussen prosociaal en antisociaal gedrag daarentegen zwak; bovendien werden voor beide typen gedrag andere voorspellers gevonden (o.a., Krueger, Hicks, & McGue, 2001). Indien prosociaal en antisociaal gedrag inderdaad twee verschillende constructen zijn, dan is het belangrijk om beide constructen ook als zodanig te behandelen in onderzoek. Dit is zeker belangrijk wanneer op basis van dergelijk onderzoek interventies ontwikkeld worden met als doel het verminderen van antisociaal gedrag en het stimuleren van prosociaal gedrag.

Dit proefschrift

De studies die in dit proefschrift beschreven worden, zijn uitgevoerd binnen de Generation R Studie, een prospectief cohort dat de groei, gezondheid en ontwikkeling van kinderen vanaf het foetale leven volgt (Jaddoe et al., 2012; Tiemeier et al., 2012). Hoofdstuk 2 beschrijft de ontwikkeling van door ouders gerapporteerde agressie bij kinderen van anderhalf jaar tot zes jaar. Deze herhaalde metingen van agressie, in combinatie met scores van door ouders gerapporteerd prosociaal gedrag, hebben gediend voor de selectie van een kleinere steekproef met meer gedetailleerde metingen bij deelnemers op achtjarige leeftijd. In Hoofdstuk 3 tot en met 5 is gebruik gemaakt van deze metingen en twee hiervan worden hieronder besproken.

Het meten van prosociaal gedrag. Onderzoek naar prosociaal gedrag richt zich vaak op moreel redeneren (o.a., Pratt, Arnold, Pratt, & Diessner, 1999). Daarnaast wordt prosociaal gedrag veelvuldig gemeten door middel van vragenlijsten (o.a., Carlo, Hausmann, Christiansen, & Randall, 2003). Op deze wijze wordt gemeten wat mensen denken en zeggen te doen, maar er wordt niet onderzocht of zij zich inderdaad ook prosociaal gedragen. Rapportage over het eigen prosociale gedrag kan sterk afwijken van het daadwerkelijk vertoonde gedrag (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). Hetzelfde geldt voor de rapportages van ouders over het prosociale gedrag van hun kind (Holmgren, Eisenberg & Fabes, 1998). Daarom wordt in dit proefschrift prosociaal gedrag gemeten door middel van observaties.

Allereerst is er gebruik gemaakt van een doneertaak waarbij de deelnemende kinderen een videoclip van een goed doel te zien kregen (Van IJzendoorn et al., 2010). Na afloop van de videoclip kregen de kinderen de mogelijkheid om recent verdiend geld te doneren aan dit goede doel. De ene helft van de kinderen kreeg direct na de videoclip een fragment te zien van een kind dat geld doneert aan hetzelfde goede doel, de andere helft kreeg dit fragment niet te zien. Op deze wijze kon onderzocht worden of een verschil in de situatie ook tot een verschil in donerend gedrag leidt bij de deelnemende kinderen. Eerder onderzoek bij volwassenen liet namelijk al zien dat het voordoen van prosociaal gedrag een effectieve manier is om dit gedrag bij een ander te stimuleren (Kallgren et al., 2000).

Een tweede manier om prosociaal gedrag te observeren is door middel van het Prosociale Cyberball Spel (PCS; Riem, Bakermans-Kranenburg, Huffmeijer, & Van IJzendoorn, 2013; Vrijhof et al., 2016), een aangepaste versie van het online balspel Cyberball (Crowley, Wu, Molfese, & Mayes, 2010; Williams, Cheung, & Choi, 2000). Met deze taak werd ook antisociaal gedrag geobserveerd. In het PCS gooiden de deelnemende kinderen samen met drie andere online spelers een bal over. Met een toetsenbord kozen de kinderen zelf naar wie zij de bal gooiden. Na enige tijd sloten twee van de medespelers de derde medespeler uit van het spel door geen bal meer naar deze persoon te gooien. Prosociaal en antisociaal gedrag werden in deze taak gemeten door de hoeveelheid ballen die het kind naar de buitengesloten speler gooide in deze fase van het spel. Kinderen die eveneens minder ballen naar de derde medespeler gooiden, gingen mee in de uitsluiting. Kinderen die juist méér naar de buitengesloten speler gooiden, compenseerden voor het uitsluitende gedrag van de andere spelers. De deelnemende kinderen konden zich daarnaast ook passief opstellen door niet duidelijk één kant te kiezen. Om ook tijdens het PCS het effect van de situatie te onderzoeken, speelden de kinderen het spel twee keer. Eenmaal werd een voor hen onbekende speler buitengesloten en eenmaal een bekende speler. Eerder onderzoek wees namelijk uit dat prosociaal gedrag toeneemt als het om een bekende gaat (Oh & Hazler, 2009). De bekende speler tijdens het PCS was de onderzoeksassistent. De onbekende speler was van hetzelfde geslacht en dezelfde leeftijd als de onderzoeksassistent.

Het effect van de situatie op prosociaal en antisociaal gedrag

De resultaten van mijn studies laten zien dat de situatie waarin kinderen zich bevinden van invloed kan zijn op zowel prosociaal als antisociaal gedrag. Zo lieten de resultaten uit Hoofdstuk 3 zien dat de hoeveelheid geld die kinderen doneren afhankelijk is van de situatie: kinderen die een ander kind zagen doneren gaven meer geld aan het goede doel dan kinderen die dit voorbeeld niet te zien kregen. Dit komt overeen met eerdere studies. Een ander afval zien oprapen zorgde er bijvoorbeeld voor dat mensen minder snel zelf afval op de grond gooiden, en lezen over gedrag dat in overeenstemming is met wat moreel juist is leidde tot een toename in donaties (Freeman, Aquino, & McFerran, 2009; Kallgren, Reno, & Cialdini, 2000). Dat mensen een voorbeeld van prosociaal gedrag volgen, komt waarschijnlijk omdat zij aan de heersende sociale norm willen voldoen, omdat zij geconfronteerd worden met een voorbeeld van hoe te handelen in een (nieuwe) situatie, of omdat het prosociale gedrag de wens doet ontstaan om een beter mens te zijn (Bandura, 1977; Freeman et al., 2009; Kallgren et al., 2000).

Vertrouwdheid met degene die hulp nodig heeft is een andere situationele factor die tot meer prosociaal gedrag kan leiden (o.a., Oh & Hazler, 2009). In Hoofdstuk 4 is dit effect echter niet gerepliceerd: tijdens het PCS compenseerden de kinderen gemiddeld gezien niet méér voor de uitsluiting van een bekende dan voor de uitsluiting van een onbekende medespeler. Een mogelijke verklaring hiervoor is dat de kinderen de onderzoeksassistent niet goed genoeg kenden om deze meer te verdedigen dan de onbekende speler. Kinderen varieerden daarentegen wel in hun prosociale en antisociale gedrag richting een bekende en onbekende speler. Sommige kinderen gooiden extra veel ballen naar de bekende speler terwijl zij de onbekende speler buitensloten, terwijl andere kinderen het omgekeerde patroon lieten zien of hetzelfde gedrag vertoonden bij zowel de bekende als de onbekende speler. Deze variatie in gedrag kon niet door dispositionele factoren zoals empathie en zelfcontrole voorspeld worden. Wellicht hebben andere situationele factoren een rol gespeeld. Zo waren de twee 'pesters' die de derde speler buitensloten mogelijk een rolmodel voor sommige kinderen, waardoor zij zich niet prosocialer naar de buitengesloten persoon gedroegen.

De afwezigheid van een relatie tussen prosociaal gedrag gemeten met de doneertaak en met het PCS is een andere aanwijzing voor de situationele afhankelijkheid van prosociaal gedrag. Kinderen die zich in de ene taak prosociaal gedroegen, lieten niet meer prosociaal gedrag zien in de andere taak. Kinderen die volgens hun ouders hoog scoorden op prosociaal gedrag en laag op antisociaal gedrag gedroegen zich ook niet prosocialer tijdens de doneertaak of het PCS. Tussen andere vormen van prosociaal gedrag, zoals helpen, delen en troosten, is in eerder onderzoek ook geen relatie gevonden (Dunfield et al., 2011). Dat een prosociale karaktertrek ten grondslag ligt aan verschillende vormen van prosociaal gedrag lijkt hiermee dus minder waarschijnlijk.

Hoewel antisociaal gedrag meestal gezien wordt als een karaktertrek (o.a., Porsch et al., 2016), zijn in Hoofdstuk 2 en 4 aanwijzingen gevonden dat ook situationele factoren dit gedrag kunnen beïnvloeden. Zo bleek er in Hoofdstuk 2 slechts een zwak verband te zijn tussen antisociaal gedrag zoals gerapporteerd door de ouders en gerapporteerd door de docent. Ofschoon bij de rapportage over antisociaal gedrag ouders niet gevraagd werd uitsluitend te rapporteren over de thuissituatie en docenten niet uitsluitend over de schoolsituatie, kan dit zwakke verband wel impliceren dat kinderen met name antisociaal gedrag vertonen in één situatie: thuis of op school. Indien verschillende mensen vanuit een andere context het gedrag van eenzelfde kind beschrijven kan er inderdaad een groot verschil ontstaan in hun rapportage (Achenbach, McConaughy, & Howell, 1987; Hinshaw, Han, Erhardt, & Huber, 1992). Een dergelijk verschil ontstaat mogelijkerwijs door situationele verschillen in antisociaal gedrag (Dirks, De Los Reyes, Briggs-Gowan, Cella, & Wakschlag, 2012).

De resultaten uit Hoofdstuk 4 lijken er ook op te wijzen dat antisociaal gedrag afhankelijk kan zijn van de situatie waarin kinderen zich bevinden. Zoals hierboven besproken hingen diverse dispositionele factoren niet samen met het prosociale en antisociale gedrag van kinderen tijdens het PCS. Desondanks lieten de deelnemers wel verschillen zien in hun prosociale en antisociale gedrag richting de bekende en onbekende speler. Deze verschillen laten de veranderlijkheid zien van het gedrag van kinderen tijdens het PCS.

De samenhang van dispositionele factoren met prosociaal en antisociaal gedrag

De resultaten uit Hoofdstuk 2, 3 en 4 wijzen op de situationele afhankelijkheid van prosociaal en antisociaal gedrag. Om ook te onderzoeken of dispositionele factoren een rol spelen bij (sommige vormen van) prosociaal gedrag is in Hoofdstuk 5 gekeken naar de samenhang tussen de anatomie van de hersenen en doneergedrag van kinderen. Hieruit bleek dat een dikkere cortex in delen van de laterale orbitofrontale cortex en pars orbitalis en delen van de pre- en postcentrale cortex gerelateerd was aan hogere donaties. Doneren heeft dus ook een neuroanatomisch component. Dit sluit aan bij de samenhang tussen prosociaal gedrag en dispositionele factoren zoals perspectief nemen, moreel redeneren en empathie die uit andere studies naar voren is gekomen (o.a., Batson & Ahmad, 2001; Carlo & Randall, 2002). Deze studies impliceren hiermee dat prosociaal gedrag tot het karakter kan behoren.

In Hoofdstuk 2 is een dispositionele kant van antisociaal gedrag gerapporteerd. Ofschoon de relatie tussen de ouder- en docentrapportages van antisociaal gedrag zwak was, zijn er in deze studie kinderen die zowel thuis als op school antisociaal gedrag vertonen. Kinderen die volgens hun ouders tussen anderhalf jaar en zes jaar hoge en toenemende niveaus van agressie lieten zien, zijn volgens hun docenten antisocialer, vergeleken met kinderen met gemiddelde of lage agressieniveaus over de tijd. Het antisociale gedrag lijkt voor deze kinderen dus een pervasieve vorm aan te nemen. In Hoofdstuk 2 bleek daarnaast dat meerdere metingen verspreid over de tijd van door ouders gerapporteerde agressie niet beter waren in het voorspellen van docent gerapporteerd antisociaal gedrag dan de ouderrapportage op slechts één meetmoment. Dat roept de vraag op naar de toegevoegde voorspellende waarde van herhaalde metingen van gedrag.

Samenspel situationele en dispositionele factoren

In Hoofdstuk 3 is het samenspel van situationele en dispositionele factoren onderzocht. Wanneer angstige kinderen en kinderen met lagere niveaus van autistische trekken een ander kind zagen doneren, gaven zij meer geld aan een goed doel dan minder angstige kinderen en kinderen met meer autistische trekken. Daarnaast doneerden angstige kinderen minder wanneer er geen prosociaal model was, vergeleken met kinderen die minder angstig waren. Dit komt overeen met andere studies waaruit blijkt dat dispositionele factoren de gevoeligheid voor situationele factoren kunnen beïnvloeden (o.a., Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011; Pozzoli & Gini, 2010).

Het is hiermee echter nog niet duidelijk hoe situationele en dispositionele hoofdeffecten zich tot elkaar verhouden. Eerder onderzoek liet zien dat de eigenschap persoonlijke verantwoordelijkheid van invloed was op prosociaal gedrag, maar alleen als dit samenging met lage groepsdruk van leeftijdsgenoten. Wanneer deelnemers veel groepsdruk ervoeren was er geen effect van persoonlijke verantwoordelijkheid op prosociaal gedrag (Pozzoli & Gini, 2010).Het is mogelijk dat het effect van dispositionele factoren op prosociaal en antisociaal gedrag vooral sterk is als situationele factoren zwak of afwezig zijn. Bij de aanwezigheid van krachtige situationele factoren worden de effecten van dispositionele factoren wellicht zeer klein of verdwijnen deze.

Conclusie

De resultaten beschreven in dit proefschrift laten zien dat, ondanks de hoge (financiële of relationele) kosten en lage baten, een substantieel deel van de kinderen zich prosociaal gedroeg in de doneertaak en/of tijdens het PCS. Daarmee laat dit proefschrift zien dat kinderen van 8 jaar oud prosociaal kunnen handelen ten aanzien van een hulpbehoevend persoon, ofschoon zij hier geen voordeel van hebben en de kosten hoog zijn. Deze vormen van prosociaal gedrag lijken daarom altruïstisch van aard.

Naast prosociaal gedrag werd ook antisociaal gedrag onder de loep genomen in de studies van dit proefschrift. Er waren echter weinig kinderen die over de verschillende metingen consistent antisociaal of prosociaal gedrag lieten zien. Dit bevestigt dat prosociaal en antisociaal gedrag deels situationeel afhankelijk zijn. Desondanks moeten dispositionele factoren nog steeds meegenomen worden in onderzoek naar prosociaal en antisociaal gedrag. Met name omdat hun interactie met situationele factoren tot verschillend gedrag kan leiden bij kinderen. Bovendien vonden we dat de anatomie van de hersenen samenhangt met hoeveel geld kinderen doneren. Dit benadrukt dat in ieder geval één vorm van prosociaal gedrag ook deels een eigenschap van het kind kan zijn.

Voor toekomstig onderzoek is het interessant om te kijken naar de effecten van verschillende situationele factoren op vormen van prosociaal gedrag. Bovendien is onderzoek naar de implementatie van situationele factoren in het echte leven, zoals een prosociaal model, van belang. Wanneer bijvoorbeeld publieke figuren en ook ouders zich bewust zijn van hun functie als rolmodel, zou dit een positief effect kunnen hebben op de samenleving en in het bijzonder op kinderen. Ook blijft het voor vervolgonderzoek belangrijk om prosociaal gedrag te observeren en niet afhankelijk te zijn van gerapporteerde percepties en intenties van prosociaal gedrag. Want alleen door het daadwerkelijke gedrag zijn anderen geholpen.

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Curriculum Vitae

Andrea Wildeboer werd geboren op 10 december 1986 in Rotterdam. In 2006 behaalde zij haar VWO diploma aan het Rudolf Steiner College in Rotterdam. Daaropvolgend startte zij de studie Pedagogische Wetenschappen aan de Universiteit Utrecht. In 2009 behaalde zij haar bachelordiploma en begon aansluitend met de tweejarige onderzoeksmaster Development and Socialisation in Childhood and Adolescence aan de Universiteit Utrecht. Na haar afstuderen in 2011 begon zij als promovenda bij Algemene en Gezinspedagogiek (AGP) aan de Universiteit Leiden. Hier deed zij onderzoek naar dispositionele en situationele factoren gerelateerd aan prosociaal en antisociaal gedrag in de kindertijd. De dataverzameling voor dit onderzoek vond plaats binnen de Generation R studie van het Erasmus Medisch Centrum in Rotterdam. De resultaten van haar onderzoek zijn beschreven in dit proefschrift. Naast haar aanstelling als promovenda heeft Andrea gewerkt als docent van diverse vakken bij AGP.

Lijst van publicaties *(List of publications)*

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