



Universiteit
Leiden
The Netherlands

The way to success: Identifying factors related to individual differences in behavioral control and prosocial behavior

Vrijhof, C.I.

Citation

Vrijhof, C. I. (2018, February 28). *The way to success: Identifying factors related to individual differences in behavioral control and prosocial behavior*. Retrieved from <https://hdl.handle.net/1887/61151>

Version: Not Applicable (or Unknown)

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/61151>

Note: To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The following handle holds various files of this Leiden University dissertation:

<http://hdl.handle.net/1887/61151>

Author: Vrijhof, C.I.

Title: The way to success: Identifying factors related to individual differences in behavioral control and prosocial behavior

Issue Date: 2018-02-28

The way to success

Identifying factors related to individual differences
in behavioral control and prosocial behavior

Claudia Inge Vrijhof



The way to success

Identifying factors related to individual differences
in behavioral control and prosocial behavior

Copyright © 2018, Claudia Inge Vrijhof

Design by Frans W. van Petegem, Linschoten

Printed by Ridderprint BV, Ridderkerk

Cover photo: iStock by Getty Images

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronically, mechanically, by photocopy, by recording, or otherwise, without prior written consent from the author.

The way to success
Identifying factors related to individual differences
in behavioral control and prosocial behavior

PROEFSCHRIFT

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus Prof. Mr. C. J. J. M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op woensdag 28 februari 2018
klokke 15.00 uur
door

Claudia Inge Vrijhof

geboren te Utrecht in 1988

Promotores:

Prof. dr. M. H. van IJzendoorn

Prof. dr. M. J. Bakermans-Kranenburg

Co-promotor:

Dr. S. Euser

Promotiecommissie:

Prof. dr. P. M. Westenberg

Prof. dr. M. Dekovic (Universiteit Utrecht)

Dr. N. Lucassen (Erasmus Universiteit Rotterdam)

The studies described in the current thesis were supported through the Gravitation program of the Dutch Ministry of Education, Culture, and Science and the Netherlands Organization for Scientific Research (NWO grant number 024.001.003). Additional funding was provided by the Netherlands Organization for Scientific Research to Prof. dr. M. H. van IJzendoorn (NWO SPINOZA prize) and to Prof. dr. M. J. Bakermans-Kranenburg (NWO VICI grant number 453-09-003).

Table of contents

Chapter 1

General introduction.....	9
---------------------------	---

Chapter 2

Stressful family environments and children's behavioral control: A multimethod test and replication study with twins.	19
---	----

Chapter 3

Parenting and children's hot and cool behavioral control: The role of sensitivity and sensitive discipline.	45
---	----

Chapter 4

The Prosocial Cyberball Game: Compensating for social exclusion and its associations with empathic concern and bullying in adolescents.....	73
--	----

Chapter 5

General discussion.....	95
-------------------------	----

References	109
------------------	-----

Appendices

Nederlandse samenvatting (Summary in Dutch)	138
Dankwoord (Acknowledgements).....	145
Curriculum Vitae	147

CHAPTER 1

General introduction

To thrive as an individual and within society, children need to master the ability to control their behavior and adapt it to social rules and standards. They also need to acquire the social competence to interact and communicate with others in an adequate way. Studies showing the relevance of behavioral control and social competence for children's future development give rise to the search for factors that are associated with or predict these competencies. These factors may partly overlap since individuals who are better able to control their behavior are generally also more socially competent (Padilla-Walker & Christensen, 2011). When we understand which factors are associated with individual differences in behavioral control and social competence and what the mechanisms behind these associations are, prevention and intervention programs to promote these skills can be developed. Factors that might influence the development of behavioral control and social competence can be characteristics of the child, factors within the child's social environment, and factors within the physical and socioeconomic environment. In the current thesis we aimed to identify factors associated with the development of behavioral control in early childhood, and with prosocial behavior in early to mid-adolescence.

Behavioral control

Behavioral control, also referred to as self-control, can be defined as the ability to voluntarily adapt one's behavior, especially to pursue long-term instead of short-term goals and to comply with rules, requests or social expectations (Baumeister, Vohs, & Tice, 2007; Duckworth & Kern, 2011). It can be seen as a coherent but multidimensional construct including, amongst others, abilities to delay gratification, suppress a dominant or inappropriate response in favor of a subdominant, more appropriate response, focus and maintain attention or modulate motor responses (Duckworth & Kern, 2011; Moffitt et al., 2011). Individuals vary greatly in their level of behavioral control and these differences have been related to important concurrent, short- and long-term developmental outcomes. Individual differences in young children's behavioral control have been associated with differences in externalizing problem behavior, social competence, and academic functioning, both concurrently and one year later (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Razza & Raymond, 2013; Spinrad et al., 2007), as well as in adolescence (Mischel, Shoda, & Peake, 1988). In addition, early childhood levels of behavioral control have been found to predict individual differences in health, wealth, and crime in adults (Moffitt

et al., 2011). Moreover, deficits in behavioral control are considered to be a central component in many psychiatric disorders (Strayhorn, 2002). Behavioral control is therefore seen as a key factor for success in life (Baumeister et al., 2007; Moffitt et al., 2011).

Measuring behavioral control. Considering the multidimensionality of behavioral control and differential relations between dimensions of behavioral control and developmental outcomes, we incorporated a multimethod assessment of behavioral control in the current thesis. Behavioral control was measured in 2- to 7-year-old children using parent report of children's effortful control (Child Behavior Checklist) and behavioral tasks assessing delay of gratification (marshmallow test), response inhibition (stop-signal task), and the ability to internalize rules and maintain appropriate behavior even when tempted to violate the rules (cheating game).

Prosocial behavior

Prosocial behavior can be seen as a hallmark of social competence (Wentzel, 2014) and is commonly defined as any voluntary action to benefit others, including behaviors such as helping, sharing, and comforting (Dunfield, 2014). These behaviors can be altruistic in nature but might also be motivated by external rewards. Furthermore, prosocial behaviors may be costly to the self, sharing for example, whereas other types of prosocial behavior are non-costly, like comforting. Just like behavioral control, prosocial behavior can therefore be described as a multidimensional construct (Padilla-Walker & Carlo, 2014). Individual differences in prosocial behavior have been related to for example children's social adjustment (Crick, 1996) and their likeability and acceptance as rated by peers (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000). Furthermore, higher levels of prosocial behavior have been associated with better academic performances (Caprara et al., 2000; Jones et al., 2015), and with less unemployment, crime, substance use and use of medication for emotional or behavioral problems later in life (Jones, Greenberg, & Crowley, 2015). Like behavioral control, prosocial behavior can thus be seen as a key factor for success in life (Dunfield, 2014; Jones et al., 2015).

Measuring prosocial behavior. The majority of studies focusing on prosocial behavior use self-report or other-report questionnaires to assess individual levels of prosocial

behavior. Questionnaires are low cost measurement instruments providing information on prosocial skills in various domains and situations. Although this information is valuable, it does not necessarily reflect actual behavior but an individual's perception of these skills in one-self or another person. Therefore, we developed a prosocial version of the classical Cyberball Game (the Prosocial Cyberball Game; PCG), based on a task developed by Riem and colleagues (Riem, Bakermans-Kranenburg, Huffmeijer, & Van IJzendoorn, 2013; see also Wesselmann, Wirth, Pryor, Reeder, & Williams, 2013), to assess prosocial compensating behavior of adolescents in response to the social exclusion of an unfamiliar peer.

Correlates of behavioral control and/or prosocial behavior

Figure 1 provides a visual overview of potential correlates of behavioral control, prosocial behavior, or both that were investigated in the current thesis. Of course, this is not an exhaustive list. Inspired by Bronfenbrenner's bioecological model (Bronfenbrenner & Ceci, 1994) and the socio-ecological model by McLeroy and colleagues (McLeroy, Bibeau, Steckler, & Glanz, 1988), correlates were categorized as either a characteristic of the child, the social environment, or the physical and socioeconomic environment of the child. Child characteristics that were assessed included children's age, gender, genetic make-up, and personality characteristics. The social environment refers to characteristics of social interactions, that is the level of sensitivity and sensitive discipline shown by parents when interacting with their child and the child's experiences as either a bully or victim of bullying, as well as characteristics of parents and peers, that is the amount of parenting daily hassles and depressive symptoms experienced by parents and the group status of peers (either ingroup or outgroup). Finally, the physical and socioeconomic environment refers to the level of chaos in children's home environments, including noise levels and crowding, as well as the socioeconomic status (SES) of the family.

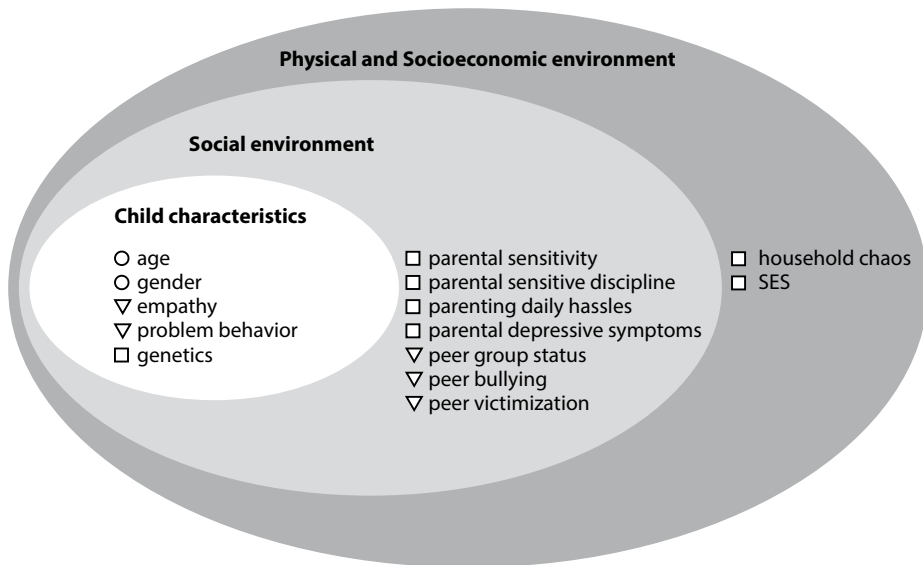


Figure 1. Visual overview of the associations child characteristics, factors in the social, or the physical and socioeconomic environment and the development of children's behavioral control (= □), adolescents' prosocial behavior (= ▽), or both (= ○) as investigated in the current thesis.

Child characteristics. We will first discuss some previous findings regarding two child characteristics included in all of the studies in the current thesis: child age and child gender. Both behavioral control and prosocial behavior have been found to emerge early in life and to increase with age, showing rapid growth in the first few years of life (Brownell, 2013; Fabes & Eisenberg, 1998; Kopp, 1982; Zelazo & Müller, 2002). The preschooler period is therefore an important and often studied period for social development. Another interesting period to study is adolescence, since individuals are faced with puberty and new (social) challenges, affecting their development on various domains including behavioral control and prosocial behavior (Casey & Caudle, 2013; Fabes, Carlo, Kupanoff, & Laible, 1999). Although findings regarding the relation with child gender are ambiguous for both behavioral control and prosocial behavior, girls are generally thought to outperform boys in both domains (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Fabes & Eisenberg, 1998).

This supposed gender difference in prosocial behavior may be partly explained by potential gender differences in empathy favoring girls (Garaigordobil, 2009). Empathy, the ability to take another person's perspective and to experience feelings of warmth, compassion and concern for others undergoing negative experiences, is an important personality characteristic associated with prosocial behavior. An increase in empathy is also an often mentioned explanation for possible age differences in prosocial behavior (Fabes & Eisenberg, 1998). In general, individuals with better empathic capacities are more prosocial (Garaigordobil, 2009; Padilla-Walker & Christensen, 2011). Other personality characteristics that seem to be related to prosocial behavior are levels of internalizing and externalizing problem behavior. Lower levels of problem behavior are associated with more prosocial behavior (Flynn, Ehrenreich, Beron, & Underwood, 2014).

Another individual characteristic that might explain individual differences in children's development, and more specifically their level of behavioral control, is someone's genetic make-up. Although heritability estimates vary greatly among different dimensions of behavioral control, individual levels of behavioral control are considered to be relatively stable over time and to be influenced by genetic factors (Gagne & Saudino, 2016; Schachar, Forget-Dubois, Dionne, Boivin, & Robaey, 2011).

Social environment. In early childhood, most of children's social interactions take place within the family context. Therefore, it seems particularly important to study the quality of parenting behavior when studying children's development in the preschool period. Parenting quality has proven to be an important predictor of a broad range of child outcomes, including children's behavioral control (Karreman, Van Tuijl, Van Aken, & Dekovic, 2006), and differences in parenting towards boys and girls have been suggested to explain gender differences in self-control (Shoenberger & Rocheleau, 2017). The quality of parenting behaviors can be operationalized as parental sensitivity, which has been defined as the ability to notice the child's signals, interpret these signals correctly and respond to these signals promptly and appropriately (Ainsworth, Bell, & Stayton, 1974). Parental sensitivity is often assessed in (semi-)structured play situations, and has been related to children's level of behavioral control (Bernier, Carlson, & Whipple, 2010; Razza

& Raymond, 2013). Next to sensitivity in play situations, sensitive discipline in limit setting situations has also been found to be associated with children's behavioral control (Houck & LeCuyer-Maus, 2004; Kok et al., 2014). Sensitive discipline is characterized by high levels of support and low levels of physical control.

The quality of parenting can be influenced by parental characteristics. When mothers are depressed or report sub-clinical levels of depressive symptoms, for example, they generally show more negative and less positive parenting behavior (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Similar relations were found for fathers (Cummings, Keller, & Davies, 2005). This might explain partly why parental depressive symptoms have been found to be negatively related to children's behavioral control (Gartstein, Bridgett, Young, Panksepp, & Power, 2013). Another factor in the social environment of the child that has been found to be negatively related to children's behavioral control is the level of parenting daily hassles, the amount of stress parents experience in relation to the upbringing of their child (Gartstein, Bridgett, Young, Panksepp, & Power, 2013). Again, part of this relation might be explained by the negative effect on the quality of parenting behavior; parents who reported more parenting daily hassles have been found to be less positive towards their children (Crnic, Gaze, & Hoffman, 2005).

When children get older, social interactions with peers become increasingly important. In general, adolescents who are more prosocial are better liked and more accepted by their peers, which shows the importance of prosocial behavior for adolescents' social development (Caprara et al., 2000). Levels of adolescents' prosocial behavior may be related to (previous) social experiences with peers. Adolescents who bully their peers or who are the victim of bullying themselves have been found to be less empathic (Van Noorden, Haselager, Cillessen, & Bukowski, 2015), and may thus be less prosocial. Another aspect in adolescents' social environment that might be associated with their level of prosocial behavior is the group status of peers. Generally, individuals are thought to be more prosocial towards ingroup members, i.e., peers that belong to the same group as the individual, than towards outgroup members, i.e., peers that belong to a different group (Baldassarri & Grossman, 2013; Balliet, Wu, & De Dreu, 2014).

Physical and socioeconomic environment. With regard to individual differences in behavioral control, associations have also been found with characteristics of the physical and socioeconomic environment in which children are raised. The socioeconomic environment in which children grow up is often referred to as the SES of the family. The most common indicators of SES are the educational level of parents, family income and parental occupational status. In general, children from families with a higher SES have been found to outperform children from families with a lower SES on multiple dimensions of behavioral control (McClelland et al., 2007; Sarsour et al., 2011; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008).

One of the factors in the physical environment of the child that has been suggested to relate to children's behavioral control is household chaos. Indicators of household chaos are levels of noise and crowding (i.e. a ratio between the number of people and the space they share), the amount of structure and routine, and traffic patterns (i.e., the number of people coming and going; Wachs, 1989). Previous studies showed that children growing up in more chaotic households have lower levels of behavioral control compared to children growing up in less chaotic households (Hardaway, Wilson, Shaw, & Dishion, 2012; Hur, Buettner, & Jeon, 2015; Valiente, Lemery-Chalfant, & Reiser, 2007).

Leiden Consortium on Individual Development

The studies in the current thesis are embedded within a longitudinal twin study with a cohort-sequential design, the Leiden Consortium on Individual Development (L-CID). The main aim of L-CID is to test the efficacy of the Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) for twin families on parenting quality and children's behavioral control and social competence. At this point in time, the study consists of two cohorts: one with preschoolers and one with children in middle childhood. Both cohorts include about 250 families with a same-sex monozygotic or dizygotic twin living in the western region of the Netherlands. The longitudinal cohort study includes six annual visits; the first two visits serve as baseline assessments, the last four as post-test assessments (see for more information Euser et al., 2016). For the first two studies presented in the current thesis the baseline assessments of the preschooler cohort were used, whereas for the last paper we used data collected in a pilot study for the middle childhood cohort.

Outline

The current thesis includes three empirical studies focusing on correlates of behavioral control in early childhood or prosocial behavior in early to mid-adolescence. The factors of interest can be classified as either characteristics of the child, factors within the child's social environment, or within the child's physical and socioeconomic environment, see Figure 1.

Chapter 2 focuses on relations between parenting daily hassles, parental depressive symptoms, and household chaos on the one hand and two types of behavioral control on the other hand: parent-reported effortful control and observed cheating behavior (as an indicator of the absence of behavioral control). These relations are tested first in a test sample and then examined in a replication sample to see which of the relations hold up. In addition, the relative influence of genetic and environmental factors on children's behavioral control is examined.

The main aim of Chapter 3 is to investigate unique contributions of parental sensitivity and sensitive discipline on children's observed behavioral control. Behavioral control is assessed using two different tasks, tapping into different types of behavioral control: delay of gratification and response inhibition. In addition, the relative influence of genetic and environmental factors on children's behavioral control is examined. In both Chapter 2 and 3, the relations of interest are corrected for potential effects of children's age and gender, as well as family SES. Although not the main aim of these chapters, we also examined the strength of the relations between these covariates and individual differences in children's behavioral control.

Correlates of prosocial behavior in early and mid-adolescence are examined in Chapter 4. Next to associations between prosocial compensating behavior and child age and gender, we also test relations with personality characteristics, that is, individual levels of empathy and problem behavior. Furthermore, we examine whether levels of prosocial behavior relate to experiences with bullying of peers or victimization by peers, as well as the group status of the excluded peer.

Finally, the main findings of the three studies included in this thesis are discussed in Chapter 5, together with methodological strengths and limitations, and theoretical and practical implications.

CHAPTER 2

Stressful family environments and
children's behavioral control:
A multimethod test and replication study with twins.

Claudia I. Vrijhof, Anja van der Voort, Marinus H. van IJzendoorn, & Saskia Euser

Online first publication in Journal of Family Psychology, August 2017.

Abstract

Young children's behavioral control predicts a broad range of developmental outcomes in child- and adulthood. It is therefore important to study how individual differences in behavioral control arise. Previous studies suggest that there are both genetic and environmental influences, which were estimated in the current study using a sample of mono- and dizygotic same-sex twins. Furthermore, we examined the associations between indicators of a stressful family environment like household chaos, parenting daily hassles, and parental depressive symptoms and children's behavioral control in two samples. Children of the same twin pair were randomly divided over two samples: a test ($N = 201$, 48.3% boys, M age 46.53 months) and replication sample ($N = 217$, 49.8% boys, M age 46.06 months). Both parents reported on their children's effortful control via the Child Behavior Questionnaire and children's cheating behavior was observed during a throwing game. We found that AE models fitted the data for effortful control ($A = 31\%$, $E = 69\%$) and cheating ($A = 16\%$, $E = 84\%$) best. Path analyses revealed that children of parents experiencing more parenting daily hassles and depressive symptoms had lower levels of effortful control in the test sample. Furthermore, we found that children growing up in more chaotic households (parent report) had an increased risk of being in the cheating group versus the possible intention to cheat group in the test samples. These results were partially replicated. We suggest that the role of stressful family environments in the development of behavioral control should be considered when setting up prevention and intervention programs targeting children's behavioral control.

Keywords:

behavioral control, household chaos, parenting daily hassles,
parental depression, twins

Introduction

Young children's behavioral control predicts social, psychological, and academic functioning in childhood (McClelland et al., 2007; Muris, van der Pennen, Sigmond, & Mayer, 2008; Spinrad et al., 2007), as well as important adult outcomes like physical health, substance dependence, criminality, and socioeconomic status (SES) (Moffitt et al., 2011). Therefore, it is important to investigate why some children can control their behavior better than others. We explored the effects of environmental and genetic factors on children's behavioral control and investigated whether or not growing up in a stressful family environment is associated with children's ability to regulate their behavior. Results of previous studies indicated that children who grow up in a more stressful family environment show less behavioral control (Coplan, Bowker, & Cooper, 2003; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005; Hur, Buettner, & Jeon, 2015; Sektnan, McClelland, Acock, & Morrison, 2010). Although indicators of a stressful family environment like household chaos, parenting daily hassles and parental depressive symptoms are positively related to each other (Dumas et al., 2005; Hur et al., 2015; Rijlaarsdam et al., 2013; Shelleby et al., 2014), most studies focusing on the effects of a stressful family environment on children's behavioral control did not investigate all of these factors within the same model. Moreover, most studies relied on self-report data, which may reflect perceptions rather than actual behavior. We tried to overcome these limitations by testing a model including parent reports on parenting daily hassles, parental depressive symptoms and household chaos, and objective indicators of household chaos, i.e. noise during week and weekend days as well as crowding as predictors of children's behavioral control. Behavioral control was measured with a questionnaire and an observation.

Behavioral control

Behavioral control can be seen as an aspect of the broader concept of self-regulation and includes the ability to focus and maintain attention, follow instructions, and inhibit inappropriate actions (McClelland et al., 2007). Another term that is often used to describe children's ability to regulate their behavior is effortful control, defined as "the efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors"

(Rothbart & Bates, 2006, p. 129). According to Kopp (1982), the ability to regulate behavior starts to emerge during toddlerhood. Toddlers begin to develop the ability to comply with requests from others and to plan their behavior. However, they often need help from their caregivers to control their behavior, especially under challenging circumstances (Bronson, 2000). In the next few years, the ability to control one's own behavior generally develops quickly. Children gradually need less guidance and support from their caregivers during the preschool and kindergarten period and show more internal self-regulation (Kopp, 1982). However, large individual variations in children's levels of behavioral control have been found (McClelland et al., 2007). Previous studies suggest that variance in behavioral control is partly heritable. In a study focusing on effortful control in adults, an AE model was found to fit the data best, indicating both genetic and unique environmental effects (Yamagata et al., 2005). Gagne and Saudino (2016) tested ACE models for both observed and parent reported inhibitory control in two- and three-year-olds and found an ACE model for parent reported inhibitory control, at age two, and an AE model at age three. For observed inhibitory control they found an AE model at age two and a CE model at age three. These results suggest only a small role for shared environmental factors (C) in explaining differences in children's behavioral control, although, as we will describe below, there are several studies showing significant relations between shared environmental factors and children's behavioral control.

Household chaos

One of the environmental factors that has been suggested to affect the development of children in general, and more specifically behavioral control is household chaos. Chaotic households are characterized by high levels of noise and crowding (a large number of people gathered closely together), a lack of structure and routines, and high-context traffic patterns (many people coming and going; Wachs, 1989). Household chaos has been related to a broad range of child outcomes, like school performance and internalizing and externalizing problem behavior (Hanscombe, Haworth, Davis, Jaffee, & Plomin, 2011; Shamama-tus-Sabah, Gilani, Kamal, & Batool, 2012). Although household chaos is related to SES in such a way that chaotic households are overrepresented in low SES families (Evans et al., 2005), household chaos seems to affect children's development over and above SES (Wachs & Evans, 2010).

Research focusing specifically on children's behavioral control showed that both preschoolers and children in elementary school had lower levels of behavioral control according to their parents and/or teachers when they grew up in chaotic households (Evans et al., 2005; Hardaway, Wilson, Shaw, & Dishion, 2012; Valiente, Lemery-Chalfant, & Reiser, 2007). The same relation with household chaos was found when the level of behavioral control in preschoolers was measured with observational tasks (Hur et al., 2015; Martin, Razza, & Brooks-Gunn, 2012). The ability to regulate behavior thus seems to be inversely related to distracting, unstructured and unpredictable environments.

Parenting daily hassles

The term parenting daily hassles refers to minor parenting stresses that accompany childrearing and challenging child behavior (Crnic & Greenberg, 1990). Parenting daily hassles have been suggested to affect children's development both directly and indirectly via parenting practices. A study including 141 families with typically developing preschoolers showed that mothers were less positive towards their child during parent-child interactions when they reported higher levels of parenting daily hassles. Furthermore, these mothers reported higher levels of behavior problems for their children (Crnic, Gaze, & Hoffman, 2005). Rijlaarsdam et al. (2013) found that high levels of parenting stress when children were 1.5 years of age predicted children's externalizing problem behavior at 3 years of age as reported by their mother and Shelleby et al. (2014) found that the level of parenting daily hassles mothers experienced when their child was 3 to 4 years old was related to children's conduct problems when they were 7 to 8 years old (rating of mothers and teachers were combined). To our knowledge only a few studies examined the more specific relation between parental stress and children's behavioral control (Barry, Dunlap, Cotten, Lochman, & Wells, 2005; Coplan et al., 2003; Mathis & Bierman, 2015), and they showed that the level of parenting daily hassles was negatively related to children's ability to focus and maintain attention. However, all of these studies focused on children's attention problems, which is only part of the broader domain of behavioral control.

Parental depressive symptoms

Both maternal and paternal depressive symptoms have been found to be related to a

range of negative outcomes, such as marital problems, low quality parenting behavior and several child problems (Cummings, Keller, & Davies, 2005). Goodman and Gotlib (1999) proposed that children of depressed parents are exposed to a more stressful environment than children of non-depressed parents. The effect of parental depression on child development may therefore be mediated by the exposure to a variety of stressors associated with parental depression, like marital discord and financial stress. Another possible mechanism they proposed is through parenting practices. It was hypothesized that depressed mothers are more often unable to meet the social and emotional needs of their children, which in turn affects the child's development.

With respect to children's behavioral control, it was found that mothers who experienced more depressive symptoms in the first 4.5 years of their children's lives, reported lower levels of behavioral regulation of their child at 4.5 years of age (Sektan et al., 2010). This negative relation was also found in a study by Gartstein and Fagot (2003); mothers who reported more depressive symptoms reported lower levels of effortful control in their children. This relation was not found for fathers. In another study however, it was found that a high level of paternal depressive symptoms in the postnatal period was associated with an increased risk of conduct problems and hyperactivity when the children were 42 months old (Ramchandani, Stein, Evans, O'Connor, & Team, 2005).

Current study

In the current study of mono- and dizygotic same-sex twins, we investigated if environmental and genetic factors were related to children's behavioral control. We performed behavioral genetics analyses to estimate the relative contributions of genetics, shared and unique environments, and tested path models with variables indicating shared environment (parent reported household chaos, parenting daily hassles, depression, crowding) and unique environment (individual noise levels). The relations between these environmental factors and parent reported and observed behavioral control levels of children were tested across two sets of co-twins. If effects of the shared environmental factors tested in the path models would be found together with a C component in the classical twin models, the path analyses might reveal some of the specific shared environmental factors that explain the effect of the

shared environment on children's behavioral control. If no C component would be found, alternative explanations, such as environmental mediation of genetic effects could be considered.

This study adds to the existing literature on behavioral control by testing a model that includes multiple indicators of a stressful family environment, measured not only with self-report measures but also with observational measures. Furthermore, we used the sample of twins to replicate the path models. Because the two sets of co-twins are similar in many respects the chance for replication is optimized, and lack of replication cannot easily be explained by varying confounders or other differences between samples.

Hypotheses

We expected that differences in children's behavioral control would be only partly explained by genetics. Furthermore, we expected that children who grow up in a more stressful family environment would show lower levels of both parent reported and observed behavioral control than children who grow up in a less stressful family environment.

Method

Participants

The sample includes families with a mono- or dizygotic same-sex twin participating in the longitudinal L-CID preschooler project, a study examining the efficacy of the Video-Intervention to promote Positive Parenting - Sensitive Discipline (VIPP-SD) in twin families (see Euser et al., 2016). The VIPP-SD is a short-term, behaviorally focused intervention program which aims to enhance parental sensitivity and the use of sensitive discipline strategies. Ethical approval for this longitudinal study was granted by the Centrale Commissie Mensgebonden Onderzoek (CCMO; NL49069.000.14, Samen Uniek). Municipalities in the western region of the Netherlands provided contact information of families with same-sex twins who were between 31 and 51 months old at the time. The families received a letter with information about the study. Interested families were contacted via telephone to

check inclusion criteria. Families were eligible if the parents were fluent in Dutch and if the children were physically and mentally able to perform all tasks. More information about the recruitment and complete sample of the L-CID preschooler project can be found elsewhere (Euser et al., 2016).

A random split was performed to divide children of the same twin pair across two samples; a test and replication sample. For the current study, children with complete data on behavioral control as measured with the throwing game (see below) were selected ($N = 418$). The test sample included 201 children (48.3% boys) and the replication sample 217 children (49.8% boys). Differences in the group size stem from the selection of participants as described above. All children were between 34 and 66 months old when the data for the current study was collected, with a mean age of 46.53 months ($SD = 6.89$) in the test sample and 46.06 months ($SD = 6.94$) in the replication sample. In most families, the twins and their biological parents were born in the Netherlands (test 91.5%, replication 92.2%), the majority of the children (test 95%, replication 94.9%) was raised by two parents, and in most cases, the primary parent, e.g. the person that spends most of the time with the children, was the biological mother (test 93%, replication 92.2%). All primary parents were between 22 to 53 years old, with a mean age of 36.58 years ($SD = 4.55$) in the test sample and 36.75 years ($SD = 4.44$) in the replication sample. The other parent was on average 38.24 years old ($SD = 5.44$) in the test sample and 38.51 years old ($SD = 5.47$) in the replication sample. For about half of the families, the twins were the firstborn children (test 48.8%, replication 49.8%), and most children were living in families with a high (test 53.7%, replication 55.3%) or middle (test 36.8%, replication 36.4%) socioeconomic status (SES).

Procedure

For the current study, only data collected before the start of the intervention was included. From September 2015 to September 2016 all families were visited at home by two female research assistants. At the start of the home visit, the purpose and content of the study were explained. Both parents or legal representatives of the twin signed an informed consent. Next, a short interview was conducted. After the interview, the children were paired up with the research assistants. One of the children conducted some individual tasks in their own bedroom, while the other child

performed some tasks with the primary parent in the living room. Half-way through the visit, the children switched places. The order of the tasks was counterbalanced. After the home visit, the primary parent received materials to perform ambulatory assessments, including the collection of noise recordings. The ambulatory assessments were conducted during four sequential days (two weekdays and two weekend days), and in most cases, within three weeks of the home visit. Furthermore, both parents were asked to fill out several computerized questionnaires about themselves and their children before the visit.

Measurement instruments

Cheating behavior. The children played a throwing game to assess their ability to internalize rules and maintain appropriate behavior, even when they are tempted to violate the rules (Kochanska, Murray, & Coy, 1997). Before the game was played, children were told that they would receive a small prize after the game was played (colorful stamps) and that they would receive one extra prize for every ball that would stick on the velcro dart board. During the game, children had to stay behind a line and could throw each ball only once. After the instructions, children practiced the game with the research assistant. After the practice session, the research assistant moved the line further away from the board until the distance was approximately three meters, making it practically impossible for children to get a ball on the board without cheating. The camera of a tablet was used to videotape the child's actions without informing the child, and the research assistant instructed the child to play the game while she would check up on his or her sibling and mother or father. Three minutes later, the research assistant came back and handed the child one to four stamps and registered the number of balls on the board.

Three undergraduate students were trained to code, together with the first author of this paper, the videotapes on cheating behavior of the child, using a coding scheme based on Zwirs et al. (2015). There were three categories of cheating behavior: 1) no cheating, 2) possible intention to cheat, and 3) cheating. Cheating behavior was defined as throwing a ball after reducing the distance to the board, throwing more than three balls, or sticking one or more balls directly on the board. Possible intention to cheat was scored when a child broke one of the rules of the game, but did not enhance his or her chance of winning more prizes by doing so. For example,

when the child crossed the line to collect the balls but did not throw again, or when the child crossed the line, approached the dart board and was out of sight for a while without a clear indication of cheating. Coder reliability was computed based on 50 videotapes, 30 of these videotapes were coded directly after the training and the other 20 videotapes were coded when roughly half of the videotapes were coded. The average intraclass correlation coefficient (absolute agreement) for the three cheating categories based on 50 videotapes was .76 (range .65 - .87). Regular meetings were organized to prevent coder drift.

Effortful control. Two subscales of the Dutch short form of the Children's Behavior Questionnaire (CBQ) (Majdandzic & van den Boom, 2007; Putnam & Rothbart, 2006) were used to measure effortful control; attentional focusing (6 items) and inhibitory control (6 items). In the current study both parents were asked to independently rate how well the statements described the behavior of their children on a seven point scale (1= extremely untrue, 7 = extremely true). Parents could also indicate that they had never seen their child in the situation described, which led to a missing score. An example item is "When drawing or coloring in a book, my child shows strong concentration". Four items were reverse coded, such that a higher score indicated more effortful control. The reliability in both samples was good (test $\alpha = .80$ for both parents, replication $\alpha = .79$ for the primary parent and $\alpha = .82$ for the other parent). An average score of all items was computed for both the primary and other parent. The average score of both parents was combined into one average score since the correlation between the scores of both parents was high in both samples (test $r = .56, p < .001$; replication $r = .54, p < .001$). If one of the parents did not fill out the CBQ (both samples; $n = 15$ for the primary parent and $n = 35$ for the other parent), the score of the parent who did fill out the questionnaire was taken as the final score. Ten children in both samples had missing CBQ data for both parents. No outliers were detected.

Household chaos. The primary parent reported on the level of household chaos using the Confusion, Hubbub and Order Scale (CHAOS) (Matheny, Wachs, Ludwig, & Phillips, 1995). This questionnaire includes 15 statements like "You can't hear yourself think in our home" and "We almost always seem to be rushed", answered on a five point scale (1 = extremely true, 5 = extremely untrue). The original English

version of the questionnaire was back-translated to create a Dutch version. Seven items were reverse coded, such that a higher score indicated more household chaos. The reliability in both samples was good ($\alpha = .81$). A sum score was used as the final score (Matheny et al., 1995). Two outlying values were detected in both samples and winsorized, such that the z-score would fall between -3.29 and 3.29, while retaining the original order in the data (Tabachnick & Fidell, 2012). Fourteen families in both samples had missing values on household chaos.

Noise. Noise in the environment of the child was measured with the Language Environment Analysis system (LENA) (Greenwood, Thiemann-Bourque, Walker, Buzhardt, & Gilkerson, 2011; Soderstrom & Wittebolle, 2013, for more information see <http://www.lenafoundation.org/Research/>). The small, unobtrusive recorders were worn by the children in a special belt around their waist. Initially, families were asked to make recordings on two weekdays from 16:00 until the children went to bed and on a weekend day from 11:00 until the children went to bed. Since the total program of ambulatory assessments appeared to be too demanding for families, one weekday recording was dropped after four months of data collection. However, not all families strictly followed the instructions, leading to variations in the number of week- and weekend days and the length of the recordings. The LENA Pro software package was used to compute mean decibel levels and peak decibel levels for every five-minute interval. Only recordings that consisted of at least six complete five-minute intervals were included in the current study.

We computed a mean decibel level for week- and weekend days, by averaging the mean decibel level for all complete five-minute intervals during either week- or weekend days. Outlying values for week and weekend days were winsorized in both samples (Tabachnick & Fidell, 2012). Furthermore, the standard deviation of the mean decibel level was computed as an indicator of variability in noise levels during week- and weekend days. Square root transformations were performed to approach a normal distribution of the variability data and outlying values were winsorized (Tabachnick & Fidell, 2012).

In addition, LENA is able to segment the audio data and provide information on the percentage of time each particular segment (in total eight segments can be

distinguished) is the predominant segment per five-minute interval. We included the average percentage of time 'silence' was the predominant segment on week- and weekend days in our analyses. Square root transformations were performed to approach a normal distribution of the data and outlying values were winsorized (Tabachnick & Fidell, 2012).

The standard deviation of the mean decibel level and the average percentage silence related negatively to the mean decibel level and were therefore reverse coded such that higher scores on each of the noise variables indicated more noise in the environment of the child. The three variables were highly correlated on weekdays (test $r's > .64$, $p < .001$; replication $r's > .64$, $p < .001$) and weekend days (test $r's > .84$, $p < .001$; replication $r's > .81$, $p < .001$). Therefore, all variables were standardized and then averaged, creating two final variables; noise on weekdays and noise on weekend days. This structure in the noise data was confirmed for both samples with a factor analysis. Noise on weekdays was missing for 57 children in the test sample and 66 children in the replication sample. Noise on weekend days was missing for 42 children in the test sample and 51 children in the replication sample.

Crowding. During the home visit, a short interview was conducted to establish the number of persons living in the house, and the number of rooms in the house in which family members spend time and that can be closed by a door (excluding for example storage spaces and open kitchens). Separate toilets were not included, but bathrooms were. A people to rooms ratio was calculated by dividing the number of persons living in the house by the number of rooms. In addition, we calculated a people to square meters ratio. In the Netherlands, municipalities provide online information about the surface area of a house (usable space only). We divided the number of people living in the house by the surface area. Since the correlation between the two indicators of crowding was high (test $r = .56$, $p < .001$; replication $r = .51$, $p < .001$), we computed an average ratio based on the standardized ratios. Higher scores on this variable indicated more crowding. We winsorized three outliers in both samples (Tabachnick & Fidell, 2012), there were no missing data.

Parenting Daily Hassles. The level of parenting daily hassles was assessed with the Dutch version of the Parenting Daily Hassles questionnaire (PDH) (Crnic

& Greenberg, 1990; Rutgers et al., 2007). This questionnaire includes 20 items describing situations that may be stressful when rearing young children, like “continually cleaning up messes of toys or food” and “the kids resist or struggle with you over bed-time”. Both the frequency, i.e., how often the situation occurred in the last week, and intensity, i.e., how much of a hassle it was for the parent, were rated by the primary parent on a five point scale (0 = never/not a hassle, 4 = constantly/big hassle). Because the frequency and intensity subscales were highly correlated (test; $r = .78$, $p < .001$, replication; $r = .79$, $p < .001$), the standardized average frequency and intensity rating were combined into one overall parenting daily hassles score. The reliability of the combined items was high in both samples ($\alpha = .91$). Two outliers in both samples were winsorized (Tabachnick & Fidell, 2012), twelve children in both samples had missing values.

Parental depressive symptoms. Both parents reported on the level of depressive symptoms they experienced in the past week on a five-point scale (0 = not at all, 4 = a lot) using the Dutch version of the depression subscale (6 items) of the Brief Symptom Inventory (BSI; De Beurs & Zitman, 2006; Derogatis & Melisaratos, 1983). An average score was computed for both parents separately, higher scores indicated more depressive symptoms. Square root transformations were performed to approach a normal distribution of the data, and outlying values (4 primary parents and 1 other parent in both samples) were winsorized (Tabachnick & Fidell, 2012). The reliability of the subscale was good (test $\alpha = .84$ for both parents, replication $\alpha = .84$ for the primary parent and $\alpha = .82$ for the other parent). There were missing values for 14 primary parents and 37 other parents in both samples.

Response bias. Response bias was examined using six non-credible items from the Dutch Wildman Symptoms Checklist (WSC) (Merckelbach, Smeets, & Jelicic, 2008) and four items that we created ourselves for the current study, see the supplemental material for more information. No deviant response patterns were detected.

Zygosity. We used a zygosity questionnaire and the accompanying algorithm (Rietveld et al., 2000) to categorize the twins as either monozygotic or dizygotic. The questionnaire includes items informing on how much the children look alike with respect to hair color and height for example, and on the frequency their parents

and other people mistake one for the other. The questionnaire was filled out by the primary parent, in the second year of the L-CID preschooler project. For seven families with missing data, the zygosity score in the second year was estimated based on the score in the first year. Rietveld et al. (2000) compared the results of the questionnaire to the results of DNA analysis/blood typing and found that the zygosity classification was correct in about 93% of the cases.

Analysis plan

We performed behavioral genetics analyses using Open Mx in R to investigate whether variance in effortful control and cheating behavior was best explained by heritability, shared or unique environmental factors, fitting the ACE model to the data. Furthermore, we computed mean's and standard deviation's for the outcome variables, all predictors (noise week, noise weekend, crowding, depression of both parents, parenting daily hassles and parent reported household chaos), and covariates (SES, child age and gender) and explored the relations between these variables using SPSS 23.

To ensure that the path models would not be more complicated than necessary, we first inspected the covariances among the predictor variables and the covariates. In this preliminary phase, all predictor variables were regressed on the covariates and the covariances between predictor variables were estimated. To ensure that fit-indices in both samples would not be influenced by misspecification of covariances, parameters that were at least borderline significant ($p < .10$) in the test sample or in the replication sample were retained in the main models.

We then tested the main models with effortful control and cheating (nominal variable) as outcome variables in the test sample. Of the three categories 'no cheating', 'intention to cheat', and 'cheating' the latter was used as the reference category. In order to avoid large differences between variances of predictors in the path-models, chaos values were divided by ten. In the first step, we tested a full model that freely estimated all paths between the predictors, the covariates, and the outcome variable. In the next step we tested a more parsimonious model, in which the covariates were retained, but non-significant paths between the predictors and outcome variable were excluded. Then, we evaluated the plausibility of the parsimonious model in the replication sample.

All models were estimated with Maximum Likelihood estimation with robust standard errors (MLR) because the depression variables were still skewed after transformation. To assess model fit, we inspected the χ^2 and the ratio between χ^2 and degrees of freedom. A ratio smaller than 2.0 indicates a good model fit (Hu & Bentler, 1999; Ullman, 2001). Also the CFI, TLI, and RMSEA were examined. CFI and TLI values above .95 and RMSEA values lower than .05 indicate that the data fit the model well (Ullman, 2001). Because of the categorical nature of cheating behavior, only few fit indices were available for this outcome variable (Muthén & Muthén, 1998-2015). To compare nested models, we used the χ^2 difference test for the difference in Loglikelihood with a scaling correction factor that is used for MLR estimation.

Missing data of both models were handled with the default methods in Mplus: Maximum Likelihood estimation, and in the case of the nominal outcome variable cheating, Monte Carlo integration was used with 150 integration points (Muthén & Muthén, 1998-2015).

Results

Preliminary analyses

Descriptive statistics and correlations between the predictor variables, the covariates and outcome variables in the test and replication sample are shown in Table 1. In both samples a higher level of depressive symptoms of both parents was related to more parenting daily hassles and self-reported household chaos. With regard to the covariates, lower SES was related to higher levels of depressive symptoms reported by the primary parent, parenting daily hassles, self-reported household chaos and crowding in both samples. Furthermore, we found that noise levels on weekend days were higher for older children in both samples. As far as the two main outcome variables are concerned, in the test sample, children in the cheating group had significantly lower scores on effortful control than children in the possible intention to cheat group. In the replication sample, there were no significant relations between these constructs.

Table 1. Descriptive statistics of the outcome variables, predictors and covariates in the test ($N = 201$) and replication sample ($N = 217$) and Pearson's correlations between all of these variables in both samples (test: left of the diagonal, replication: right of the diagonal).

	Test			Replica			1	2	3	4	5	6	7	8	9	10	11	12	13
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>													
1. Effortful control	191	4.74	0.78	207	4.70	0.78	-	.07	-.11	-.09	-.19*	-.28**	-.27**	-.09	-.10	-.03	.11	.11	.10
2. Cheating vs no cheating ¹	201	66	34 ^b	217	68	32 ^a	.07	-	-.36**	-.03	-.03	.05	-.02	-.18*	-.04	.04	-.02	.11	-.04
3. Cheating vs possible intention to cheat ¹	201	83	17 ^b	217	78	22 ^b	.16*	-.33**	-	.05	.03	.08	-.02	-.01	-.14	.07	-.09	.12	-.05
4. Depression PP	187	0.68	0.89	203	0.66	0.87	-.13	-.05	-.08	-	.19*	.32**	.25**	.12	.09	.12	-.17*	-.01	.05
5. Depression OP	164	0.46	0.79	180	0.48	0.78	-.28**	-.18*	.02	.19*	-	.30**	.21**	.03	-.14	-.04	-.08	-.03	-.08
6. Parenting daily hassles	189	-0.01	0.91	205	-0.01	0.92	-.35**	-.11	-.03	.32**	.29**	-	.52**	.03	-.03	-.04	-.19**	-.06	-.19**
7. Household chaos	187	32.79	7.77	203	32.78	7.76	-.26**	-.05	-.17*	.26**	.23**	.50**	-	.08	.12	.11	-.24**	-.03	-.07
8. Noise week	144	0.00	0.90	151	0.00	0.88	.02	-.09	.02	.08	.10	.04	.17*	-	.22*	.12	-.15	-.11	.09
9. Noise weekend	159	0.00	0.95	166	0.00	0.95	.07	.07	-.03	.04	-.10	-.14	-.03	.15	-	.19*	.05	-.20*	.18*
10. Crowding	201	-0.03	1.69	217	-0.03	1.66	-.02	.06	-.23**	.12	-.03	-.06	.10	.11	.02	-	-.14*	.04	-.07
11. SES	201	10 ^c	54 ^d	217	8 ^c	55 ^d	.24**	.12	.08	-.18*	-.10	-.23**	-.24**	-.13	.11	-.17*	-	-.05	-.03
12. Gender ¹	201	48 ^e	52 ^f	217	50 ^e	50 ^f	.12	.05	.09	.04	<-.01	-.06	-.02	-.10	-.09	.06	-.06	-	.01
13. Age child	201	46.53	6.89	217	46.06	6.94	.04	.04	-.13	.07	-.09	-.12	-.07	.12	.24**	-.11	<-.01	<-.01	-

Note. ¹ = point-biserial correlation; ^a = percentage no cheating, ^b = percentage possible intention to cheat, ^c = percentage low SES, ^d = percentage high SES, ^e = percentage boys, ^f = percentage girls; ** = percentage girls; * $p < .01$, * $p < .05$.

Path model for effortful control

First, we tested the full model with children's effortful control as outcome variable in the test sample. More depressive symptoms of the other parent and more parenting daily hassles significantly predicted lower levels of effortful control in children. In the next step we tested a more parsimonious model, excluding non-significant paths between predictor variables and children's effortful control, but retaining the covariates (see Figure 1a). The fit-indices of this more parsimonious model indicated a good model fit (see Table 2). Furthermore, the difference between the Loglikelihood of the full model and the parsimonious model was not significant, and therefore the more parsimonious model was preferred. More parenting daily hassles ($\beta = -.26$, 95% CI of β , lower = $-.34$, upper = $-.10$, $p < .01$; see Figure 1a) and more depressive symptoms of the other parent ($\beta = -.18$, 95% CI of β , lower = $-.33$, upper = $-.03$, $p = .02$; see Figure 1a) were significantly related to lower levels of effortful control in the test sample.

We then tested the plausibility of this parsimonious model in the replication sample. Results showed that the parsimonious model fitted the data in the replication sample well (see Table 2). When compared to a full model, we found no significant difference in Log Likelihood which suggests that the parsimonious model should be preferred. The significant negative effect of parenting daily hassles on children's effortful control was replicated in the replication sample ($\beta = -.22$, $p < .01$; see Figure 1a); again, children of parents reporting more daily hassles had lower effortful control scores. Depression of the other parent was not a significant predictor of effortful control in the replication sample ($\beta = -.11$, $p = .13$; see Figure 1a). To examine the difference between the regression weights of depression of the other parent in the two samples, we checked if the regression weight in the replication sample fell within the range of the 95% confidence interval of the regression weight in the test sample. This was indeed the case, which suggested that the effect of depression of the other parent was not incompatible with the model of the test sample.

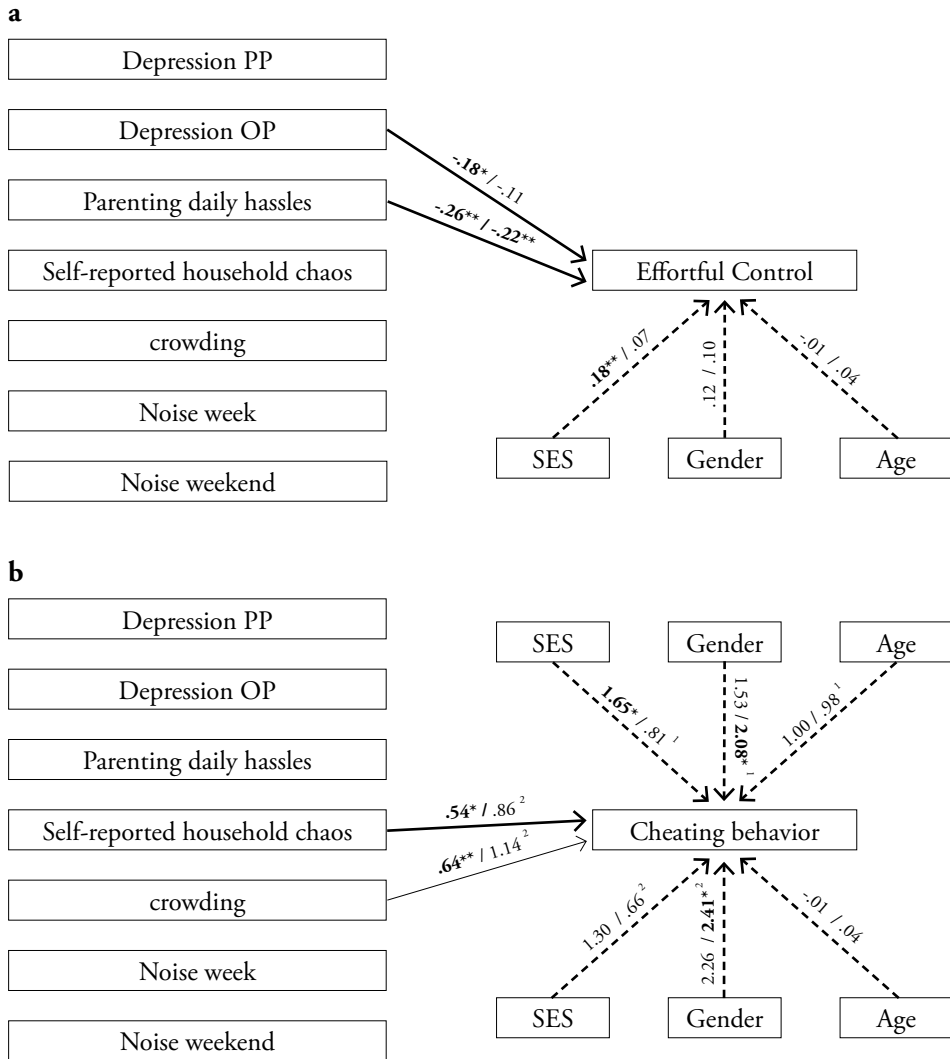


Figure 1a. Parsimonious path model for effortful control.

Figure 1b. Parsimonious path model for cheating behavior.

Solid lines represent beta's (1a) / odds ratio's (OR; 1b) for predictor variables (thick line: consistent path, thin line: inconsistent path; statistics on the left: test sample, statistics on the right: replication sample). Dashed lines represent beta's / OR's for covariates in the model. For the sake of clarity relations between covariates and predictors are not presented. Note. ¹ = OR's for cheating vs. no cheating, ² = OR's for cheating vs. possible intention to cheat; PP = primary parent, OP = other parent; * $p < .05$, ** $p < .01$.

Table 2. Fit-indices of the full and parsimonious model with effortful control as the outcome variable in the test and replication sample and results of the log likelihood difference tests.

		χ^2	<i>df</i>	χ^2/df	CFI	TLI	RMSEA	Loglikelihood	Δdf	<i>p</i> $\Delta \chi^2$
Test	Full model	26.536	24	1.106	.98	0.97	.02	-1831.701		
	Parsimonious model	29.770	29	1.027	1.00	0.99	.01	-1832.988	5	.70
Replica	Full model	22.214	24	.93	1.00	1.02	<.001	-1958.997		
	Parsimonious model	28.466	29	.98	1.00	1.01	<.001	-1962.291	5	.18

Path model for cheating behavior

Results of the full model with cheating behavior as outcome variable showed that both parent-reported household chaos and crowding were significantly related to cheating behavior in the test sample, with higher levels household chaos and of crowding increasing the risk of being in the cheating group versus the intention to cheat group. Next, we tested a more parsimonious model excluding non-significant paths between the predictor variables and cheating, but retaining the covariates in the model (see Figure 1b). The non-significant difference in Loglikelihood suggested that the more parsimonious model should be preferred (see Table 3). Children growing up in more chaotic ($OR = 0.54$, 95% CI of OR , lower = 0.31, upper = 0.95, $p = .03$; see Figure 1b) and more crowded houses ($OR = 0.64$, 95% CI of OR , lower = 0.48, upper = 0.86, $p < .01$; see Figure 1b) were less likely to be in the possible intention to cheat group versus the cheating group.

We then tested the same parsimonious model in the replication sample. The non-significant difference in Log Likelihood between the full and parsimonious model suggested that the parsimonious model should be preferred (see Table 3). Household chaos was not a significant predictor of effortful control in the replication sample. However, the odds ratio value of the relation between household chaos and cheating versus possible intention to cheat in the replication sample ($OR = 0.86$, $p = .53$) fell within the range of the 95% confidence interval of the test sample, suggesting that the effect of household chaos was not incompatible with the model of the test sample. Crowding was also no longer a significant predictor of cheating behavior

(see Figure 1b). Furthermore, the odds ratio value of the relation between crowding and cheating versus possible intention to cheat in the replication sample ($OR = 1.14$, $p = .22$) did not fall within the range of the 95% confidence interval of the test sample.

Table 3. Results of the Loglikelihood difference tests between the full and parsimonious model with cheating behavior as the outcome variable in the test and replication sample.

		Loglikelihood	Δdf	$p \Delta \chi^2$
Test	Full model	-1815.119		
	Parsimonious model	-1819.397	10	.60
Replica	Full model	-1946.025		
	Parsimonious model	-1952.640	10	.23

Behavioral genetics analyses

Behavioral genetics analyses were performed for children's effortful control and 'no cheating vs. cheating'. For these specific analyses, only families who completed the zygosity questionnaire and in which both children had cheating data were included ($n = 186$, 53.2% monozygotic, 48.4% boys). Of these families, 6 did not complete the CBQ, therefore the sample size for the analysis with effortful control was 180 (53% monozygotic). For both variables, AE models fitted the data best. We found that 31% of the variance in effortful control was heritable and 16% of the variance in 'no cheating vs. cheating'. The rest of the variance was explained by the unique environment of the child and/or measurement error. Shared environmental factors did not significantly contribute to the variance in children's behavioral control.

Discussion

Children's effortful control was found to be negatively associated with parenting daily hassles and depressive symptoms of the other parent; children of parents experiencing high levels of parenting daily hassles and depressive symptoms had lower levels of

effortful control than children in families with low levels of family stress. For children's cheating behavior we only found a relation with parent reported household chaos; children growing up in more chaotic households had an increased risk of being in the cheating group versus the possible intention to cheat group. These results were partially replicated. The relation between crowding and children's cheating behavior was not consistent; children growing up in more crowded houses were less likely to end up in the possible intention to cheat group than in the cheating group, but this effect was only found in one of the samples. In addition, we explored the effects of environmental and genetic factors on children's behavioral control, using behavioral genetics analyses. Surprisingly, AE models fitted the data for effortful control and cheating versus no cheating best. The majority of the variance in effortful control and cheating behavior was explained by the unique environment of the children and/or measurement error (69% and 84% respectively). Genetic factors also played a significant role, about one-third (31%) of the variance in effortful control and 16% of the variance in cheating behavior was heritable.

The strengths of the current study are the test and replication design and the multimethod, multi-informant approach. We created two samples, a test and a replication sample, by randomly dividing children of the same twin pair. This design enabled us to test the associations between the environmental factors and children's behavioral control in one group, and to examine the replicability of these effects in a second group. Replication is essential for science (Simons, 2014). A recent multilab replication study showed that the results of an experiment by Strack, Martin, and Stepper (1988) could not be replicated (Wagenmakers, Beek, Dijkhoff, & Gronau, 2016), thereby stressing the importance of this type of research. However, a study focusing on psychology publications since 1900, found an overall replication rate of only 1.07% (Makel, Plucker, & Hegarty, 2012). Another strength of the study is the fact that behavioral control of the children was measured in two ways: both parents reported independently on the level of their children's effortful control and the child's actual cheating behavior was observed during a throwing game. For household chaos, we also included more objective indicators, namely noise and crowding, next to a well-validated questionnaire (Matheny et al., 1995).

Our finding that children of parents experiencing high levels of parenting daily hassles

and depressive symptoms had lower levels of effortful control than children of parents that did not experience these kinds of stress is in line with previous studies (Barry et al., 2005; Coplan et al., 2003; Gartstein & Fagot, 2003; Mathis & Bierman, 2015; Sektnan et al., 2010). There might be several interpretations for this association. Growing up in a stressful environment might, on the one hand, directly undermine the development of children's behavioral control. On the other hand, the association might be mediated by other environmental family factors, such as parenting practices. Indeed, both parenting daily hassles and parental depressive symptoms have been associated with less positive parenting (Crnic et al., 2005; Cummings et al., 2005), and less positive parenting was found to predict lower levels of effortful control (Eisenberg et al., 2005). Furthermore, it is possible that stressed or depressive parents perceive or interpret their child's behavior more negatively and therefore report lower levels of effortful control. However, in the current study, we combined the reports of the primary and other parent regarding their children's effortful control. Thereby, reducing the chance that we measured biased perception, rather than actual child behavior. Although we found a significant correlation in both samples indicating that more household chaos as reported by the primary parent was related to lower levels of children's effortful control, none of the indicators of household chaos significantly predicted children's effortful control when we controlled for the other variables in the model. The lack of such an association might be caused by the relatively strong association between parenting daily hassles and household chaos. Some of the daily hassles parents experienced might be associated with or caused by the unstructured, uncontrollable environment they created for their family. Effects of household chaos on children's behavioral control might therefore be at least partly confounded with parenting daily hassles, which would explain the absence of a direct effect of household chaos in the path model. The lack of an association between depressive symptoms of the primary parent and children's effortful control may also be explained by the association between the depressive symptoms of this parent and the level of parenting daily hassles. The effect of parenting daily hassles, as reported by the primary parent, may potentially overshadow the effect of depression of this parent.

The relation between household chaos as reported by the primary parent and children's cheating behavior is in line with previous research (Evans et al., 2005;

Hardaway et al., 2012; Valiente et al., 2007; Hur et al., 2015; Martin et al., 2012). All other indicators of a stressful family environment were, different from what we expected, not consistently related to children's cheating behavior. This lack of further associations might originate from the assessment method. It could be argued that cheating behavior during the throwing game is actually an indicator of children's moral development instead of children's behavioral regulation. Kochanska et al. (1997) used the throwing game as an indicator of children's internalized conscience. According to Kochanska and Aksan (2006) important predictors of moral conduct in children are their level of effortful control and fearfulness, parental discipline strategies and the quality of the parent-child relationship.

In contrast to what we expected, no significant shared environmental influences were found in the behavioral genetics analyses, although the path analyses did reveal some significant relations between indicators of a stressful family environment and children's behavioral control. One explanation for the absence of a C component could be that ACE analyses in samples of modest size leave room for undetected but important parts of the variance explained by the shared environment. Another explanation might be that genetic effects are mediated by shared environmental factors. The genetic make-up of parents is passed on to their children, but also influences the environments parents shape for their children. Genes affecting behavioral control may also relate to the ability of parents to create a stable and structured environment, which is in turn related to their stress level and depressive symptoms. And the children's inherited genetic make-up in its turn might select specific environmental features that have important impact on their behavior and development, thus creating gene-environment correlation (Knafo & Jaffee, 2013). Further research should look into these possibilities. Furthermore, it is important in future studies to assess each co-twin's unique perception of parenting styles and more or less subtle differences in parental treatment of each co-twin to uncover what is hidden behind the large percentages of E, that is unique environment or error.

It is important to consider a few limitations of the current study when interpreting the results. First of all, it is important to note that zygosity classifications were based on questionnaire data rather than the comparison of DNA markers. Therefore, we cannot be 100% sure that all classifications were correct. A previous study however,

showed that in 93% of the cases, the classification based on the questionnaire we used was correct (Rietveld et al., 2000). Furthermore, it is important to recognize that the replication sample was not independent of the test sample, since children of the same twin pair were randomly divided over a test and replication sample. The advantage, however, is the optimal match for birth dates, family background, and in many cases even structural DNA make-up. Matching a replication sample to a test sample this way means that very few alternative interpretations remain when test results cannot be replicated. Lastly, the range of most variables was restricted because of the non-clinical and primarily lower-middle to higher SES background of the sample, and transformations may not always have solved skewness completely.

Conclusion

The findings of the current study suggest that children of parents experiencing more daily hassles or depressive symptoms show lower levels of behavioral control as reported by their parents. They also suggest that children growing up in more chaotic households may have an increased risk of being in the cheating group versus the possible intention to cheat group. Since young children's behavioral control predicts a broad range of developmental outcomes in childhood and adulthood, it is important to search for correlates of the ability of young children to control their behavior. The current study suggests that we need to consider the role of a stressful family environment in the development of behavioral control when preventive intervention programs such as the VIPP-SD (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2017) and Incredible Years (Gardner & Leijten, 2017), aiming at increasing children's behavioral control, are implemented and tested.

Supplemental material

Response bias

Parents were asked about unlikely physical or mental symptoms of themselves and their children, like “I have headaches that are so severe my feet hurt”, and “If my child is stressed, he/she can feel it in his/her feet”. We created two sum scores of number of endorsed items, one for items about themselves and one for items about their children. In the case of sumscores of 3 or higher for items about themselves (2 primary parents in both samples), and sumscores of 4 for items about their children (test 3 primary parents and 6 other parents, replication 5 primary parents and 6 other parents) all the answers of a participant on the BSI, PDH, CHAOS and CBQ were manually checked for deviant response patterns

CHAPTER 3

Parenting and children's hot and cool behavioral control:
The role of sensitivity and sensitive discipline.

Claudia I. Vrijhof, Saskia Euser, Marian Bakermans-Kranenburg, Bianca G.
van den Bulk, Jizzo R. Bosdriesz, Marielle Linting, & Marinus H. van IJzendoorn

Manuscript submitted for publication.

Abstract

We investigated whether parental sensitivity and sensitive discipline were differentially related to children's hot and cool behavioral control (BC) one year later. The current study included 427 children from 214 twin pairs (48% boys, M_{age} 4.77 years, 55% monozygotic) and their primary parent. Sensitive discipline contributed uniquely to the prediction of hot BC (marshmallow test) and cool BC (stop-signal task), parental sensitivity only to cool BC. Individual differences in hot and cool BC were mostly explained by unique environmental factors and the association between both types by shared environmental factors. Our study contributes to a better understanding of the antecedents of hot and cool BC, suggesting sensitive discipline as a target for preventive interventions focusing on hot and cool BC.

Keywords:

behavioral control, sensitive parenting, twins

Introduction

Children who are better able to regulate their own behavior tend to do better later in life. Higher levels of behavioral control in young children have been found to predict academic and social success in childhood and adolescence (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Mischel, Shoda, & Peake, 1988; Razza & Raymond, 2013) and health and wealth in adulthood (Moffitt et al., 2011). Problems in behavioral control, however, are a central component of many psychiatric disorders (Strayhorn, 2002) and a predictor of criminality in adulthood (Moffitt et al., 2011).

In a broad sense, behavioral control, also referred to as self-control, may be defined as a coherent but multidimensional construct (Duckworth & Kern, 2011) and refers to the ability to voluntarily alter “one’s own responses, especially to bring them into line with standards such as ideals, values, morals, and social expectations, and to support the pursuit of long-term goals” (Baumeister, Vohs, & Tice, 2007, p. 351). A distinction between hot and cool behavioral control can be made. When children are faced with a problem containing an emotional component, hot behavioral control is required, whereas cool behavioral control is needed when faced with a more abstract, cognitive, affectively neutral problem (Zelazo & Müller, 2002). Hot behavioral control (also labeled hot self-regulation, hot effortful control (EC), hot executive functioning (EF) or impulse control) is typically measured with tasks assessing the ability to delay gratification. Cool behavioral control (also labeled cool self-regulation, cool EC, cool EF or conflict EF) can be measured with tasks assessing response inhibition (Stop-Signal and Go-NoGo), motor inhibition (Walk-a-Line-Slowly), or effortful attention (Stroop) (Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011). It is thought that hot and cool behavioral control are differentially related to specific developmental outcomes (Kim et al., 2013; Willoughby et al., 2011) and that they might have different antecedents.

One of the antecedents of behavioral control that is open to intervention might be parental sensitivity. Previous studies showed that children of parents who are more sensitive during (semi-structured) play situations are better able to control their behavior (Bernier, Carlson, & Whipple, 2010; Kok et al., 2014; Razza & Raymond,

2013), as are children of parents who set limits in a sensitive way (Houck & LeCuyer-Maus, 2004; Kok et al., 2014). Since most studies included only one type of behavioral control, hot or cool, and one type of parental sensitivity, either in play or in a discipline situation, it is not clear whether sensitivity and sensitive discipline are differentially related to hot and cool behavioral control. The main aim of the current study is therefore to simultaneously test the associations between parental sensitivity, sensitive discipline, and children's hot and cool behavioral control.

Behavioral control

The meta-analysis by Duckworth and Kern (2011) on the convergent validity of behavioral control measures showed that behavioral control is a multidimensional construct. Results showed small to moderate convergence between measures of delay of gratification (i.e., tasks measuring hot behavioral control), executive functioning tasks (such as Stop-Signal, Go-NoGo and motor inhibition tasks assessing cool behavioral control but also hot behavioral control tasks like the Iowa gambling task), and self- and informant-reports. The average correlation between delay of gratification tasks and stop-signal tasks was for example .17 (95% CI = .02 - .31), for Go-NoGo tasks .12 (95% CI = .05 - .19), and for motor inhibition tasks .11 (95% CI = .04 - .18). Furthermore, studies differentiating between hot and cool behavioral control in predicting future development indicated that the use of a multidimensional model for behavioral control might fit data better than a unidimensional model (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Kim et al., 2013; Willoughby et al., 2011). Multiple studies showed for example that even though both hot and cool behavioral control were related to academic success when investigated separately, only cool behavioral control contributed uniquely to the prediction of academic success when effects of hot and cool behavioral control were investigated simultaneously (Brock et al., 2009; Kim et al., 2013; Willoughby et al., 2011). A similar pattern emerged when studying behavior problems. When investigated separately, hot and cool behavioral control were both found to be related to externalizing problem behavior, but when studied simultaneously, only hot behavioral control contributed uniquely to the prediction of children's behavior problems (Kim et al., 2013; Willoughby et al., 2011).

Both hot and cool behavioral control start to emerge around the end of the first year of life (Kopp, 1982; Zelazo & Müller, 2002), and girls are thought to outperform

boys on both hot and cool behavioral control (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Between age two to five, major steps are taken in the development of both hot and cool behavioral control (Kopp, 1982; Zelazo & Müller, 2002; Zelazo & Carlson, 2012). For many behavioral control tasks though, adult levels are not reached before the age of twelve and on some tasks, performance even keeps increasing through adolescence and adulthood (Kopp, 1982; Zelazo & Müller, 2002). Although levels of behavioral control increase with age, large differences are found between individuals of the same age. Individual differences in behavioral control appear to be relatively stable across the life span, but can be improved when stimulated (Zelazo & Carlson, 2012).

Differences in children's behavioral control levels might be partly explained by genetic differences. Studies investigating genetic effects on cool behavioral control measured with a stop-signal or hybrid stop-signal task (a combination of a Go-NoGo and stop-signal task) in 6- to 18-year-old twins showed for example that 26 to 50 percent of the variance between individuals might be ascribed to genetic differences (Crosbie et al., 2013; Schachar, Forget-Dubois, Dionne, Boivin, & Robaey, 2011). Research investigating genetic effects on hot behavioral control is limited. To our knowledge, there are no studies on the genetics of delay abilities in early or middle childhood. There are, however, behavioral genetics studies on delay discounting in adolescence showing increasing heritability estimates with age, from 30% at age 12 to 62% at age 18 (Anokhin, Golosheykin, Grant, & Heath, 2011; Anokhin, Grant, Mulligan, & Heath, 2015). These estimates for genetic effects also show that a substantial part of the variance in individual differences in behavioral control can be attributed to environmental factors, especially at younger ages. One of those factors might be the quality of parenting towards the child.

Parental sensitivity

Parental sensitivity has been defined as the ability to notice the child's signals, interpret these signals correctly and respond to these signals promptly and appropriately (Ainsworth, Bell, & Stayton, 1974). Sensitivity is known to be an important predictor of multiple child developmental outcomes such as attachment security (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003), prosocial behavior (Newton, Laible, Carlo, Steele, & McGinley, 2014), and cognitive development (Tamis-LeMonda,

Shannon, Cabrera, & Lamb, 2004). Furthermore, parental sensitivity has been found to predict children's behavioral control. For example, Razza and Raymond (2013) found that higher levels of maternal sensitivity during the first three years of life as assessed in (semi-structured) play situations predicted higher delay abilities in the famous marshmallow test when children were four-and-a-half years old ($N = 1007$). Assessing hot behavioral control with the snack delay task at 26 months, Bernier et al. (2010) did not find an association with maternal sensitivity at 12 months as measured with the Maternal Behavior Q-Sort or maternal autonomy support in a challenging problem solving task at 15 months.

The study by Bernier et al. (2010), however, did show that children of more sensitive and supportive mothers scored higher on a set of cool executive functioning tasks at 26 months. The same relation between early maternal sensitivity and cool behavioral control as measured with an executive functioning battery was found in three-year-olds (Towe-Goodman et al., 2014). Maternal sensitivity was measured in a free play situation when children were 7 months old and a puzzle task at 24 months. Another study showed that maternal sensitivity in challenging tasks (building a tower and an etch-a-sketch task) at age three predicted less problems with parent-reported inhibition, working memory and planning when the children were four years old (Kok et al., 2014).

Parental sensitive discipline

Another important aspect of parenting after the first year of life is the way parents discipline their child. Positive discipline strategies include distracting the child, giving explanations for rules or explaining consequences of the child's behavior (induction), and showing interest in and understanding of children's feelings and thoughts (Van Zeijl et al., 2006). Other positive discipline strategies include positive reinforcement (i.e., praising good behavior) and postponing (i.e., stating that the child can later do something he or she is not allowed to do right now) (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2015). Negative discipline strategies include giving prohibitions and commands, showing disapproval of the child's behavior, physically interfering and giving in (Van Zeijl et al., 2006).

A study by Houck and LeCuyer-Maus (2004) showed that the discipline style

of mothers in a don't touch task at 12, 24, and 36 months was associated with children's hot behavioral control as measured with the marshmallow test at age five. Mothers with an indirect discipline style (sensitive support without clear limit setting) or teaching-based style (sensitive support combined with clear limit setting) had children who showed higher levels of hot behavioral control, than children of mothers with an inconsistent or power-based style (focus on limit setting, low levels of sensitive support). The use of active distraction by mothers during the don't touch task especially predicted longer delay times in children (LeCuyer & Houck, 2006). Studies on the relation between parental discipline strategies and young children's cool behavioral control focused mostly on the use of corporal punishment, which was found to be negatively related to children's performance on an executive functioning battery (Xing, Wang, & Wang, 2016). In the study by Kok et al. (2014), who focused not only on negative but also positive limit setting strategies, higher levels of parental sensitive discipline were related to lower levels of cool behavioral control. However, this relation disappeared when controlled for maternal sensitivity.

Current Study

The main aim of the current study was to test the relations between parental sensitivity and sensitive discipline on the one hand and children's hot and cool behavioral control on the other, using longitudinal data from a sample of monozygotic and dizygotic twins. Hot behavioral control was operationalized as delay of gratification and cool behavioral control as response inhibition. We expected that more parental sensitivity and more sensitive discipline would be related to higher levels of delay of gratification and response inhibition in children one year later (Bernier et al., 2010; Houck & LeCuyer-Maus, 2004; Kok et al., 2014; Razza & Raymond, 2013; Towe-Goodman et al., 2014), with sensitive discipline being more important for children's delay of gratification, and sensitivity in a structured play situation being more important for children's response inhibition (Bernier et al., 2010; Kok et al., 2014). Furthermore, we tested to what extent individual differences in young children's delay of gratification and response inhibition, as well as the association between the two types of behavioral control, can be explained by genetic, shared, and/or unique environmental factors. We hypothesized that both types of behavioral control and the association between them would be explained by both genetic and (unique) environmental factors (Anokhin et al., 2011; Anokhin et al., 2015; Crosbie et al., 2013; Schachar et al., 2011).

Method

Participants

The current study is part of the pre-intervention phase of the preschooler cohort of the L-CID project, a longitudinal cohort study with the main objective of testing the efficacy of the Video-feedback Intervention to Promote Positive Parenting – Sensitive Discipline (VIPP-SD) in families with a monozygotic or dizygotic same-sex twin (Euser et al., 2016). Participants were recruited via records of municipalities in the western region of the Netherlands. Families with same-sex, 31- to 51-month-old twins received an invitation letter and information brochure. Interested families were contacted by phone to check their eligibility. Families were eligible if the children were physically and mentally able to perform all tasks and both the children and their parents were fluent in Dutch. More information about the recruitment and complete sample of the preschooler cohort of the L-CID project can be found elsewhere (Euser et al., 2016).

The sample of the current study includes all families that participated in the first two years of the study ($N=214$). For one child, data was missing on both of the outcome measures. This child was excluded from the analyses, resulting in a sample size of 427 children (48% boys). About half of the twins were monozygotic (55%) and the mean age of the children at the start of the study was 3.78 years ($SD = 0.58$, range 2.83 – 5.50). Most children were living in middle (38%) or high (55%) socioeconomic status (SES) families, with their biological mother and father (94%). The parent who was spending most time with the children, was selected as the primary parent. In most cases (92%), this was the mother. The mean age of the primary parent was 36.24 years ($SD = 4.66$), the other parent was on average 37.94 years old ($SD = 5.61$).

Procedure

The L-CID project consists of six yearly visits and a series of questionnaires for both parents about themselves and their children before each visit. The first visit was a home visit and the second visit, which was about one year later ($M = 11.42$ months, $SD = 0.87$), was at the university. Both visits included a series of individual tasks for the children to measure their level of social competence and behavioral control, and several interaction tasks with the primary parent to observe the parenting quality.

All parenting data used in the current study was collected in the first visit, whereas data on children's behavioral control was collected in the second visit of the study. Ethical approval for this project was granted by the Central Committee on Research Involving Human Subjects (CCMO, NL49069.000.14) and both parents or legal representatives of the twins signed an informed consent.

Measures

Delay of Gratification. Children's ability to delay gratification, i.e. hot behavioral control, was assessed with an adapted version of the marshmallow test (Mischel, Ebbesen, & Zeiss, 1972). Following Kidd, Palmeri, and Aslin (2013), we did not require the children to ring a bell if they decided that they did not want to wait anymore. This way, the task instruction was less complicated, making the task less demanding for young children. Furthermore, following the procedure in the NICHD Study of Early Child Care (Ramani, Brownell, & Campbell, 2010) and based on a pilot sample of 24 children (50% boys, $M_{\text{age}} = 4.83$ years) we reduced the maximum waiting time from 10 to 8 minutes. Finally, in order to enhance the level of temptation at the start of the marshmallow test, children were told at the beginning of the lab visit that they would play a game involving sweets later on in the visit and asked to choose their favorite sweet out of three options. Then, a transparent box with the chosen sweets was placed on a cupboard in the room while they performed another task which lasted approximately 10 to 15 minutes.

Before the actual test started, children were asked if they would rather have one or two sweets, to check if the delayed reward was preferred over the immediate reward. Then the research assistant placed one piece of candy on a plate and gave the following instruction "This piece of candy is for you. I will be leaving in a minute, and although it may take a while, I will definitely come back. When I'm gone you may choose: You can either eat this piece of candy while I am gone, or you can wait for me to come back and then you will get two sweets." The research assistant then placed the plate with the piece of candy in front of the child and repeated the options. "So, when I'm gone, you can choose to eat this one piece of candy, or to wait until I get back and then you will get an extra piece of candy, so then you will have two. Try to stay in your chair."

The waiting period started the moment the research assistant shut the door. From behind a one-way mirror in the adjacent room, the research assistant observed the child's behavior and registered if the child passed or failed the test as well as the delay time, which was set to 480 seconds if the child passed. Children failed the test if they tasted from or ate the piece of candy before the 8 minutes had passed, or if the test had to be aborted before the 8 minutes had passed, for example because the child showed high levels of distress. In these cases, the delay time was equal to the number of seconds that had passed up till the moment the child tasted from or ate the piece of candy, or the moment the research assistant entered the room after a preliminary abortion of the task.

Since the test was filmed, we were able to test the reliability of the real-time observations. One undergraduate student coded 76 randomly selected videos and these scores were compared to the real-time observations. The reliability of the real-time observations was good for both passing versus failing ($\kappa = .79$) and the number of seconds the child waited ($ICC = .96$). If the research assistant indicated that she had doubts about a child's performance on the test or the waiting time, the video was checked by the undergraduate student or the first author of this paper. The behavior of co-twins was never scored or checked by the same person. Data was missing for three children, since they did not want to be left alone in the room.

Because the distribution of waiting time was u-shaped, we recoded this variable. All children with a delay time less than 30 seconds were considered to have 'low' delay abilities. Children who waited the full 8 minutes had 'high' delay abilities. All other children were assigned to the 'medium' category. We investigated the order of this recoded variable with a categorical regression analysis, predicting nominally transformed delay ability from parental sensitivity and sensitive discipline. Because the transformation plot for delay ability showed an upward linear line (indicating linear relations with the predictors), we decided to treat this variable as numeric in the analyses.

Response inhibition. Children's response inhibition, i.e. cool behavioral control, was measured with a stop-signal task. We adapted the stop-signal task developed by Tillman, Thorell, Brocki, and Bohlin (2008) to further improve the task for the use

with preschoolers. First of all, we programmed the task on a tablet. Young children are nowadays used to operate this device, while operating a computer can be challenging. Furthermore, tablets are often used to play games, making it easier to frame the task as a game, and more fun to play. For this reason we also added background music. To keep the children motivated, a thumbs up picture was depicted on the screen after every block and applause sounded. Finally, we shortened the task of Tillman et al. (2008) by one block.

Children were told that they were about to play a game with a car and that this game had two rules. They would see a crossroad on the screen (start screen) and whenever a car would appear on either the left or right side of the screen, they had to click on it as quickly as possible (go trial). However, sometimes a stop sign would appear next to the car, indicating that the car was not allowed to drive away, so the child should refrain from clicking on the car (stop trial). For a visual overview of the task, see the supplemental material (Figure S1). We told the children that implementing the second rule would be hard and that it was ok if they sometimes would fail to inhibit their reaction in time. During a practice block consisting of 9 go trials and 3 stop trials, the children received feedback on their performance from the research assistant. After this practice block, children played 5 blocks consisting of 18 go and 6 stop trials. The order of go and stop trials was random. Between the blocks, the research assistant reminded the child to click on the car as quickly as possible.

The task was programmed according to the tracking method developed by Logan and Cowan (1984). The initial stop-signal delay (SSD) was 250 ms, meaning that the first stop stimulus, e.g. the stop sign, appeared on the screen 250 ms after the go stimulus, e.g. the car, appeared. When children inhibited their behavior following a stop stimulus, the SSD increased with 50 ms, making it more difficult to inhibit their response. When children did not successfully inhibit their behavior, the SSD decreased with 50 ms, making it easier to inhibit their response. Due to this tracking method, participants should be able to succeed in about 50% of the trials. The maximum reaction time was 2500 ms.

We computed the percentage correct go trials, percentage correct stop trials (probability of inhibition), mean SSD over all trials, and the median reaction time

(RT) over all correct go trials. The stop-signal reaction time (SSRT), an estimation of the latency of the response to the stop stimulus was computed by subtracting the mean SSD from the median RT for each participant. A higher SSRT implies that a participant needed more time to suppress the dominant go response, indicating a lower level of behavioral control. Therefore, SSRT's were inverted such that a higher score indicated more behavioral control.

Like Tillman et al. (2008), we inspected the number of complete blocks, the percentage correct go trials and the percentage correct stop trials for all children to establish the validity of the data, prior to running the analyses. Only data from children with more than 3 complete blocks, more than 72% correct go trials and a percentage correct stop trials between 25% and 75%, was considered to be valid (Tillman et al., 2008). Data was invalid, and therefore marked as missing, for 48 children. We tested whether the characteristics of this group differed from those of the group with valid stop-signal data and found only a significant difference with respect to age ($t(425) = -2.76, p < .01$). The group with invalid stop-signal data was younger ($M = 4.56$ years) than the group with valid data ($M = 4.80$ years).

Sensitivity. Parental sensitivity was observed for both co-twins separately during a ten minute structured play situation. The primary parent thus performed the task twice during the home visit, once with the firstborn child and once with the second born child. The order was random across families. The child and parent were instructed to imitate three drawings on a computer using 4 buttons. This task is a computerized version of the Etch-A-Sketch game, which was used in a study by Cents et al. (2014). Both the children and parents had to control two buttons, either up and down, or left and right. They could decide for themselves who controlled which pair of buttons. Diagonal lines could be made by combining two buttons, demanding more co-operation. The drawings had different degrees of difficulty, the first one was the easiest (mostly straight lines), the last one the hardest (mostly curved lines). Four minutes after the start of the game, an audio sign was given to instruct the participants to start with the second drawing if they had not done so already.

The interactions between the parent and the child were filmed by a research assistant and the computer recorded the drawing on the screen. Then, a single video was

created by putting both recordings side by side, which was later coded using the revised Erickson 7-point rating scales for supportive presence (1 = The parent completely fails to be supportive to the child, 7 = The parent skillfully provides support throughout the session) and intrusiveness (1 = The parent allows the child sufficient time to explore and to attempt to solve tools on her/his own, 7 = the parent is highly intrusive; her/his agenda clearly has precedence over the child's wishes) (Egeland, Erickson, Clemenhausen-Moon, Hiester, & Korfmacher, 1990). The videos were coded by a group of five coders, trained by an expert coder (=the second author of this paper). Intercooder reliability (intraclass correlation coefficient: ICC) with the expert coder and within the group of coders was based on 47 videos. The mean ICC for supportive presence with the expert coder was .82 (range .79 - .85) and within the group of coders .79 (range .69 - .85). For intrusiveness the mean ICC with the expert coder was .81 (range .75 - .85) and within the group of coders .77 (range .69 - .85). Videos of co-twins were never coded by the same coder.

Data was missing for five children. For these children, supportive presence and intrusiveness scores of the second year were used. In order to create an overall parental sensitivity score, intrusiveness scores were inversed. This way, higher scores on both scales indicated higher levels of parental sensitivity. The correlation between the two scales was .58. Both scores were standardized and then aggregated into one parental sensitivity score.

Sensitive discipline. Parental discipline techniques were observed during a don't touch task (Van der Mark, Bakermans-Kranenburg, & Van IJzendoorn, 2002). Parents performed this task twice within the first year visit, once with each child. The order of the children was random between families, similar to the etch-a-sketch task. Parents received an instruction card explaining the task before they were handed a bag of attractive toys which they all had to take out. For a period of two minutes, the child was not allowed to touch any of the toys. After two minutes, the child was allowed to play with the least attractive toy only. This episode also lasted two minutes. Then children and their parents could play with all of the toys for a few minutes. The task was filmed by a research assistant and the don't touch episodes were coded by five coders, including the expert coder (=first author of this paper), who trained the other coders.

The task was coded using three scales; Supportive presence, rated on the 7-point Erickson scale (Egeland et al., 1990), physical interference, and laxness, both rated on a 5-point scale (1 = the parent does not interfere physically / is never lax, 5 = the parent often interferes physically / is often lax) (Yagmur, Mesman, Malda, Bakermans-Kranenburg, & Ekmekci, 2014). Intercoder reliability with the expert coder and within the group was based on 50 video's. The mean ICC for supportive presence with the expert coder was .77 (range .71 - .80) and within the group .76 (range .65 - .80). For physical interference the mean ICC with the expert coder was .86 (range .79 - .93) and within the group .83 (range .69 - .93). For laxness the mean ICC with the expert coder was .87 (range .83 - .89) and within the group .83 (range .78 - .89). Videos of co-twins were never coded by the same coder.

Data was missing for two children (one child also had missing data on sensitivity). For these children we used the scores of the second year. The distributions of physical interference (40% scored 1) and especially laxness (78% scored 1) were skewed to the right. Since laxness scores were still considerably skewed after a log-transformation, we decided not to use those in the current study. For physical interference the log-transformation successfully corrected for the skewness. The log-transformed scores were then inversed such that a higher score indicated less physical interference. This way, higher scores on both scales indicated more sensitive discipline. The correlation between the two scales was .29. The scores on both subscales were standardized and then aggregated.

Zygosity. Primary parents were asked to fill out a questionnaire about the physical resemblance of their children (Rietveld et al., 2000) in the second year of the study to assess the zygosity of the twins. They reported for example how much the children looked alike with respect to hair color and height, and how often they themselves and other people mistake one for the other. Using an algorithm developed by Rietveld et al. (2000), we classified the twins as either mono- or dizygotic. This classification method was proven to be reliable in about 93% of the cases, when compared to classifications based on DNA analysis/blood typing.

Path analysis

To test the unique effects of parental sensitivity and sensitive discipline on children's

ability to delay gratification and their response inhibition, we performed a path analysis in Mplus (version 7; Muthén & Muthén, 1998-2015). SES, gender, and age of the child in the second year of the study were included in the path analysis as covariates. To avoid large differences between variances of the variables in the model, SSRT values were divided by 100. Furthermore, we used Maximum Likelihood estimation with robust standard errors (MLR) to correct for the clustering of children within families (Muthén & Satorra, 1995). As described by Rebollo, de Moor, Dolan, and Boomsma (2006) this type of estimation effectively deals with the downward bias in standard errors caused by the dependency in twin data. Initially, all paths between the predictors, covariates and outcome variables were freely estimated. In the next step, non-significant paths between the predictor and outcome variables were excluded, creating a more parsimonious model. Paths between covariates and all other variables were retained in the parsimonious model. We assessed the fit of the models by inspecting the CFI, TLI, RMSEA, and adjusted $\Delta\chi^2$. CFI and TLI values above .95, RMSEA values lower than .05, and a $\Delta\chi^2$ smaller than 2 indicate a good model fit (Hu & Bentler, 1999; Ullman, 2001). Finally we compared the goodness-of-fit of the two nested models using a chi-square difference test based on Loglikelihood values and scaling correction factors (see for more information <https://www.statmodel.com/chidiff.shtml>). When there was no significant difference between the two models ($p > .05$), the most parsimonious model was selected.

Bivariate behavioral genetics analyses

We selected twin pairs in which both children had valid data for both behavioral control tasks from the total sample to estimate the relative influence of genetic (A), shared environmental (C), and unique environmental/measurement error (E) contributions to variance in and covariance (i.e., association) between individual differences in children's delay of gratification and response inhibition. In this subsample ($n = 167$ twin pairs), 55% of the twins were monozygotic, 46% were boys and the mean age of the children was 4.84 years ($SD = 0.59$). The analysis was performed using the SEM package Open Mx (version 2.7.4; Neale et al., 2016) in R (version 3.3.2). We used a bivariate Cholesky decomposition model, as depicted in Figure 1, which is the base model for bivariate analyses (Neale & Cardon, 1992; Verweij, Mosing, Zietsch, & Medland, 2012). We first ran a saturated Cholesky model and then compared the goodness-of-fit of the full ACE and AE, CE, and E

submodels. When no significant difference between the fit of two nested models was found in the likelihood ratio test ($p > .05$), the more parsimonious model was selected. The fit of a model is indicated by the minus two Loglikelihood statistic (-2LL), the difference in -2LL of two nested models ($\Delta\chi^2$), both distributed as χ^2 , and by Akaike's Information Criterion (AIC). The model with the lowest $\Delta\chi^2$ and AIC, was considered the best fitting model (Neale & Cardon 1992; Verweij et al., 2012).

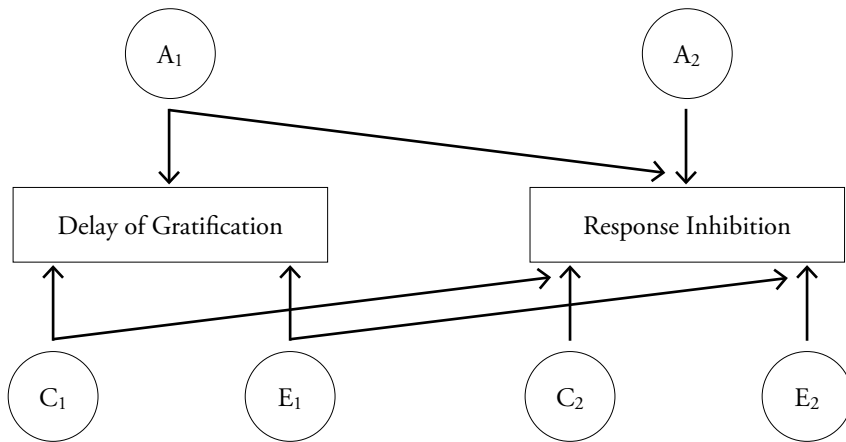


Figure 1. Bivariate Cholesky decomposition model. A_1 , C_1 , and E_1 indicate genetic, shared and unique environmental factors respectively that influence both children's delay of gratification and response inhibition, whereas A_2 , C_2 , and E_2 indicate factors that influence response inhibition only.

Next, standardized path loadings were computed. These path loadings were then squared to estimate the relative influence of A, C, and E on individual differences in children's delay of gratification and response inhibition. To estimate the degree to which the association between individual differences in children's delay of gratification and their response inhibition could be explained by genetic, shared, and unique environmental factors, the standardized path loading for the relation between either A_1 , C_1 , or E_1 and delay of gratification was multiplied by the standardized path loading for the relation between the same factor (A_1 , C_1 , or E_1) and response inhibition and this value was then divided by the cross-trait, within-twin correlation (Treur, Boomsma, Ligthart, Willemsen, & Vink, 2016). Finally, we estimated to

what extent all genetic or environmental factors influencing individual differences in one outcome overlapped with those factors influencing the other outcome, by adding a covariance matrix to the best fitting model and calculating the correlation between the relevant A, C, and E factors for both outcomes (Treur et al., 2016).

Results

Preliminary analysis

Before the delay of gratification task started, the majority of the children (85%) said that they preferred two pieces of candy (the delayed reward) over one piece of candy (the immediate reward). For 4% of the sample this information was missing. However, only a little less than a third of the children (27%) passed the marshmallow test and waited the full 8 minutes. Most children waited between 30 and 480 seconds before they tasted from or ate the piece of candy in the marshmallow test (42%) or did so within 30 seconds of the start of the test (31%), see Table 1. The children with valid stop-signal data responded on average correctly to 93% ($SD = 6.0$) of the go trials and 61% ($SD = 8.6$) of the stop trials, which is somewhat higher than the ideal 50%. The median RT in response to correct go trials was 1037 ms ($SD = 152$) and the mean SSD was 502 ms ($SD = 135$). The average SSRT was therefore 535 ms ($SD = 150$), which was reversed for further analyses, see Table 1.

In the etch-a-sketch task, parents scored on average a 4.50 ($SD = 1.35$) on supportive presence and 4.54 ($SD = 1.63$) on intrusiveness (raw scores). In the don't touch task, the mean supportive presence score was 5.27 ($SD = 1.29$) and the mean physical interference score was 1.97 ($SD = 1.15$; raw scores). The mean's and SD's reported in Table 1 are the composite scores for parental sensitivity and sensitive discipline.

Furthermore, Pearson's correlations between the mean outcome variables, predictors and covariates are shown in Table 1. We found a small but significant correlation between children's delay of gratification and response inhibition ($r = .15$, $p < .01$); children who waited longer for the delayed reward in the marshmallow test were also better able to inhibit their responses in the stop-signal task.

Table 1. Descriptive statistics of the outcome variables, predictors and covariates and Pearson's correlations between all variables.

	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Delay of Gratification	424	31 ^a	27 ^b	-					
2. Response Inhibition	379	-534.97	149.72	.15**	-				
3. Sensitivity	427	0.00	0.89	.12*	.24**	-			
4. Sensitive Discipline	427	0.00	0.80	.15**	.20**	.32**	-		
5. Gender child ¹	427	48 ^c	52 ^d	.02	.22**	< .01	.15**	-	
6. Age child	427	4.77	0.58	.08	.40**	.19**	.08	.02	-
7. SES	427	2.48	0.63	.09	< .01	.20**	.18**	-.06	> -.01

Note. ¹ = point-biserial correlation; ^a = percentage low delayers, ^b = percentage high delayers, ^c = percentage boys, ^d = percentage girls; ** $p < .01$, * $p < .05$.

Path analysis

The results of the full model showed that, when both parenting variables were included in the model, only parental sensitive discipline uniquely contributed to the prediction of children's delay of gratification, whereas both parental sensitive discipline and parental sensitivity uniquely contributed to the prediction of children's response inhibition. Thus, parental sensitivity in a structured play situation did not contribute over and above the level of parental sensitive discipline to the level of children's delay of gratification. Therefore, we tested a more parsimonious model, excluding the path between parental sensitivity and children's delay of gratification, while retaining paths between the covariates (age and gender of the child and SES) and the predictor and outcome variables (see Figure 2). The fit indices indicated that the more parsimonious model had a good fit (CFI = 1.00, TLI = 0.98, RMSEA = .02, $\Delta\chi^2 = 1.17$) and the chi-square difference test based on Loglikelihood values showed that there was no significant difference in fit between the two models ($p = .28$). Therefore, the parsimonious model was selected. More parental sensitivity was related to higher levels of response inhibition in children one year later ($\beta = .16$, $p < .01$). Parental sensitive discipline was also positively related to children's behavioral

control; higher levels of sensitive discipline were related to higher levels of children's delay of gratification ($\beta = .13, p = .01$) as well as higher levels of response inhibition ($\beta = .13, p < .01$). Furthermore, the results showed that children who had higher levels of delay of gratification, generally also had higher levels of response inhibition ($\beta = .11, p = .02$) and that parents who were more sensitive during play, generally also disciplined their child more sensitively ($\beta = .29, p < .01$). With respect to the covariates, we found that parents of older children were more sensitive during play, whereas parents of girls had higher sensitive discipline scores. Higher SES was related to more sensitivity and sensitive discipline, see Figure 2. Unstandardized coefficients and their standard errors for the full and parsimonious model can be found in the supplemental material (Table S1).

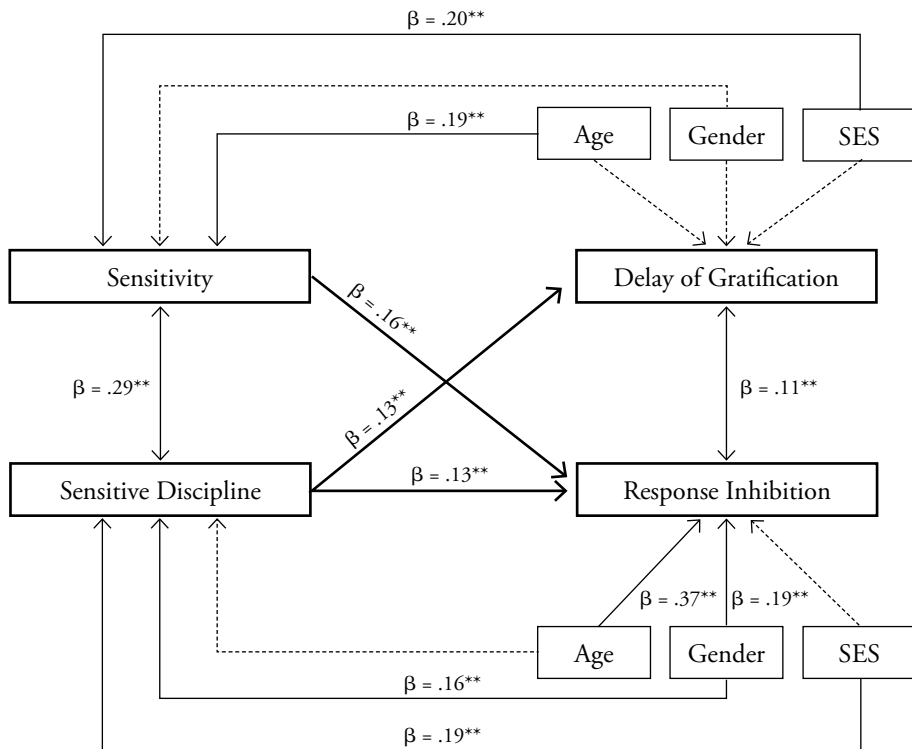


Figure 2. Parsimonious path model for delay of gratification and response inhibition. Thick lines indicate the main paths of interest; solid lines indicate significant paths, dashed lines indicate insignificant paths; statistics are corrected for non-independency in the data. *Note.* $^{**} p < .01$, $^{*} p < .05$.

Bivariate behavioral genetics analysis

Results of the likelihood ratio tests showed that the fit of the AE and CE models was not significantly worse than the fit of the ACE model, whereas the fit of the model including only E was significantly worse than the models including A or C, see Table 2. Since both the $\Delta\chi^2$ and AIC of the CE model were lower than the values of the AE model, the CE model was selected, indicating that variance in and covariance between children's delay of gratification and response inhibition was best explained by a combination of shared and unique environmental factors.

Table 2. Fit indices of the full and nested bivariate models as well as the results of the likelihood ratio tests.

	-2LL	df	AIC	Comparison model	$\Delta\chi^2$	Δdf	<i>p</i>
1. Saturated model	1741.10	640	-	-	-	-	-
2. Full ACE model	1765.19	657	451.19	1	24.09	17	0.12
3. AE model	1767.15	660	447.15	2	1.96	3	0.58
4. CE model	1765.75	660	445.75	2	0.56	3	0.91
5. E model	1787.00	663	461.00	3	19.85	3	0.00

Note. Bold text indicates statistics for the best fitting model.

The variance explained in both types of behavioral control by genetic, shared and unique environmental factors for the full model and submodels can be found in Table 3. For both delay of gratification and response inhibition we found that most of the variance in individual differences was explained by unique environmental factors (93% and 68% respectively). Shared environmental factors explained 7% of the variance in individual differences in delay of gratification and 32% of the variance in individual differences in response inhibition, see Table 3. The covariance between individual differences in delay of gratification and response inhibition was explained mostly by shared environmental factors $((.20 \cdot .57)/.11 = 1.04)$ and only for a small part by unique environmental factors $((-.01 \cdot .82)/.11 = -0.07)$. Furthermore, we found that the shared environmental correlation, reflecting to what degree shared environmental factors influencing individual differences in delay of gratification

overlap with the shared environmental factors influencing individual differences in response inhibition, was high ($r = .74$). The unique environmental correlation was low ($r = -.01$).

Table 3. Relative influence of genetic (A), shared (C) and environmental (E) factors on variance in children's delay of gratification and response inhibition represented by squared path loadings.

	Delay of Gratification			Response Inhibition		
	A ²	C ²	E ²	A ²	C ²	E ²
ACE model	.09	.01	.90	.13	.24	.64
AE model	.08	-	.92	.40	-	.60
CE model	-	.07	.93	-	.32	.68

Note. Bold text indicates statistics for the best fitting model.

Discussion

The main aim of the current study was to test the associations between parental sensitivity and sensitive discipline on the one hand, and children's hot (i.e., delay of gratification) and cool behavioral control (i.e. response inhibition) on the other hand. We found that parental sensitive discipline predicted both hot and cool behavioral control over and above parental sensitivity, whereas parental sensitivity only predicted cool behavioral control over and above parental sensitive discipline. Children's hot behavioral control was thus uniquely predicted by sensitive discipline, whereas cool behavioral control was predicted by both parenting variables.

The finding that only parental sensitive discipline uniquely contributed to the prediction of children's delay of gratification when both parenting variables were included in the analyses, is in line with our hypothesis. According to Mischel (2014), successful delayers in the marshmallow test create all sorts of ways to distract themselves. As Houck and LeCruyer (2006) suggested, children may internalize a

capacity for self-distraction through the active distractions provided by the parent in limit-setting situations. This might explain why sensitive discipline, which includes the use of active distraction, is important for the development of children's hot behavioral control. As the association between sensitivity and hot behavioral control disappeared after controlling for sensitive discipline, we speculate that the association with sensitivity is overshadowed by the association with sensitive discipline because the latter concept includes both sensitivity and discipline. Next to being reassuring, calm, and an affectively secure base, mothers need to use techniques like distraction, induction and postponing to support their child in discipline situation. Furthermore, Karreman, van Tuijl, van Aken, and Dekovic (2006) found in their meta-analysis somewhat stronger effects of parenting on children's self-regulation when investigating positive (e.g. limit setting, guidance and instructional behavior) and negative controlling (e.g. power-assertive control, coercive behaviors and intrusiveness) rather than responsive aspects of parenting (e.g. warmth, affection, sensitivity and involvement). Both controlling and responsive aspects of parenting were included in our observation of sensitivity as well as sensitive discipline, but controlling behaviors were probably more elicited by the don't touch task than by the etch-a-sketch, since this task seems to be more demanding and distressing for both children and parents. Additionally, maternal sensitivity to distress and sensitivity in emotionally arousing contexts is thought to be a more salient predictor of children's emotional and behavioral regulation than sensitivity to non-distress situations (see for a review Leerkes, Weaver, & O'Brien, 2012).

The finding that both parental sensitivity and sensitive discipline uniquely contributed to children's cool behavioral control was not in line with our hypothesis that only parental sensitivity would be uniquely related to cool behavioral control when including both parenting variables in the analyses. This hypothesis was based on results of Kok et al. (2014), who found that the relation between sensitive discipline and parent-reported cool behavioral control disappeared when controlled for sensitivity. The difference with our findings might be explained by differences in the assessment of cool behavioral control, since it is unclear how the questionnaire used by Kok et al. (2014) relates to typical cool behavioral control tasks, like a stop-signal task. The finding that sensitivity predicts children's cool behavioral control is in line with previous studies. Bernier, Carlson, Deschenes, and Matte-Gagne

(2012) suggested that the relation between parental sensitivity and children's cool behavioral control may be explained by the positive effect of parental sensitivity on children's attachment security. Secure attachment relationships in turn support the development of cognitive regulatory mechanisms. The mechanisms behind the association of parental discipline strategies with cool behavioral control, however, remain unclear. To our knowledge there are no other studies examining the effects of sensitive discipline on children's cool behavioral control.

A second aim of the study was to test to what extent individual differences in delay of gratification and response inhibition as well as the association between both types, could be explained by genetic, shared, and/or unique environmental factors. We found that a combination of shared and unique environmental factors predicted individual differences in children's hot and cool behavioral control and the association between both types best. Most variance in individual differences in children's delay of gratification and response inhibition was explained by unique environmental factors (93% and 68% respectively), whereas the association between the two types of behavioral control was mostly explained by, largely overlapping, shared environmental factors. The results of the path model suggested some of the specific unique environmental factors that may explain the effect of the unique environment on differences in children's hot and cool behavioral control, i.e., the level of sensitivity and sensitive discipline of the primary parent towards that specific child.

The lack of a genetic effect may be due to the age of the children in our samples, since heritability estimates of for example cognitive abilities and impulsivity have been found to increase with age (Anokhin et al., 2011; Anokhin et al., 2015; Briley & Tucker-Drob, 2013). Previous studies included children between 6 and 18 years old (Anokhin et al., 2011; Anokhin et al., 2015; Crosbie et al., 2013; Schachar et al., 2011), whereas our sample consists of 4- to 6-year-old children. Moreover, previous studies on hot behavioral control used a delay discounting task in which children were offered a choice between \$7 now or \$10 one week later. Although both delay of gratification and delay discounting tasks assess the preference for a smaller immediate reward over a larger, but delayed, reward, there is a key difference: delay of gratification tasks measure the ability to sustain a choice for the delayed reward

whereas delay discounting tasks only measure the initial choice response (Reynolds & Schiffbauer, 2005). This may also explain why our results, specifically for hot behavioral control, may differ from those of previous studies. Lastly, it is important to note that although the goodness-of-fit indices of the CE model were better than those of the AE model, the likelihood ratio test showed no significant difference between the ACE and AE model. It is therefore debatable if it is possible to choose between an AE and CE model (Groot, de Sonnevile, Stins, & Boomsma, 2004). For this reason, genetic influences cannot be discarded completely. Further research is needed to examine the relative influence of genetic, shared, and unique environmental factors on young children's delay of gratification and response inhibition, and the covariance between the two types.

When interpreting the results of the current study, some limitations should be taken into account. First of all, despite adjustments to the original task developed by Tillman et al. (2008), the stop-signal task might have been somewhat too demanding for some of the youngest children in our sample. Data of 48 children, who were on average younger than the other children, were invalid due to inattention or a failure to comply to the task instructions. Another limitation concerns the small variance in laxness and physical interference, which might be explained by the skewed distribution of SES in the current sample: only 7% of the families were classified as a low SES family. Moreover, this limits the generalizability of our results to higher SES families (with same-sex twins). Furthermore, the correlational design does not exclude the possibility that children who are better able to control their own behavior elicit more sensitive parenting strategies. Causality and direction of effects can only be demonstrated using an experimental design. In time, we will be able to analyze the data collected in the post-intervention phase of the L-CID project to overcome this limitation. The longitudinal nature of the study, however, does provide some indication of the direction of the effects, since parenting quality was assessed one year before children's hot and cool behavioral control. Another strength of the current study is that both parental sensitivity and sensitive discipline as well as children's hot and cool behavioral control were assessed using observational measures.

The current study adds to the existing literature by testing the relative influence of genetic, shared and environmental factors on individual differences in children's

delay of gratification and response inhibition and the association between them, as well as by testing a model that includes both parental sensitivity and sensitive discipline as well as children's hot and cool behavioral control. To our knowledge, there are no behavioral genetics studies for delay of gratification as measured with the marshmallow test and for response inhibition as measured with the stop-signal task in 4- to 6-year-old children. With regard to the antecedents of both hot and cool behavioral control, most studies included only one parenting variable or measured only one type of behavioral control, limiting the possibilities to examine whether sensitivity and sensitive discipline are differentially related to hot and cool behavioral control. We showed that hot behavioral control, which has been related to behavior problems (Kim et al., 2013; Willoughby et al., 2011), seems to be predicted by sensitive discipline only when controlling for parental sensitivity during play, whereas cool behavioral control, which has been related to academic performance (Kim et al., 2013; Willoughby et al., 2011), seems to be predicted by both parental sensitivity and sensitive discipline. When the current findings can be replicated, they would yield important implications for programs aiming to promote school success or prevent behavior problems as they suggest special emphasis on promoting parental sensitive discipline.

Supplemental material

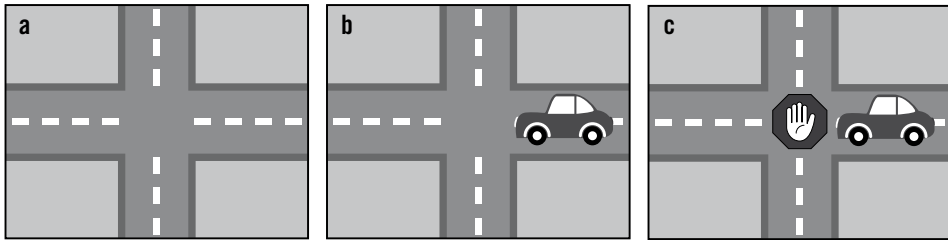


Figure S1. Visual overview of the stop-signal task. S1a = start screen, S1b = go trial, S1c = stop trial.

Table S1. Unstandardized coefficients and standard errors for the relations between the outcome variables and the predictors and covariates in both models.

		Full model			Parsimonious model		
		<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Delay of Gratification	Sensitivity	.05	.05	.28	-	-	-
	Sensitive discipline	.11	.05	.04	.13	.05	.01
	Gender child	>-.01	.08	.99	-.01	.08	.95
	Age child	.08	.06	.22	.09	.06	.15
	SES	.07	.06		.08	.06	.18
Response Inhibition	Sensitivity	.28	.08	<.01	.27	.08	<.01
	Sensitive discipline	.24	.08	<.01	.24	.08	<.01
	Gender child	.58	.14	<.01	.58	.14	<.01
	Age child	.95	.13	<.01	.95	.13	<.01
	SES	-.10	.11	.38	-.09	.11	.39

Note. Statistics are corrected for non-independency in the data.

CHAPTER 4

The Prosocial Cyberball Game: Compensating for
social exclusion and its associations with empathic concern
and bullying in adolescents

Claudia I. Vrijhof, Bianca G. van den Bulk, Sandy Overgaauw, Gert-Jan
Lelieveld, Rutger C.M.E. Engels, & Marinus H. van IJzendoorn.

Published in Journal of Adolescence, 2016, 52, 27–36.

Abstract

In this study we examined prosocial compensating behavior towards socially excluded ingroup and outgroup members by using a 'Prosocial Cyberball Game' in 9- to 17-year-old Dutch adolescents ($N=133$). Results showed that adolescents compensated for the social exclusion of an unknown peer in a virtual ball tossing game, by tossing the ball more often to that player in compensation conditions compared to the fair play condition. The proportion of tosses towards the excluded player did not significantly differ as a function of the group status of that player. Although compensating behavior towards ingroup versus outgroup members did not differ, the underlying motivation for this behavior may vary. More empathic concern was associated with more prosocial tosses towards an ingroup member, whereas more self-reported bullying behavior was associated with less compensating behavior in the outgroup condition. These findings may have practical implications for programs intending to change bystander behavior in bullying situations.

Keywords:

prosocial behavior, Cyberball, social exclusion, group status, adolescence

Introduction

Prosocial behavior can be broadly defined as voluntary actions benefitting others and it has been suggested to include behaviors like helping, sharing, donating, comforting, and cooperation (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Fabes & Eisenberg, 1998; Schroeder & Graziano, 2015). Prosocial behavior in children and adolescents predicts future social adjustment (Crick, 1996), academic achievement (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000) and self-esteem (Laible, Carlo, & Roesch, 2004). Moreover, it seems to be a particularly interesting factor in determining children's and adolescents' likeability or acceptance as rated by peers, as the presence of prosocial behavior predicts peer acceptance, whereas the absence of verbal and physical aggressive behavior does not (Caprara et al., 2000; Denham, McKinley, Couchoud, & Holt, 1990). Social support has a great influence on people's life, and peer acceptance for example, has been found to moderate the relation between family adversities and externalizing problem behavior (Criss, Pettit, Bates, Dodge, & Lapp, 2002).

Altogether, early prosocial behavior influences a person's development and life outcomes in numerous ways and it is therefore important to study this behavior reliably. However, research focusing on prosocial behavior of children and adolescents generally relies on self- or other-reports, which does not necessarily reflect actual behavior. Therefore, it is important to investigate these behaviors also in a more objective way by using behavioral assessments. The aim of the current study was to observe prosocial behavior in early to mid-adolescents (9- to 17-year-olds) with an adapted version of a virtual ball tossing game, the 'Prosocial Cyberball Game' (PCG), and to examine the associations with age, gender, group status of the excluded participant and personality characteristics.

The original Cyberball Game (Williams, Cheung, & Choi, 2000) consists of three players, one of whom is the participant, who is going to be excluded from tossing a ball by the two other (virtual) players. This provokes strong feelings of rejection and being bullied (Williams et al., 2000; Zadro, Williams, & Richardson, 2004). Previously, Cyberball has been used mainly to study the effects of social exclusion on the participant. The prosocial variant however can be used to study prosocial behavior after observing social exclusion.

The PCG was based on the task developed by Riem, Bakermans-Kranenburg, Huffmeijer, & Van IJzendoorn (2013), see also Wesselmann, Wirth, Pryor, Reeder, & Williams (2013). After a fair play block with equal numbers of tosses to every player, two of the virtual players started to exclude the third virtual player in the observation and compensation blocks. In the compensation blocks the participant could either choose to join the excluders by tossing less balls to the excluded player than in the fair play block (complicit bystander), take a neutral position (passive bystander) or compensate for their behavior by tossing more balls to the excluded player than in the fair play block (active defender), which would be considered prosocial behavior.

Results of previous studies in college student samples showed that (under)graduate students compensated for the exclusion of another player by tossing more balls to the excluded player (Nozaki, 2015; Riem et al., 2013; Wesselmann et al., 2013). The same result was found in a study focusing on 10- to 15-year-old boys (Howard, Landau, & Pryor, 2014). In this study, the participants played the four-player Cyberball Game after they watched a video of the three alleged confederates. In the video, one of the boys was bullied by one of the other boys, while the third boy either played the role of an active defender of the victim, a passive bystander or a complicit bystander. In the Cyberball Game that followed, the bully did not throw any balls to the victim after the first 20 trials, while the bystander threw a third of the balls to the victim. Participants tossed significantly more balls to the victim than to the bully.

To our knowledge, the prosocial compensating behavior of adolescent girls has not yet been studied. Research suggests that with growing age, females are more empathic than males (Fabes & Eisenberg, 1996, as described in Fabes & Eisenberg, 1998; Van der Graaff et al., 2014). Therefore, female adolescents may be expected to be more prosocial than male adolescents. By including both adolescent boys and girls, our study adds to the existing literature on prosocial behavior towards socially excluded individuals. Furthermore, we included quite a broad age range to investigate possible effects of age on the participants' behavior. A meta-analysis by Fabes and Eisenberg (1998) on age differences in prosocial behavior showed that 13- to 17-year-olds are generally more prosocial than 7- to 12-year-olds. However, these age differences vary considerably among different forms of prosocial behavior and methods to investigate prosocial behavior.

Another distinctive characteristic of this study is the ingroup-outgroup manipulation that we added to the paradigm. Since people tend to be more cooperative with ingroup members compared to outgroup members (Balliet, Wu, & De Dreu, 2014; Goette, Huffman, & Meier, 2006) and share more resources with ingroup members (Baldassarri & Grossman, 2013; Chen & Li, 2009), prosocial compensating behavior in response to social exclusion may vary as a function of the group status of the excluded player. In order to investigate differences in prosocial behavior of adolescents towards ingroup and outgroup members, we added an ingroup versus outgroup feature to the PCG by using colors to suggest group membership of the players (Wirth & Williams, 2009), which can be characterized as a minimal group method (Tajfel, Billig, Bundy, & Flament, 1971). A meta-analytic review showed that minimal group paradigms reliably produce ingroup preference of moderate magnitude (Mullen, Brown, & Smith, 1992). Recently, a study by Dunham and colleagues (2011) showed that minimal groups paradigms can result in ingroup favoritism, even in children as young as four to six years old.

Differences in prosocial compensating behavior between adolescents may at least partly be explained by differences in empathic capacities. According to Eisenberg, Eggum, & Di Giunta (2010), definitions of empathy generally include the ability to understand others' emotions or perspectives and to resonate with others' emotional states. Empathy therefore is an important correlate of prosocial behavior as was demonstrated in a study on African-American adolescents (McMahon, Wernsman, & Parnes, 2006) showing that adolescents who scored higher on empathy also showed more prosocial behavior. Furthermore, Nozaki (2015) found a positive relation between emotional competence, operationalized as individual differences in the identification, understanding, expression, regulation and use of one's own emotions and those of others (Brasseur, Gregoire, Bourdu, & Mikolajczak, 2013) and the proportion of tosses towards the socially excluded participant of students in a Cyberball Game.

The link between empathy and prosocial behavior towards an excluded individual may be explained by the fact that highly empathic individuals activate not only the regions of their brain involved in mentalizing, but also the social pain-related regions (Masten, Morelli, & Eisenberger, 2011), indicating that these individuals

might vicariously experience the social pain experienced by a socially excluded individual (Wesselmann, Williams, & Hales, 2013). This empathy-related activation in especially the medial prefrontal cortex was found to mediate the relation between trait empathy and prosocial behavior towards a socially excluded person, which was assessed by rating the emails the participants wrote to the victim for level of prosocial behavior (e.g. helping, comforting; Masten et al., 2011).

Individual differences in prosocial behavior may also be related to bullying. Bullying and being bullied have been found to be associated with lower levels of empathy (Van Noorden, Haselager, Cillessen, & Bukowski, 2015), which in turn could be related to less prosocial behavior. Therefore, it is important to examine experience with bullying and being bullied when investigating prosocial behavior, especially in the context of a social exclusion paradigm. Furthermore, higher rates of externalizing problem behavior and physical aggression seem to be associated with less prosocial behavior (Flynn, Ehrenreich, Beron, & Underwood, 2014; Kokko, Tremblay, Lacourse, Nagin, & Vitaro, 2006; Nantel-Vivier, Pihl, Cote, & Tremblay, 2014). Previous research has shown that children with clinical levels of behavioral problems show deficits in the development of concern for others (Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000), which might be the reason why they display less prosocial behavior. Therefore, the influence of problem behavior on prosocial compensating behavior during the Cyberball Game was investigated as well.

In sum, we expected that participants would compensate for the social exclusion of another player by tossing the ball more often to that player in the compensation blocks compared to the fair play block (Howard et al., 2014; Nozaki, 2015; Riem et al., 2013; Wesselmann et al., 2013). Furthermore, we hypothesized that participants would be more likely to act prosocially towards an ingroup member than towards an outgroup member (Balliet et al., 2014; Goette et al., 2006). We also expected that individuals who reported higher levels of empathy and lower levels of problem behavior (Flynn et al., 2014), bullying, and victimization (Van Noorden et al., 2015) would be more likely to act prosocially. Lastly we hypothesized that older participants would show more prosocial behavior than younger participants and that girls would act more prosocially than boys, since they are thought to be more empathic (Fabes & Eisenberg, 1996, as described in Fabes & Eisenberg, 1998; Van der Graaff et al., 2014).

Method

Participants

Recruitment was aimed at sampling typically developing early (9- to 12-years-old) to mid-adolescents (13- to 17-years-old) (Crone & Dahl, 2012) from different educational levels. We made phone calls to several regular schools in the western part of the Netherlands, and asked if they were interested in participating in our study. In the Netherlands, students with severe behavioral or psychiatric problems, intellectual deficits or physical disabilities receive special (needs) education, therefore we assumed all participants from regular schools to be typically developing students. After the phone call schools received an information letter about the study. Schools that decided to participate ($N = 6$) handed out information letters to parents describing the aim and procedure of the study. Participants and their parents were told that the focus of the study was on processes involved in decision making. Permission for this study was obtained from the Ethics Committee of the Psychology Department of Leiden University.

In total, one hundred and thirty-six subjects from primary (25%), vocational (12.5%), and high schools (62.5%) in the western part of the Netherlands participated in this study. Two high-school students with missing data on the PCG and one high-school student with a deviant response pattern (tossing all balls to the player at the right side in the fair and outgroup compensation block and all balls to the player at the top of the screen in the ingroup compensation block) were excluded, resulting in a total sample size of 133 adolescents. The mean age of the participants was 13.93 years ($SD = 2.33$, range 9 - 17) and 54% percent of them were boys. Forty participants were early adolescents (55% boys, M age = 10.82), and ninety-three participants were mid-adolescents (54% boys, M age = 15.27). All but one participant reported their nationality, 85% reported only a Dutch nationality, 6% reported both a Dutch and another nationality (for example Turkish or Surinamese) and 8% reported a non-Dutch nationality (for example Turkish, Chinese or Bulgarian). Informed consent was obtained for all participants included in the study and their parents.

Procedure

As part of a larger pilot study, all participants were tested on three different occasions.

Test sessions were conducted at the schools in an allocated classroom. During the first session, which lasted approximately 20 minutes, participants created an online profile on a website that was designed for this study. This profile was used in one of the computer tasks performed by the participants in the second session. During this session that lasted about 45 minutes, participants also performed the PCG. In the third session, which lasted also about 45 minutes, participants filled out several online questionnaires. Due to computer problems, the order of session two and three was changed for a few participants. At the end of the last test session, participants were debriefed and received a gift certificate of 10 Euro as a reward for participation. Data was collected by a group of six well-trained undergraduate psychology students and one graduate student.

Measures

The Prosocial Cyberball Game. We used an adapted version of the four player Cyberball Game previously developed by Riem et al. (2013), see also Wesselmann et al. (2013). Participants were led to believe that they were about to play an online ball game with three unfamiliar peers who also participated in this study. In fact, the other players were computerized confederates. Similar to studies using the original Cyberball Game, we instructed the participants to play the game by tossing the ball to the other players using the arrow buttons on the keyboard and to mentally visualize the game (Williams et al., 2000). The participants were completely free to decide for themselves to which of the other players he or she would toss the ball. The participant was an animated player at the bottom of the screen (player 2), and three other animated figures, representing the three other participants, were positioned at the left (player 1), right (player 3) and upper side of the screen (player 4), see Figure 1. The game consisted of five blocks (detailed below): A fair play block consisting of 48 trials, an ingroup observation block consisting of 20 trials, an ingroup compensation block consisting of 48 trials, an outgroup observation block of 20 trials and an outgroup compensation block of 48 trials. All five blocks were played by the participants.

In the fair play block (see Figure 1a), all players had the same neutral color and received about one fourth of the tosses. In the other four blocks, player 4 was excluded from the game and did not receive any tosses from player 1 and player

3. We counterbalanced the order of the four unfair blocks in a way that half of the participants played the ingroup blocks first, while the other half played the outgroup blocks first. In the ingroup observation block, the participant was asked to observe the other players while they were playing the game. This block was inserted to make sure that the participant noticed the exclusion of player 4 by player 1 and player 3, before playing the compensation block. In the ingroup compensation block, the participant could play along again and had the possibility to compensate for the social exclusion by tossing the ball more often to the excluded player (player 4). To elicit the idea of belongingness to the same group, the animated figure that represented the excluded player had the same color as the participant (yellow), whereas the animated figures that represented the excluders were purple (see Figure 1b). The same procedure was used for the outgroup observation and compensation blocks. However, in these blocks, the excluded player did not belong to the same group as the participant, therefore the animated figure representing the excluded person was purple, whereas the figures representing the participant and excluders were yellow (see Figure 1c).

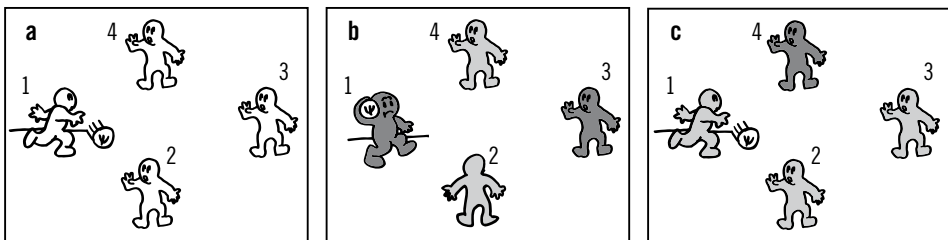


Figure 1. The animated figure at the bottom of the screen (player 2) represents the participant. The unknown other players are represented by the animated figures on the left (player 1) and right (player 3), and at the top of the screen (player 4). In the fair play block (Fig. 1a) all participants are included. In the ingroup compensation block (Fig. 1b), the ingroup member at the top of the screen (player 4) is excluded from the game by the outgroup members on the left (player 1) and right (player 3). In the outgroup compensation block (Fig. 1c) the outgroup member at the top (player 4) is excluded from the game by the ingroup members on the left (player 1) and right (player 3). *Note.* In the original game the figures were displayed in white, yellow, purple; here displayed in white, light grey and dark grey.

To correct for small differences in the total number of tosses per participant per block (fair play block 11 - 13 tosses, ingroup and outgroup compensation block 14 -16 tosses) we computed the proportion of tosses to player 1, 3 and 4 by dividing the number of tosses to that player by the total number of tosses of the participant in each specific block. Since participants could not play along in the observation blocks, these blocks were excluded from the analyses.

Interpersonal Reactivity Index (IRI). Empathy was measured with two subscales of the Dutch IRI self-report (De Corte et al., 2007): empathic concern (five items, one item was removed to improve the inter-item reliability) and perspective taking (six items). The empathic concern subscale assesses feelings of warmth, compassion, and concern for others undergoing negative experiences, whereas the perspective taking subscale reflects the ability to adopt the perspective, or point of view, of other people (Davis, 1983). Participants were asked to rate to what extent the statements described their feelings and behaviors on a 5-point scale (1 = does not describe me well, 5 = describes me very well). One participant only completed two items, one of each subscale. We replaced the scores of this participant by the mean scores of same age, same sex, same educational level participants. The internal consistency of the empathic concern subscale as well as the perspective taking subscale was just acceptable ($\alpha = .65$ and $\alpha = .68$ respectively).

Strengths and difficulties Questionnaire (SDQ). Prosocial and problem behavior of the adolescents was assessed with the Dutch version of the SDQ (Van Widenfelt, Goedhart, Treffers, & Goodman, 2003). The questionnaire consists of 25 items divided over five subscales: emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial behavior. Five items consisted of two parts (e.g. I try to be nice to other people. I take their feelings into account.) and were split in two items, resulting in a total number of thirty items. An average score was computed for the items that were split in two parts. Participants were asked to report if the behavior described was applicable to them on a 3-point scale (1 = not true, 3 = certainly true). Since the SDQ was designed for 11-year-olds and older, 20 participants who were younger than 11 years did not fill out the questionnaire.

Because the reliability of some of the subscales regarding problem behavior was

too low (conduct problems and peer problems), we made a composite score for internalizing (emotional symptoms and peer problems) and externalizing (conduct problems and hyperactivity) problem behavior (Goodman, Lamping, & Ploubidis, 2010). For the SDQ, no outliers were detected. The internal consistency of both the internalizing and externalizing problem behavior subscale was satisfactory ($\alpha = .72$ and $\alpha = .70$ respectively). The internal consistency of the prosocial behavior scale was just acceptable ($\alpha = .60$).

Olweus Bully/Victim Questionnaire (OBVQ). Exposure to direct bullying by peers and bullying of peers was measured with the Dutch version of the OBVQ questionnaire (Olweus, 1986) consisting of nine items divided over two subscales: victimization (five items) and bullying other students (four items, one item was removed to improve reliability). Participants rated the questions on a 4- or 5-point rating scale depending on the question. A high score implies frequent exposure to bullying or frequent bullying behavior towards others. The internal consistency of the victimization and bullying subscales was acceptable to good ($\alpha = .80$, $n = 130$ and $\alpha = .68$, $n = 128$ respectively).

Analysis Plan

We used SPSS 21 to analyze our data. Variables were inspected for possible outliers, defined as values more than 3.29 *SD* below or above the mean (Tabachnick & Fidell, 2012). No outliers were detected for the IRI and SDQ subscales. On the OBVQ we detected three outliers, these scores were winsorized (Tabachnick & Fidell, 2012). Mean scores on each of the subscales were computed by dividing the mean score of the participant by the number of valid items. We checked if the scores were normally distributed. Since the scores on both subscales of the OBVQ were positively skewed, we performed square root transformations (Tabachnick & Fidell, 2012).

First, correlations between the proportion of tosses to player 1, 3, and 4 across the fair, ingroup and outgroup condition were inspected. Analyses of covariance with repeated measures were used to analyze the response pattern of the participants in the PCG. To examine the individual tossing behavior of the participants more detailed, we computed difference scores by subtracting the proportion of tosses to player 4 in the fair play block from either the proportion of tosses to this player in the ingroup

or outgroup compensating block and dividing this number by the proportion of tosses to player 4 in the fair play block. Finally, two series of backward regression analyses were conducted in order to examine the relations between the tosses to player 4 in the ingroup and outgroup condition and the scores on the IRI, SDQ and OBVQ subscales. Backward regression starts with inclusion of all variables in the equation and successively removes non-significant predictors from the equation. The advantage above stepwise or forward regression is that a sub-set of variables might be significant whereas individual variables remain below threshold. Age and gender were included as covariates in all analyses.

Results

Correlations between the proportion of tosses to player 1, 3 and 4

In all three conditions (fair play, ingroup, and outgroup), a higher proportion of tosses to player 4 was strongly associated with a lower proportion of tosses to both player 1 ($r = -.56, p < .01$; $r = -.80, p < .01$ and $r = -.77, p < .01$ respectively) and player 3 ($r = -.63, p < .01$; $r = -.86, p < .01$ and $r = -.80, p < .01$ respectively), see the correlation matrix (Table S1; supplemental material). Therefore, only the proportion of tosses to player 4 was examined in the repeated measures ANCOVAs and the regression analyses. Furthermore, since the proportion of tosses to player 4 in the fair play condition was positively related to the proportion of tosses to player 4 in the ingroup condition ($r = .22, p = .01$), as well as the outgroup condition ($r = .18, p < .04$; see the correlation matrix [Table S1] in the supplemental material), we took the proportion of tosses to player 4 in the fair play condition into account as a covariate in the regression analyses with either the proportion of tosses to player 4 in the ingroup or outgroup condition as dependent variable.

Repeated measures ANCOVA and individual difference scores

To examine whether participants compensated for the exclusion of player 4 by tossing the ball more often to player 4, a repeated measures analysis was performed with the proportion of tosses to player 4 as the dependent variable and condition (fair play, ingroup, and outgroup) as the within-subject variable (Bonferroni corrected). The results showed a main effect of condition on the proportion of tosses to player 4

($F(2, 260) = 3.45, p = .03$, partial $\eta^2 = .03$). Participants tossed the ball more often to the excluded player in the ingroup condition ($p < .01$) and in the outgroup condition ($p < .01$) than in the fair play condition (see Fig. 2). No significant difference was found between the proportion of tosses to player 4 in the ingroup condition and the outgroup condition ($p = 1.00$). No main or interaction effects of age or gender were found.

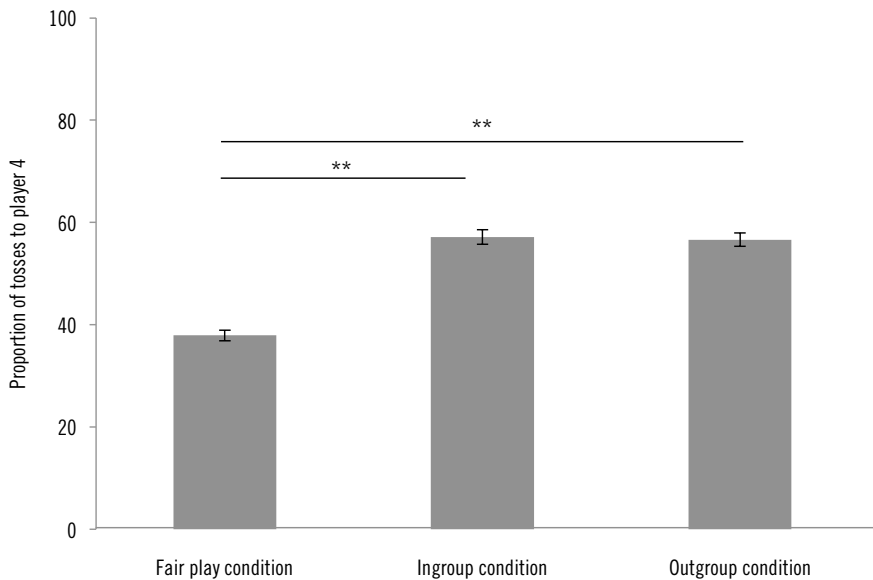


Figure 2. Mean proportion of tosses to player 4 in the fair play, ingroup, and outgroup condition ($N = 133$). *Note.* ** $p < 0.01$, * $p < 0.05$.

We checked whether early and mid-adolescents responded similarly to the social exclusion of player 4 by performing a repeated measures analysis with age group (early versus mid-adolescents) as a between-subject variable. Gender was included as a covariate. The results showed a main effect for condition ($F(2,260) = 15.19, p < .01$, partial $\eta^2 = .11$), but no interaction effect between condition and age group ($F(2, 260) = 0.21, p = .81$, partial $\eta^2 < .01$).

The pattern of individual difference scores for the fair play block compared to the ingroup compensation block was almost identical to the pattern of the fair play versus outgroup compensation block. About 13% of the participants showed a decrease in the proportion of tosses to player 4 in the compensation block compared to the fair play block, whereas approximately 2% did not change their proportion of tosses in the compensation blocks compared to the fair play block. The majority of the participants (85%), however, showed an increase in the proportion of tosses to player 4 compared to the fair play block.

Correlations between the IRI, SDQ and OBVQ subscales

Higher levels of perspective taking were associated with more self-reported prosociality and less externalizing behavior problems and victimization (see Table 1 for correlation matrix). Adolescents who reported high levels of empathic concern, described themselves as more prosocial than adolescents who reported lower levels of empathic concern. Moreover, they reported less bullying behavior as well. More externalizing problem behavior was related to more internalizing behavior and to less self-reported prosociality. Adolescents with higher scores on internalizing or externalizing problem behavior were bullied more often than children who reported lower levels of problem behaviors, which was in turn related to more bullying behavior.

Regression analyses

In order to examine whether the rationale for the compensating behavior of adolescents differed in the ingroup and outgroup condition, we conducted two series of backward regression analyses to test the relation between the proportion of tosses to player 4 and the scores on the IRI, SDQ and OBVQ subscales. The dependent variable was the proportion of tosses to player 4 in the ingroup or outgroup condition.

In the regression analysis with the ingroup condition as dependent variable, a model with four predictors was significant ($F(4,108) = 3.84, p < .01, R^2 = .12$). Two predictors were significant: gender ($\beta = -.22, p = .02$) and the proportion of tosses to player 4 in the fair play condition ($\beta = .22, p = .02$). Boys tossed more balls to player 4 than girls, and participants who tossed more often to player 4 in the fair play condition, tossed more balls to player 4 in the ingroup condition. Empathic concern ($\beta = .21, p = .06$) and prosocial behavior ($\beta = -.18, p = .10$) were not significant.

Table 1. Mean raw scores and standard deviations on the IRI ($N = 133$), SDQ ($N = 113$) and OBVQ ($N = 133$) subscales and correlations between the subscale scores, percentage of tosses to player 4, age and gender.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. Perspective taking	3.36	0.68	-								
2. Empathic concern	3.42	0.68	.15	-							
3. Prosocial behavior	2.53	0.34	.53**	.49**	-						
4. Externalizing problem behavior	1.70	0.32	-.25**	-.09	-.26**	-					
5. Internalizing problem behavior	1.50	0.36	-.09	-.00	-.12	.47**	-				
6. Victimization	1.50	0.61	-.17*	.03	-.02	.27**	.48**	-			
7. Bullying	1.35	0.41	-.08	-.18*	.12	.17	.04	.18*	-		
8. % tosses to p4 Ingroup condition	57.2	16.7	-.07	.08	-.08	.09	.07	.06	-.02	-	
9. % tosses to p4 Outgroup condition	56.7	15.2	-.09	.07	-.09	-.02	.09	.05	-.17*	.32**	-
10. Age	13.93	2.33	.04	.00	.01	-.05	-.22*	-.35**	-.01	-.07	.05
11. Gender	54 ^a	46 ^b	.04	.16	.04	-.02	.21*	.08	-.18	-.18*	-.07

Note. ^a = percentage boys, ^b = percentage girls; ** $p < .01$, * $p < .05$.

The proportion of tosses to player 4 in the outgroup compensation block was predicted by two variables ($F(2,110) = 5.00$, $p < .01$, $R^2 = .08$): the proportion of tosses to player 4 in the fair play condition ($\beta = .20$, $p = .03$) and bullying ($\beta = -.21$, $p = .02$). Participants who tossed the ball more often to player 4 in the fair play condition, tossed more balls to player 4 in the outgroup condition. Furthermore, adolescents who bullied others more often tossed significantly fewer balls to player 4 in the outgroup condition.

Discussion

In line with previous studies (Howard et al., 2014; Nozaki, 2015; Riem et al., 2013; Wesselmann et al., 2013), the current study showed that adolescents showed prosocial compensating behavior towards the excluded player by tossing the ball more often to that player in the compensation conditions compared to the fair play condition. Surprisingly, no differences were found in compensating behavior towards ingroup versus outgroup members. This is not in line with previous research showing that people are more likely to act prosocially towards ingroup compared to outgroup members (Baldassarri & Grossman, 2013; Balliet et al., 2014; Chen & Li, 2009; Goette et al., 2006).

A possible explanation for this discrepancy is related to the manipulation we applied. We used a subtle manipulation of group status in which we did not provide any information about the meaning of the different colors. It could be that our manipulation was not strong enough to promote ingroup favoritism. In the study by Dunham and colleagues for example, the child was told that he or she would be assigned to either a red or blue group and was then asked to put on a t-shirt of the appropriate color. Other studies investigating ingroup versus outgroup differences in prosocial behavior used various more explicit strategies. Studies focusing on helping behavior for example, created groups based on sexual orientation (Sturmer, Snyder, & Omoto, 2005) or cultural background (Sturmer, Snyder, Kropp, & Siem, 2006). Future studies investigating prosocial compensating behavior in adolescents might use these more explicit manipulations to examine ingroup versus outgroup differences.

Although the actual behavior towards ingroup and outgroup members did not differ, follow-up analyses suggested that the compensating behavior in the two conditions might be predicted by different child characteristics. The model that predicted compensating behavior of adolescents in the ingroup condition included empathic concern, prosocial behavior, and gender, whereas the model that predicted compensating behavior in the outgroup condition only included bullying. These results suggest that there might be motivational differences for prosocial behavior to an ingroup versus an outgroup member.

Concerning age and gender we did not find consistent or substantial associations with prosocial compensating behavior. The repeated measures analyses, did not reveal any main or interaction effects of age or gender for the proportion of tosses to the excluded player. In the regression analysis regarding the ingroup condition however, a significant relation emerged between gender and the proportion of tosses to the excluded player. Surprisingly, boys compensated more than girls.

Previous studies on gender differences in prosocial behavior showed inconsistent results. A meta-analysis by Fabes and Eisenberg (1998) showed that the magnitude of the effect of gender on prosocial behavior is influenced by the type of prosocial behavior. The same meta-analysis (Fabes & Eisenberg, 1998) revealed that the effect sizes for the effect of age on prosocial behavior varied by subtype of prosocial behavior: a comparison of the group of 13- to 17-year-olds to the group of 7- to 12-year-olds led to an effect size of .02 for instrumental help .33 for comforting and .65 for sharing/donating. Compensating for the social exclusion of another player seems to relate more to helping than comforting or sharing/donating. These different types of prosocial behaviors have different personal and situational correlates (Carlo & Randall, 2002; Padilla-Walker & Carlo, 2014), which may explain the inconsistent results regarding, amongst others, age and gender effects on the global construct of prosocial behavior.

Future research and limitations

Further research is needed to investigate the possible influence of gender differences on prosocial compensating behavior. Are boys really more inclined than girls to show prosocial compensating behavior towards an excluded person? Although speculative, our findings may be related to gender differences in type of bullying. Some researchers have argued that although boys may generally bully more, this pattern is reversed in case of relational bullying (Ostrov & Crick, 2007; Wang, Iannotti, & Nansel, 2009), which refers to indirect forms of bullying such as social exclusion. Since the PCG is about social exclusion, it would interesting to investigate whether this might explain why girls compensate less than boys.

Some limitations should be taken into account when interpreting the results. First, the internal consistency of some of the questionnaire subscales was relatively low,

therefore any related results should be interpreted with caution. However, the relations among the subscales within a domain (e.g. empathy/prosocial behavior and problem behavior/bullying) were significant and in the expected direction. Furthermore, we did not find a relation between levels of self-reported prosocial behavior and prosocial behavior observed in PCG. Previous studies showed that mismatches between self-reported and observed behavior are common and that multiple measurements should be used for complex constructs like prosocial behavior (Duckworth & Kern, 2011; Meyer et al., 2001).

Another limitation is that the excluded player always was the player at the top of the screen. One could argue that the compensating behavior might be influenced by possible symmetry preferences of the participant. However, we used the number of balls tossed to the fourth player in the fair condition as covariate to compensate for this possible symmetry preference of participants. Moreover, Wesselmann et al., (2013) used a design in which the excluded player was always positioned on the right hand side of the participant in study 1a and 1b, with similar numbers of compensating tosses. In Study 2 they counterbalanced the position of the excluded player and found a comparable proportion of tosses to the excluded player. For this reasons, we do not expect to find different results when the position of the (excluded) player would have been different.

Conclusion

We found that both male and female early to mid-adolescents generally compensated for the exclusion of another player in a virtual ball tossing game. These findings contribute to the growing body of research focusing on prosocial responses of individuals after observing social exclusion. The PCG may be used to observe prosocial behavior instead of relying on self-reports. The PCG can be used in 9- to 17-year-old boys and girls, which makes it a suitable instrument for longitudinal research designs. Our findings might also have practical implications for programs intending to change bystander intervention behavior in bullying situations. It is important to focus on bystanders of bullying in interventions, since the behavior of bystanders in a situation in which a person is socially excluded by another person influences the willingness of other individuals to include the victim in subsequent social situations (Howard et al., 2014). We found that individuals with high scores on empathic concern and low scores on bullying seem to feel more compelled to

help a peer when he or she is socially excluded and are more likely to act upon these feelings. Since bullying has been related to lower levels of empathy (Van Noorden et al., 2015), it seems to be important to focus on enhancing empathic concern in anti-bullying programs focusing on bystanders.

Supplemental material

Table S1. Correlations between the percentage of tosses to each of the players per block ($N=133$).

		Percentage of tosses to player 1			Percentage of tosses to player 3			Percentage of tosses to player 4		
		Fair	Ingroup	Outgroup	Fair	Ingroup	Outgroup	Fair	Ingroup	Outgroup
Percentage of tosses to player 1	Fair	-								
	Ingroup	.18*	-							
	Outgroup	.14	.20*	-						
Percentage of tosses to player 3	Fair	-.30**	-.03	.02	-					
	Ingroup	.03	.39**	.19*	.24**	-				
	Outgroup	.02	.11	.24**	.15	.32**	-			
Percentage of tosses to player 4	Fair	-.56**	-.12	-.13	-.63**	-.23**	-.15	-		
	Ingroup	-.12	-.80**	-.23**	-.14	-.86**	-.27**	.22*	-	
	Outgroup	-.10	-.19*	-.77**	-.11	-.33**	-.80**	.18*	.32**	-

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

CHAPTER 5

General discussion

The general aim of the studies presented in the current thesis was the identification of correlates of two key factors for success: behavioral control and prosocial behavior, a hallmark of social competence. We assessed four different types of children's behavioral control (Chapter 2 and 3): parent-reported effortful control, observed cheating behavior, delay of gratification and response inhibition. For prosocial behavior, one type was assessed (Chapter 4): observed compensating behavior towards an excluded peer. Potential correlates were categorized as characteristics of the child, factors in the child's social environment, or factors in the child's physical or socioeconomic environment. In Chapter 2 we focused on relations between factors in the social and physical environment on the one hand and children's effortful control and their cheating behavior on the other hand. The results indicate that individual differences in effortful control were associated with factors in the social environment, whereas differences in cheating behavior were related to factors in the physical environment. Child characteristics and the socioeconomic environment show potential relations with individual differences in both effortful control and cheating behavior. In Chapter 3, relations between factors in the social environment and children's delay of gratification and response inhibition were examined. Evidence for such relations was found for both types of behavioral control. Furthermore, we found that child characteristics were only related to individual differences in response inhibition and that the socioeconomic environment was not related to either delay of gratification or response inhibition. A visual overview of the main results for behavioral control can be found in Figure 1a. Finally, in Chapter 4, we tested relations between adolescents' prosocial behavior, child characteristics, and factors in the social environment of the child on the other hand. We found evidence for some relations in both domains. A visual overview of the main results for prosocial behavior can be found in Figure 1b. In the following sections, the findings will be discussed in more detail.

a

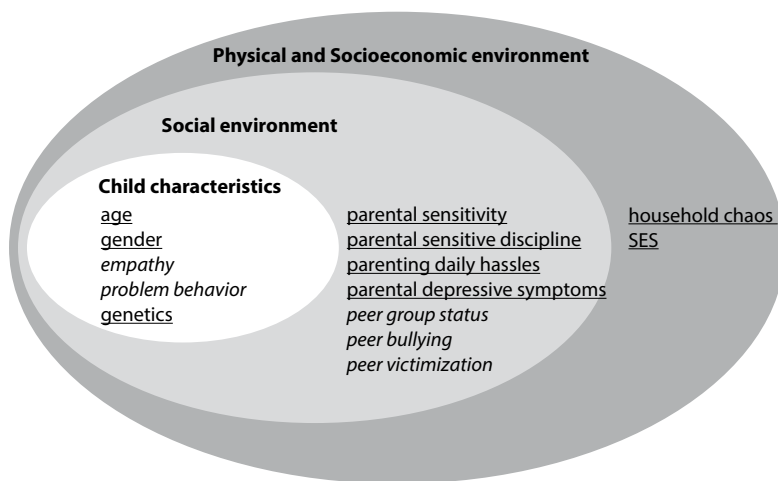


Figure 1a. Results of the current thesis regarding children's behavioral control. Child characteristics and factors in the social, physical, and socioeconomic environment that were significantly related to children's behavioral control are underlined. Factors in a regular font style were not significantly related to children's behavioral control. Factors that were not tested are in italics.

b

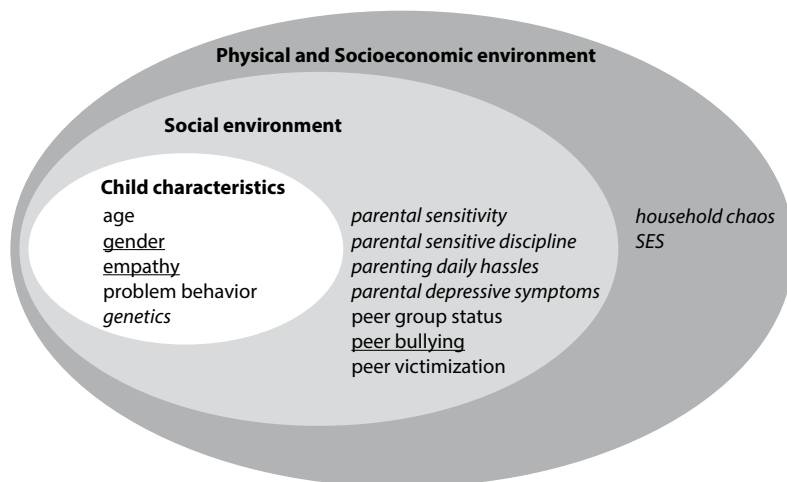


Figure 1b. Results of the current thesis regarding adolescents' prosocial behavior. Child characteristics and factors in the social, physical, and socioeconomic environment that were significantly related to adolescents' prosocial behavior are underlined. Factors in a regular font style were not significantly related to adolescents' prosocial behavior. Factors that were not tested are in italics.

Child characteristics

First of all, relations between child characteristics and individual differences in children's behavioral control (Chapter 2 and 3) and adolescents' prosocial behavior (Chapter 4) were examined. With regard to child age, we only found evidence for an association with behavioral control, not prosocial behavior. We found a positive effect of age on children's response inhibition: older children showed better response inhibition (Chapter 3). In addition, Chapter 2 showed a positive effect of age on children's cheating behavior, which was categorized into three groups: a cheating group, a possible intention to cheat group and a group that did not cheat. Results showed that older children had a higher chance of being in the possible intention to cheat group compared to the cheating group, indicating that older children cheated less. This relation was, however, only found in the test sample and could not be replicated. We speculate that children in the possible intention to cheat group might be considered as children with the highest levels of behavioral control, since they may have been more tempted than children who did not cheat, but resisted this temptation anyway. The fact that we did not find an effect of age on prosocial behavior in early- to mid-adolescents was not in line with our expectations based on previous studies (Chapter 4). It has been shown, however, that prosocial behavior, like behavioral control, is a multidimensional construct and that different dimensions of prosocial behavior are differentially related to child characteristics like child age (Carlo & Randall, 2002; Padilla-Walker & Carlo, 2014). This might explain the lack of an age effect on prosocial compensating behavior. The only other study investigating prosocial compensating behavior in adolescents using a sample of 10- to 15-year-old boys did not find an age effect either (Howard, Landau, & Pryor, 2014).

Child gender was found to be related to both behavioral control and prosocial behavior. With respect to children's behavioral control, we found that girls outperformed boys on response inhibition (Chapter 3). In addition, results from Chapter 2 suggest that girls cheated less than boys, since they had a higher chance of being in the no cheating or possible intention to cheat group than the cheating group. It should be noted however, that this relation could not be replicated in another part of the sample. A possible explanation for this gender difference could be that girls are better in controlling their behavior than boys because of genetic differences, but it could also be that girls elicit a more optimal social environment,

which in turn promotes the development of behavioral control. In Chapter 3, for example, we found that parents of girls disciplined their child more sensitively, which is in line with the results by Kok et al. (2014). For prosocial behavior, we found some evidence indicating that adolescent boys compensated more for the social exclusion of an ingroup member, but not of an outgroup member compared to adolescent girls (Chapter 4). This effect is in the opposite direction of our expectation. It should be noted, however, that we examined gender differences in prosocial behavior using two different statistical analyses and that the other analysis did not show any gender differences. As described in Chapter 4, gender effects on prosocial behavior have been found to vary among different dimensions of prosocial behavior, just like age effects (Fabes & Eisenberg, 1998). In a social exclusion situation gender effects may be reversed since girls tend to score higher on relational bullying than boys (Ostrov & Crick, 2007; Wang, Iannotti, & Nansel, 2009). As a result, girls might be more likely to go along with the excluders and thus compensate less for the exclusion of a peer compared to boys.

In Chapters 2 and 3 we examined the relative influence of genetic factors on individual differences in behavioral control. We found evidence for small (16%) to moderate (31%) genetic contributions to individual differences in children's cheating behavior and parent-reported effortful control respectively (Chapter 2), but not to individual differences in delay of gratification and response inhibition (Chapter 3). For all four types of behavioral control, most of the variance in individual levels was explained by unique environmental factors and/or measurement error. Speculatively, genetic contributions to children's behavioral control might have been smaller than expected because of the young age of the children included in our studies. There is evidence that genetic contributions to individual differences in for example cognitive abilities and impulsivity become larger when individuals grow older (Anokhin, Golosheykin, Grant, & Heath, 2011; Anokhin, Grant, Mulligan, & Heath, 2015; Briley & Tucker-Drob, 2013).

With regard to relations between prosocial behavior and personality characteristics of early- to mid-adolescents, we found that children with higher levels of empathic concern compensated more for the social exclusion of an ingroup member (Chapter 4). It should be noted, however, that empathic concern was related to prosocial

behavior on a trend level only. Individual differences in prosocial behavior were not related to levels of perspective taking and internalizing and externalizing problem behavior (Chapter 4). Interestingly, empathic concern, perspective taking, and externalizing problem behavior were significantly related to self-reported prosocial behavior (r 's are .49, .53, and -.26 respectively). However, self-reported prosocial behavior was not significantly related to observed prosocial compensating behavior. Speculatively, social desirability might have played a role. In our opinion, these results show the importance of assessing what individuals actually do and not what they say they do.

Social environment

Next to child characteristics, we also examined relations between factors in the social environment of children and individual differences in behavioral control and prosocial behavior. The results of Chapter 2 indicate that children of parents who experienced more parenting daily hassles and more depressive symptoms had lower levels of effortful control compared to children of parents who experienced low levels of parenting stress and depressive symptoms. Surprisingly, only the level of depressive symptoms reported by the other parent, who was the biological father in most cases, and not the level reported by the primary parent, who was the biological mother in most cases, was related to children's effortful control. Speculatively, the effect of depressive symptoms of the primary parent is overshadowed by the level of parenting daily hassles, which was also reported by the primary parent, since individuals who reported more parenting daily hassles also reported more depressive symptoms. Another unexpected finding was that no relations were found between children's cheating behavior on the one hand and parenting daily hassles, and parental depressive symptoms of the primary and the other parent on the other hand. Most studies on the effects of parenting daily hassles and parental depressive symptoms on children's behavioral control, however, used parent-report measures for children's behavioral control, whereas in our study cheating was observed. Parent-reports usually include a range of behaviors observed by parents over a longer period of time, which might lead to more variation in individual levels than a single observation in a specific situation, especially when behavior is categorized in one of three categories. Furthermore, it could be that parents who experience more stress or depressive symptoms report more negatively on their child's behavior, leading to an overestimation of the effect,

at least when only one parent reports on the behavior of the child, which was not the case in the current study.

As we explained in the general introduction, the relation between parenting daily hassles and children's behavioral control, as well as the relation between parental depressive symptoms and children's behavioral control, might be at least partly mediated by the quality of parenting practices (Crnic, Gaze, & Hoffman, 2005; Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Indeed, we found that children of primary parents who showed more sensitive discipline practices towards their child, had higher levels of delay of gratification and response inhibition one year later. These relations were found to be significant even when controlled for parental sensitivity in a structured play situation (Chapter 3). One explanation for the relation between parental sensitive discipline and children's delay of gratification is that children of parents who use active distraction during a don't touch task, may have internalized the ability to distract themselves (Houck & LeCuyer-Maus, 2004), which in turn helped them to successfully delay gratification in the marshmallow test (Mischel, 2014). For now, the mechanisms underlying the relation between parental sensitive discipline and children's response inhibition remain unclear. Parental sensitivity in the structured play situation contributed only uniquely to the prediction of children's response inhibition (Chapter 3), as we expected. Children of parents that were more sensitive to them during play were better able to inhibit their reactions than children of less sensitive parents. It has been suggested that the effect of sensitivity on children's behavioral control might be mediated by attachment security (Bernier, Carlson, Deschenes, & Matte-Gagne, 2012). Parental sensitivity is a documented predictor of attachment security and recent research suggest that attachment security provides a base for the optimal development of behavioral control (Dindo et al., 2017).

As children grow older, their social environment expands and the importance of relations with peers increases. When examining differences in individual levels of adolescents' prosocial behavior, we therefore focused on characteristics of (relations with) peers in stead of parents. The results of Chapter 4 indicated that early to mid-adolescents compensated equally for the exclusion of ingroup and outgroup members in the Prosocial Cyberball Game. Generally, people have been found to

be more prosocial towards individuals who belong to the same group as themselves, compared to individuals belonging to another group (Baldassarri & Grossman, 2013; Balliet, Wu, & De Dreu, 2014). As we discussed in Chapter 4, it might be that our manipulation was too subtle. In the ingroup condition, the excluded player had the same color as the participant, whereas the excluded player in the outgroup condition had a different color than the participant. We did not inform the participants about the meaning of the colors. The effect of peer group status might have been stronger when groups would have been created using characteristics that are more salient for the participant. Previous studies that found effects of group status on prosocial behavior used for example sexual orientation or cultural background (Sturmer, Snyder, Kropp, & Siem, 2006; Sturmer, Snyder, & Omoto, 2005).

The results of Chapter 4 indicate also that prosocial behavior was not related to experiences of the adolescents with being bullied themselves. Experiences of the participants with bullying others, however, were related to prosocial behavior: adolescents who reported more bullying showed less prosocial compensating behavior towards the excluded peer than adolescents who reported lower levels of bullying. This was only true, however, for outgroup but not for ingroup members. Adolescents who did not compensate for the social exclusion either did not change their behavior towards the excluded peer at all, or even decreased the number of tosses, thereby joining the excluders. This could be categorized as bullying, explaining the negative association that we found.

Physical and socioeconomic environment

In addition to child characteristics and factors in the social environment of children, we also examined factors in the physical and socioeconomic environment of the child in the current thesis. Chapter 2 showed that the level of household chaos reported by the primary parent was associated with children's cheating behavior: children growing up in more chaotic households had an increased risk of being in the cheating group versus the possible intention to cheat group. Speculatively, children growing up in a more chaotic home environment are monitored less, which might in turn influence children's moral development negatively. Children's cheating behavior might be viewed as an indicator of children's moral development rather than as a type of behavioral control. Surprisingly, household chaos was not related to

parent-reported effortful control. It could be that the effect of household chaos on children's effortful control was overshadowed by the effects of the level of depressive symptoms of the other parent and, in particular, the level of parenting daily hassles as reported by the primary parent. After all, we found that individuals in more chaotic households reported more depressive symptoms and parenting daily hassles. Effects of household chaos on children's behavioral control might thus be partly confounded with parenting daily hassles, indicating that the stress associated with living in a chaotic environment, as experienced by parents, is more important for the prediction of individual levels of effortful control than the level of household chaos itself. For cheating behavior, the opposite seems to be true. Observed indicators of household chaos, i.e. noise levels and crowding, were not related to any of the behavioral control measures. Possibly, other indicators of household chaos like a lack of structure and routines are more important than noise and crowding.

With regard to the socioeconomic environment we found that children growing up in families with a lower SES showed less effortful control and cheated more compared to children growing up in families with a higher SES (Chapter 2). However, these relations could not be replicated in another part of the sample. Chapter 3 showed that SES was not related to individual differences in delay of gratification and response inhibition (Chapter 3). It might be that SES is only indirectly related to children's behavioral control via factors in the social and physical relation of the child. The results of the studies in the current thesis showed for example that a lower SES was related to more parental depression, parenting daily hassles, and household chaos, and less parental sensitivity and parental sensitive discipline, factors that were in turn related to children's behavioral control.

Methodological strengths and limitations

When interpreting the findings reported in the current thesis, there are some methodological limitations and strengths that should be taken into account. First, the majority of the correlates we examined in Chapter 2 and 4 were measured using questionnaires. The answers of the participants may have been biased by social desirability, considering the sensitive nature of some of the questionnaires. Participants might have presented a more favorable picture of themselves by reporting for example less depressive symptoms, parenting daily hassles, bullying, or problem behavior. We

should note, however, that the questionnaires were generally completed online and were always anonymous, which has been found to produce lower levels of social desirability than non-anonymous and paper-and-pencil questionnaires (Joinson, 1999). Furthermore, all questionnaires are often used and proven to be reliable and valid, and in Chapter 2, we screened participants' answers for reporter bias using a selection of items from the Wildman Symptoms Checklist. Ideally, we would have assessed the correlates in Chapters 2 and 4 in a more objective way, but we had to make concessions, since there are limits to our financial resources and to the time participants are willing to invest in the study. With regard to the correlates we chose to invest more in a selective set of factors, including parental sensitivity and sensitive discipline (Chapter 3) as well as noise levels and crowding (Chapter 4). Furthermore we invested in the development of behavioral assessments of the central outcome measures: behavioral control and prosocial behavior. We believe it is important to include observational measures because they assess actual behavior instead of a perception of someone's (own) behavior. Moreover, the tasks we used focus on specific types of behavioral control and prosocial behavior, whereas questionnaires generally cover multiple dimensions of these multidimensional constructs. As we mentioned, different types of behavioral control as well as different types of prosocial behavior are often only moderately related (Carlo & Randall, 2002; Duckworth & Kern, 2011) and may be associated with different factors. It is, therefore, important to assess different types separately.

Another limitation is the correlational design of the studies. For all studies, we cannot exclude the possibility that the direction of the effects is in the opposite direction. Children with higher levels of behavioral control could elicit for example more sensitive parenting and less parenting daily hassles. Causality and direction of effects can only be demonstrated using an experimental design. Although less certain, a longitudinal design in which bidirectional effects are examined can also shed some light on the direction of effects. In time, these analyses will be possible within the sample of L-CID, but for the current thesis data for these analyses was not yet available. One of the strong aspects of the design in all studies is the inclusion of multiple, theoretically related correlates within the same model. By including multiple factors in the same model, we were able to investigate the association(s) between a specific predictor and the outcome measure(s) over and above the other

factors. This is more informative than assessing these relations separately, because it indicates which factors are most important.

Another strength we would like to highlight is the inclusion of twins in the studies described in Chapter 2 and 3. By using twins, we can investigate the relative influence of genetic, shared environmental, and unique environmental (also including measurement error) factors on children's behavioral control, while we try to identify some of the shared and unique environmental factors that can explain these influences. Furthermore, the twin design can be used to create two groups that resemble each other very well. This procedure allowed us to test a specific model in one group and then test the same model in the other sample. If the results in the first group can be replicated in the second group, the findings may be considered replicable under ideal circumstances, i.e., highly similar twin sub-samples. Within science, replication is essential (Simons, 2014). However, a study focusing on psychology publications since 1900 found an overall replication rate of only 1.07% (Makel, Plucker, & Hegarty, 2012). This shows the need for more replication studies, of which the study in Chapter 2 is an example. The inclusion of twins, however, also has a drawback: it limits the generalizability of the results presented in Chapter 2 and 3 to families with only one child or non-twin siblings. However, a previous study by Robbers et al. (2010), showed that the development of twins with respect to externalizing behavior resembles the development of singletons, suggesting that these groups might not be so different after all. Furthermore, the results of our studies cannot be transferred one-on-one to families with opposite sex twins, since we only included same-sex twins.

Another aspect limiting the generalizability of the results is the distribution of SES within our sample. About 7% of the families who decided to participate in L-CID had a low SES background. Families were classified as low SES if no more than one of the parents finished an intermediate vocational education, pre-university education, or higher general secondary education. If both parents finished a higher vocational education or university the family was classified as high SES (55%) and all other families were classified as middle SES. In the general Dutch population of 2014, the year we started to recruit families, 10% of the adults over 25 finished primary school only, 20% completed a lower vocational education, 39% completed an intermediate

vocational education, pre-university education, or higher general secondary education and 30% finished a higher vocational education or university (Rijksinstituut voor Volksgezondheid en Milieu). Although the educational level of both parents was used to assess family SES within Samen Uniek, it seems that low SES families are underrepresented in our sample and high SES families are overrepresented, which limits the generalizability of the results to the Dutch population as a whole.

A final strong aspect we would like to highlight is the relatively large sample size in all of the studies in the current thesis. A twin design, which was used in both Chapter 2 and 3, can be challenging, especially when only same-sex twins with a European background and within a specific age range are targeted. In addition, the study design is longitudinal in nature and includes an intervention phase, which potential participants might find too demanding. Despite these challenges, we were able to include 238 families at the start of the study.

Theoretical implications

The modest effect sizes we found in the current studies indicate that there are also other factors that can explain individual differences in behavioral control and prosocial behavior than those examined in the current thesis. More research is needed to identify these factors, especially for prosocial behavior in a social exclusion situation. Moreover, results from Chapter 2 and 3 showed that genetic influences within the preschool period are at best small to moderate in size and that the relative influence of genetic effects varies among different dimensions of behavioral control. Most variance in behavioral control during the preschool period was explained by unique environmental effects, but shared environmental effects were also found. We tried to identify some of the shared and unique environmental factors related to children's behavioral control and found factors in especially the social environment, but also children's physical and socioeconomic environment, to be important. Considering the large unique environmental effects, it seems to be especially important to identify more unique environmental factors contributing to individual differences in behavioral control in future studies.

Furthermore, the results of the studies in the current thesis confirm the multidimensional nature of children's behavioral control and prosocial behavior.

Correlations between different dimensions of the same construct were generally significant but weak. Chapter 2 showed that children in the cheating group had significantly lower scores on effortful control than children in the possible intention to cheat group, but the correlation was rather small ($r = .16$) and, more importantly, could not be replicated. The correlation between children's delay of gratification and response inhibition was also significant, but again rather small ($r = .15$, Chapter 3). For prosocial behavior, no significant relation between self-reported prosocial behavior and compensating behavior in the Prosocial Cyberball Game was found (Chapter 4). We therefore suggest that a multimethod approach, i.e., including multiple tasks or a combination of tasks and questionnaires within one study, as we did in the current thesis, is the best approach when examining individual differences in behavioral control and prosocial behavior. Furthermore, given the different antecedents for the different dimensions of behavioral control and prosocial behavior, we believe that it is most informative to study the different dimensions separately instead of aggregating data in order to create an overall behavioral control or prosocial behavior score. In addition, recent studies showed that different dimensions of behavioral control are differentially related to later child outcomes such as externalizing problem behavior and academic performance (Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011), which underlines the importance of studying different dimensions of behavioral control separately.

Finally, the studies presented in the current thesis showed that the tasks we used to measure behavioral control and prosocial behavior reveal individual differences that are related in a meaningful way to (known) predictors. These tasks may thus be used in other studies as well. To our knowledge, we were one of the first to successfully use a stop-signal task in 4-year-old children. We were also among the first to examine prosocial behavior in a social exclusion situation in early to mid-adolescents. Most studies focused on college students, and the one study that did focus on adolescents only included boys (Howard, Landau, & Pryor, 2014).

Practical implications

Considering the major developmental steps that are taken during the preschool period in behavioral control and the fact that higher levels of behavioral control early in life are an important predictor to more favorable outcomes later in life,

it seems important to monitor children's behavioral control closely during this age period. When behavioral control levels are low, we could try to promote children's self-regulatory skills by stimulating for example parental sensitivity and sensitive discipline and reducing parental stress, depressive symptoms, and household chaos. Although we don't know yet how individual differences in adolescents' prosocial behavior can be explained, we do know now that the Prosocial Cyberball Game may be used to objectively assess prosocial behavior in a social exclusion situation. When trying to decide which children need help improving their prosocial skills, this game might be part of a screening instrument for prosocial behavior. Perhaps the Prosocial Cyberball Game might also be part of a screening instrument for antisocial behavior in social exclusion situations, identifying children that may be (at risk for) bullying their peers.

Concluding remarks

The current thesis shows that there is quite some variation in the level of children's behavioral control as well as in the level of adolescents' prosocial behavior and that these levels can be related to child characteristics, factors in their social environment, and their physical and socioeconomic environment in a meaningful way. Furthermore, the studies in the current thesis underline the importance of treating both behavioral control and prosocial behavior as multidimensional concepts. Moreover, the results of the current thesis indicate that different types of behavioral control might be differentially related to child characteristics and factors in their social, physical and socioeconomic environment. Since previous studies showed that different types of behavioral control are in turn differentially related to child outcomes like academic performance and problem behavior, we think it is important to study which specific factors are related to individual differences in specific types of behavioral control. This might also be true for prosocial behavior, since this is also a multidimensional construct. The multidimensionality of behavioral control and prosocial behavior may be taken into account when designing intervention programs that aim to improve a specific dimension of one of these constructs by targeting only the factors that are uniquely associated with that dimension of behavioral control or prosocial behavior.

REFERENCES

A

- Ainsworth, M. D. S., Bell, S. M., & Stayton, D. (1974). Infant-mother attachment and social development. In M.P. Richards (Ed.), *The introduction of the child into a social world* (pp. 99–135). London: Cambridge University Press.
- Anokhin, A. P., Golosheykin, S., Grant, J. D., & Heath, A. C. (2011). Heritability of Delay Discounting in Adolescence: A Longitudinal Twin Study. *Behavior Genetics*, 41(2), 175-183. doi:10.1007/s10519-010-9384-7
- Anokhin, A. P., Grant, J. D., Mulligan, R. C., & Heath, A. C. (2015). The Genetics of Impulsivity: Evidence for the Heritability of Delay Discounting. *Biological Psychiatry*, 77(10), 887-894. doi:10.1016/j.biopsych.2014.10.022

B

- Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., & Juffer, F. (2003). Less is more: Meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological Bulletin*, 129(2), 195-215. doi:10.1037/0033-2909.129.2.195
- Baldassarri, D., & Grossman, G. (2013). The Effect of Group Attachment and Social Position on Prosocial Behavior. Evidence from Lab-in-the-Field Experiments. *Plos One*, 8(3). doi:10.1371/journal.pone.0058750
- Balliet, D., Wu, J., & De Dreu, C. K. (2014). Ingroup favoritism in cooperation: a meta-analysis. *Psychological Bulletin*, 140(6), 1556-1581. doi:10.1037/a0037737
- Barry, T. D., Dunlap, S. T., Cotten, S. J., Lochman, J. E., & Wells, K. C. (2005). The influence of maternal stress and distress on disruptive behavior problems in boys. *Journal of the American Academy of Child and Adolescent Psychiatry*, 44(3), 265-273. doi: 10.1097/00004583-200503000-00011

- Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science*, 16(6), 351-355. doi:10.1111/j.1467-8721.2007.00534.x
- Bernier, A., Carlson, S. M., Deschenes, M., & Matte-Gagne, C. (2012). Social factors in the development of early executive functioning: a closer look at the caregiving environment. *Developmental Science*, 15(1), 12-24. doi:10.1111/j.1467-7687.2011.01093.x
- Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: early parenting precursors of young children's executive functioning. *Child Development*, 81(1), 326-339. doi:10.1111/j.1467-8624.2009.01397.x
- Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: impact, moderation, and mediation in the Head Start REDI program. *Development and psychopathology*, 20(3), 821-843. doi:10.1017/S0954579408000394
- Brasseur, S., Gregoire, J., Bourdu, R., & Mikolajczak, M. (2013). The Profile of Emotional Competence (PEC): development and validation of a self-reported measure that fits dimensions of emotional competence theory. *Plos One*, 8(5). doi:10.1371/journal.pone.0062635
- Briley, D. A., & Tucker-Drob, E. M. (2013). Explaining the Increasing Heritability of Cognitive Ability Across Development A Meta-Analysis of Longitudinal Twin and Adoption Studies. *Psychological Science*, 24(9), 1704-1713. doi:10.1177/0956797613478618
- Brock, L. L., Rimm-Kaufman, S. E., Nathanson, L., & Grimm, K. J. (2009). The contributions of 'hot' and 'cool' executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly*, 24(3), 337-349. doi:10.1016/j.ecresq.2009.06.001

Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nurture reconceptualized in developmental perspective: a bioecological model. *Psychological Review*, 101(4), 568-586.

Bronson, M. B. (2000). *Self-regulation in early childhood: Nature and nurture*. New York: The Guilford Press.

Brownell, C. A. (2013). Early Development of Prosocial Behavior: Current Perspectives. *Infancy*, 18(1), 1-9. doi:10.1111/inf.12004

C

Caprara, G. V., Barbaranelli, C., Pastorelli, C., Bandura, A., & Zimbardo, P. G. (2000). Prosocial foundations of children's academic achievement. *Psychological Science*, 11(4), 302-306. doi:10.1111/1467-9280.00260

Carlo, G., & Randall, B. A. (2002). The development of a measure of prosocial behaviors for late adolescents. *Journal of Youth and Adolescence*, 31, 31-44. doi:10.1023/A:1014033032440

Casey, B. J., & Caudle, K. (2013). The Teenage Brain: Self Control. *Current Directions in Psychological Science*, 22(2), 82-87. doi:10.1177/0963721413480170

Cents, R. A., Kok, R., Tiemeier, H., Lucassen, N., Szekely, E., Bakermans-Kranenburg, M. J., . . . Lambregtse-van den Berg, M. P. (2014). Variations in maternal 5-HTTLPR affect observed sensitive parenting. *The Journal of Child Psychology and Psychiatry*, 55(9), 1025-1032. doi:10.1111/jcpp.12205

Chen, Y., & Li, S. X. (2009). Group Identity and Social Preferences. *American Economic Review*, 99, 431-457. doi:10.1257/aer.99.1.431

- Coplan, R. J., Bowker, A., & Cooper, S. M. (2003). Parenting daily hassles, child temperament, and social adjustment in preschool. *Early Childhood Research Quarterly*, 18(3), 376-395. doi:10.1016/S0885-2006(03)00045-0
- Crick, N. R. (1996). The role of overt aggression, relational aggression, and prosocial behavior in the prediction of children's future social adjustment. *Child Development*, 67(5), 2317-2327. doi:10.1111/j.1467-8624.1996.tb01859.x
- Criss, M. M., Pettit, G. S., Bates, J. E., Dodge, K. A., & Lapp, A. L. (2002). Family adversity, positive peer relationships, and children's externalizing behavior: A longitudinal perspective on risk and resilience. *Child Development*, 73, 1220-1237. doi:10.1111/1467-8624.00468
- Crnic, K. A., Gaze, C., & Hoffman, C. (2005). Cumulative parenting stress across the preschool period: Relations to maternal parenting and child behaviour at age 5. *Infant and Child Development*, 14(2), 117-132. doi: 10.1002/icd.384
- Crnic, K. A., & Greenberg, M. T. (1990). Minor parenting stresses with young children. *Child Development*, 61(5), 1628-1637.
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, 13, 636-650. doi:10.1038/nrn3313
- Crosbie, J., Arnold, P., Paterson, A., Swanson, J., Dupuis, A., Li, X., . . . Schachar, R. J. (2013). Response Inhibition and ADHD Traits: Correlates and Heritability in a Community Sample. *Journal of Abnormal Child Psychology*, 41(3), 497-507. doi:10.1007/s10802-012-9693-9
- Cummings, E. M., Keller, P. S., & Davies, P. T. (2005). Towards a family process model of maternal and paternal depressive symptoms: exploring multiple relations with child and family functioning. *Journal of Child Psychology and Psychiatry*, 46(5), 479-489. doi: 10.1111/j.1469-7610.2004.00368.x

D

- Davis, M. H. (1983). Measuring Individual-Differences in Empathy - Evidence for a Multidimensional Approach. *Journal of Personality and Social Psychology*, 44, 113-126. doi:10.1037/0022-3514.44.1.113
- De Beurs, E., & Zitman, F. G. (2006). De Brief Symptom Inventory (BSI): De betrouwbaarheid en validiteit van een handzaam alternatief voor de SCL-90. *Maandblad Geestelijke Volksgezondheid*, 61, 120-141.
- De Corte, K., Buysse, A., Verhofstadt, L. L., Roeyers, H., Ponnet, K., & Davis, M. H. (2007). Measuring Empathic Tendencies: Reliability and Validity of the Dutch Version of the Interpersonal Reactivity Index. *Psychologica Belgica*, 47, 235-260. doi:10.5334/pb-47-4-235
- Denham, S. A., Mckinley, M., Couchoud, E. A., & Holt, R. (1990). Emotional and Behavioral Predictors of Preschool Peer Ratings. *Child Development*, 61, 1145-1152. doi:10.2307/1130882
- Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory - an Introductory Report. *Psychological Medicine*, 13(3), 595-605. doi:10.1017/S0033291700048017
- Dindo, L., Brock, R. L., Aksan, N., Gamez, W., Kochanska, G., & Clark, L. A. (2017). Attachment and Effortful Control in Toddlerhood Predict Academic Achievement Over a Decade Later. *Psychological Science*, 28(12), 1786-1795. doi:10.1177/0956797617721271
- Dumas, J. E., Nissley, J., Nordstrom, A., Smith, E. P., Prinz, R. J., & Levine, D. W. (2005). Home chaos: Sociodemographic, parenting, interactional, and child correlates. *Journal of Clinical Child and Adolescent Psychology*, 34(1), 93-104. doi: 10.1207/s15374424jccp3401_9

- Dunham, Y., Baron, A. S., & Carey, S. (2011). Consequences of “minimal” group affiliations in children. *Child Development*, 82, 793-811. doi:10.1111/j.1467-8624.2011.01577.x
- Duckworth, A. L., & Kern, M. L. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality*, 45(3), 259-268. doi:10.1016/j.jrp.2011.02.004
- Dunfield, K., Kuhlmeier, V. A., O’Connell, L., & Kelley, E. (2011). Examining the Diversity of Prosocial Behavior: Helping, Sharing, and Comforting in Infancy. *Infancy*, 16, 227-247.
- Dunfield, K. A. (2014). A construct divided: prosocial behavior as helping, sharing, and comforting subtypes. *Frontiers in Psychology*, 5. doi:10.3389/fpsyg.2014.00958

E

- Egeland, B., Erickson, M. F., Clemenhausen-Moon, J., Hiester, M. K., & Korfmacher, J. (1990). *24 months tools coding manual. Project STEEP revised 1990 from Mother–Child project scales*. University of Minnesota. Minneapolis.
- Eisenberg, N., Eggum, N. D., & Di Giunta, L. (2010). Empathy-related Responding: Associations with Prosocial Behavior, Aggression, and Intergroup Relations. *Social issues and policy review*, 4, 143-180. doi:10.1111/j.1751-2409.2010.01020.x
- Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children’s effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development*, 76(5), 1055-1071. doi:10.1111/j.1467-8624.2005.00897.x

- Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin*, 132(1), 33-72. doi:10.1037/0033-2909.132.1.33
- Euser, S., Bakermans-Kranenburg, M. J., Van den Bulk, B. G., Linting, M., Damsteegt, R. C., Vrijhof, C. I., . . . Van IJzendoorn, M. H. (2016). Efficacy of the Video-feedback Intervention to promote Positive parenting and Sensitive Discipline in Twin Families (VIPP-Twins): Study protocol for a randomized controlled trial. *BMC Psychology*, 4(3). doi:10.1186/s40359-016-0139-y
- Evans, G. W., Gonnella, C., Marcynyszyn, L. A., Gentile, L., & Salpekar, N. (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science*, 16(7), 560-565. doi:10.1111/j.0956-7976.2005.01575.x

F

- Fabes, R. A., Carlo, G., Kupanoff, K., & Laible, D. (1999). Early adolescence and prosocial/moral behavior I: The role of individual processes. *Journal of Early Adolescence*, 19(1), 5-16. doi:10.1177/0272431699019001001
- Fabes, R. A., & Eisenberg, N. (1998). *Meta-Analyses of Age and Sex Differences in Children's and Adolescents' Prosocial Behavior*. Working paper. Retrieved from: www.public.asu.edu/~rafabes/meta.pdf
- Flynn, E., Ehrenreich, S. E., Beron, K. J., & Underwood, M. K. (2014). Prosocial Behavior: Long-term Trajectories and Psychosocial Outcomes. *Social Development*, 24(3), 462 - 482. doi:10.1111/sode.12100

G

- Gagne, J. R., & Saudino, K. J. (2016). The Development of Inhibitory Control in Early Childhood: A Twin Study From 2-3 Years. *Developmental Psychology*, 52(3), 391-399. doi:10.1037/dev0000090

- Garaigordobil, M. (2009). A Comparative Analysis of Empathy in Childhood and Adolescence: Gender Differences and Associated Socio-emotional Variables. *International Journal of Psychology and Psychological Therapy*, 9(2), 217 - 235.
- Gardner, F., & Leijten, P. (2017). Incredible Years Parenting Interventions: Current Effectiveness Research and Future Directions. *Current Opinion in Psychology*, 15, 99-104. doi:10.1016/j.copsyc.2017.02.023
- Gartstein, M. A., Bridgett, D. J., Young, B. N., Panksepp, J., & Power, T. (2013). Origins of Effortful Control: Infant and Parent Contributions. *Infancy*, 18(2), 149-183. doi:10.1111/j.1532-7078.2012.00119.x
- Gartstein, M. A., & Fagot, B. I. (2003). Parental depression, parenting and family adjustment, and child effortful control: Explaining externalizing behaviors for preschool children. *Journal of Applied Developmental Psychology*, 24(2), 143-177. doi:10.1016/S0193-3973(03)00043-1
- Goette, L., Huffman, D., & Meier, S. (2006). The impact of group membership on cooperation and norm enforcement: Evidence using random assignment to real social groups. *American Economic Review*, 96, 212-216. doi:10.1257/000282806777211658
- Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review*, 106(3), 458-490. doi:10.1037/0033-295x.106.3.458
- Goodman, A., Lamping, D. L., & Ploubidis, G. B. (2010). When to Use Broader Internalising and Externalising Subscales Instead of the Hypothesised Five Subscales on the Strengths and Difficulties Questionnaire (SDQ): Data from British Parents, Teachers and Children. *Journal of Abnormal Child Psychology*, 38, 1179-1191. doi:10.1007/s10802-010-9434-x

Greenwood, C. R., Thiemann-Bourque, K., Walker, D., Buzhardt, J., & Gilkerson, J. (2011). Assessing Children's Home Language Environments Using Automatic Speech Recognition Technology. *Communication Disorders Quarterly*, 32(2), 83-92. doi:10.1177/1525740110367826

Groot, A. S., de Sonnevile, L. M. J., Stins, J. F., & Boomsma, D. I. (2004). Familial influences on sustained attention and inhibition in preschoolers. *Journal of Child Psychology and Psychiatry*, 45(2), 306-314. doi:10.1111/j.1469-7610.2004.00222.x

H

Hanscombe, K. B., Haworth, C. M. A., Davis, O. S. P., Jaffee, S. R., & Plomin, R. (2011). Chaotic homes and school achievement: a twin study. *Journal of Child Psychology and Psychiatry*, 52(11), 1212-1220. doi:10.1111/j.1469-7610.2011.02421.x

Hardaway, C. R., Wilson, M. N., Shaw, D. S., & Dishion, T. J. (2012). Family Functioning and Externalizing Behaviour among Low-income Children: Self-regulation as a Mediator. *Infant and Child Development*, 21(1), 67-84. doi:10.1002/icd.765

Hastings, P. D., Zahn-Waxler, C., Robinson, J., Usher, B., & Bridges, D. (2000). The development of concern for others in children with behavior problems. *Developmental Psychology*, 36, 531-546. doi:10.1037/0012-1649.36.5.531

Houck, G. M., & LeCuyer-Maus, E. A. (2004). Maternal limit setting during toddlerhood, delay of gratification, and behavior problems at age five. *Infant Mental Health Journal*, 25(1), 28-46. doi:10.1002/imhj.10083

Howard, A. M., Landau, S., & Pryor, J. B. (2014). Peer bystanders to bullying: who wants to play with the victim? *Journal of Abnormal Child Psychology*, 42, 265-276. doi:10.1007/s10802-013-9770-8

Hu, L. T., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, 6(1), 1-55. doi:10.1080/10705519909540118

Hur, E., Buettner, C. K., & Jeon, L. (2015). Parental Depressive Symptoms and Children's School-Readiness: The Indirect Effect of Household Chaos. *Journal of Child and Family Studies*, 24(11), 3462-3473. doi:10.1007/s10826-015-0147-1

J

Joinson, A. (1999). Social desirability, anonymity, and Internet-based questionnaires. *Behavior Research Methods, Instruments, & Computers*, 31(3), 433-438. doi:10.3758/BF03200723

Jones, D. E., Greenberg, M., & Crowley, M. (2015). Early Social-Emotional Functioning and Public Health: The Relationship Between Kindergarten Social Competence and Future Wellness. *American Journal of Public Health*, 105(11), 2283-2290. doi:10.2105/Ajph.2015.302630

Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2015). *Manual Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) (version 3)*. Leiden: Leiden University, Centre for Child and Family Studies.

Juffer, F., Bakermans-Kranenburg, M.J., & Van IJzendoorn, M.H. (2017). Pairing attachment theory and social learning theory in video-feedback intervention to promote positive parenting. *Current opinion in psychology*, 15, 189–194. doi:10.1016/j.copsyc.2017.03.012

K

- Karreman, A., van Tuijl, C., van Aken, M. A. G., & Dekovic, M. (2006). Parenting and self-regulation in preschoolers: A meta-analysis. *Infant and Child Development*, 15(6), 561-579. doi:10.1002/icd.478
- Kidd, C., Palmeri, H., & Aslin, R. N. (2013). Rational snacking: young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition*, 126(1), 109-114. doi:10.1016/j.cognition.2012.08.004
- Kim, S., Nordling, J. K., Yoon, J. E., Boldt, L. J., & Kochanska, G. (2013). Effortful control in "hot" and "cool" tasks differentially predicts children's behavior problems and academic performance. *Journal of Abnormal Child Psychology*, 41(1), 43-56. doi:10.1007/s10802-012-9661-4
- Knafo, A., & Jaffee, S. R. (2013). Gene-environment correlation in developmental psychopathology. *Development and Psychopathology*, 25(1), 1-6. doi:10.1017/S0954579412000855
- Kochanska, G., & Aksan, N. (2006). Children's conscience and self-regulation. *Journal of Personality*, 74(6), 1587-1617. doi:10.1111/j.1467-6494.2006.00421.x
- Kochanska, G., Murray, K., & Coy, K. C. (1997). Inhibitory control as a contributor to conscience in childhood: From toddler to early school age. *Child Development*, 68(2), 263-277. doi:10.1111/j.1467-8624.1997.tb01939.x
- Kok, R., Lucassen, N., Bakermans-Kranenburg, M. J., van, I. M. H., Ghassabian, A., Roza, S. J., . . . Tiemeier, H. (2014). Parenting, corpus callosum, and executive function in preschool children. *Child Neuropsychology*, 20(5), 583-606. doi:10.1080/09297049.2013.832741

- Kokko, K., Tremblay, R. E., Lacourse, E., Nagin, D. S., & Vitaro, F. (2006). Trajectories of prosocial behavior and physical aggression in middle childhood: Links to adolescent school dropout and physical violence. *Journal of Research on Adolescence*, 16, 403-428. doi:10.1111/j.1532-7795.2006.00500.x
- Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, 18(2), 199-214. doi:10.1037//0012-1649.18.2.199

L

- Laible, D. J., Carlo, G., & Roesch, S. C. (2004). Pathways to self-esteem in late adolescence: the role of parent and peer attachment, empathy, and social behaviours. *Journal of Adolescence*, 27, 703-716. doi:10.1016/j.adolescence.2004.05.005
- LeCuyer, E., & Houck, G. M. (2006). Maternal limit-setting in toddlerhood: Socialization strategies for the development of self-regulation. *Infant Mental Health Journal*, 27(4), 344-370. doi:10.1002/imhj.20096
- Leerkes, E. M., Weaver, J. M., & O'Brien, M. (2012). Differentiating Maternal Sensitivity to Infant Distress and Non-Distress. *Parenting-Science and Practice*, 12(2-3), 175-184. doi:10.1080/15295192.2012.683353
- Logan, G. D., & Cowan, W. B. (1984). On the Ability to Inhibit Thought and Action: a Theory of an Act of Control. *Psychological Review*, 91(3), 295-327. doi:10.1037//0033-295x.91.3.295
- Lovejoy, M. C., Graczyk, P. A., O'Hare, E., & Neuman, G. (2000). Maternal depression and parenting behavior: a meta-analytic review. *Clinical Psychology Review*, 20(5), 561-592. doi:10.1016/S0272-7358(98)00100-7

M

- Majdandzic, M., & van den Boom, D. C. (2007). Multimethod longitudinal assessment of temperament in early childhood. *Journal of Personality*, 75(1), 121-168. doi: 10.1111/j.1467-6494.2006.00435.x
- Makel, M. C., Plucker, J. A., & Hegarty, B. (2012). Replications in Psychology Research: How Often Do They Really Occur? *Perspectives on Psychological Science*, 7(6), 537-542. doi:10.1177/1745691612460688
- Martin, A., Razza, R., & Brooks-Gunn, J. (2012). Specifying the Links Between Household Chaos and Preschool Children's Development. *Early Child Development and Care*, 182(10), 1247-1263. doi:10.1080/03004430.2011.605522
- Masten, C. L., Morelli, S. A., & Eisenberger, N. I. (2011). An fMRI investigation of empathy for 'social pain' and subsequent prosocial behavior. *Neuroimage*, 55, 381-388. doi:10.1016/j.neuroimage.2010.11.060
- Matheny, A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing Order out of Chaos - Psychometric Characteristics of the Confusion, Hubbub, and Order Scale. *Journal of Applied Developmental Psychology*, 16(3), 429-444. doi:10.1016/0193-3973(95)90028-4
- Mathis, E. T. B., & Bierman, K. L. (2015). Dimensions of Parenting Associated with Child Prekindergarten Emotion Regulation and Attention Control in Low-income Families. *Social Development*, 24(3), 601-620. doi:10.1111/sode.12112
- McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, 43(4), 947-959. doi:10.1037/0012-1649.43.4.947

- McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, 15(4), 351-377. doi:10.1177/109019818801500401
- McMahon, S. D., Wernsman, J., & Parnes, A. L. (2006). Understanding prosocial behavior: the impact of empathy and gender among African American adolescents. *Journal of Adolescent Health*, 39, 135-137. doi:10.1016/j.jadohealth.2005.10.008
- Merckelbach, H., Smeets, T., & Jelicic, M. (2008). Onwaarschijnlijke symptomen simuleren: de Wildman Symptom Checklist. *Neuropsychiatry*, 2, 53-57. doi:10.1007/BF03077120
- Meyer, G. J., Finn, S. E., Eyde, L. D., Kay, G. G., Moreland, K. L., Dies, R. R., Eisman, E. J., Kubiszyn, T. W., & Reed, G. M. (2001). Psychological testing and psychological assessment - A review of evidence and issues. *American Psychologist*, 56, 128-165.
- Mischel, W. (2014). *The marshmallow test: mastering self-control*. New York: Little, Brown and Company.
- Mischel, W., Ebbesen, E. B., & Zeiss, A. R. (1972). Cognitive and attentional mechanisms in delay of gratification. *Journal of Personality and Social Psychology*, 21(2), 204-218. doi:10.1037/0003-066X.56.2.128
- Mischel, W., Shoda, Y., & Peake, P. K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology*, 54(4), 687-696. doi:10.1037/0022-3514.54.4.687
- Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., . . . Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *PNAS*, 108(7), 2693-2698. doi:10.1073/pnas.1010076108

- Mullen, B., Brown, R., & Smith, C. (1992). Ingroup bias as a function of salience, relevance, and status: An integration. *European Journal of Social Psychology*, 22, 103–122. doi:10.1002/ejsp.2420220202
- Muris, P., van der Pennen, E., Sigmond, R., & Mayer, B. (2008). Symptoms of anxiety, depression, and aggression in non-clinical children: relationships with self-report and performance-based measures of attention and effortful control. *Child Psychiatry and Human Development*, 39(4), 455–467. doi:10.1007/s10578-008-0101-1
- Muthén, B. O., & Satorra, A. (1995). Complex sample data in structural equation modeling. *Sociological Methodology*, 25, 267–316. doi:10.2307/271070
- Muthén, L. K., & Muthén, B. O. (1998–2015). *Mplus User's Guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.

N

- Nantel-Vivier, A., Pihl, R. O., Cote, S., & Tremblay, R. E. (2014). Developmental association of prosocial behaviour with aggression, anxiety and depression from infancy to preadolescence. *Journal of Child Psychology and Psychiatry*, 55, 1135–1144. doi:10.1111/jcpp.12235
- Neale, M. C., & Cardon, L. R. (1992). *Methodology for Genetic Studies of Twins and Families*. Dordrecht, the Netherlands: Kluwer.
- Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., . . . Boker, S. M. (2016). OpenMx 2.0: Extended Structural Equation and Statistical Modeling. *Psychometrika*, 81(2), 535–549. doi:10.1007/s11336-014-9435-8

Newton, E. K., Laible, D., Carlo, G., Steele, J. S., & McGinley, M. (2014). Do Sensitive Parents Foster Kind Children, or Vice Versa? Bidirectional Influences Between Children's Prosocial Behavior and Parental Sensitivity. *Developmental Psychology*, 50(6), 1808-1816. doi:10.1037/a0036495

Nozaki, Y. (2015). Emotional Competence and Extrinsic Emotion Regulation Directed Toward an Ostracized Person. *Emotion*, 15, 763-774. doi:10.1037/emo0000081

O

Olweus, D. (1986). *The Bully/victim Questionnaire*. Bergen, Norway.

Ostrov, J. M., & Crick, N. R. (2007). Forms and functions of aggression during early childhood: A short-term longitudinal study. *School Psychology Review*, 36, 22-43.

P

Padilla-Walker, L. M., & Carlo, G. (2014). The study of prosocial behavior: past, present, and future. In L. M. Padilla-Walker & G. Carlo (Eds.), *Prosocial development: A multidimensional approach* (pp. 3-16). New York, NY: Oxford University Press.

Padilla-Walker, L. M., & Christensen, K. J. (2011). Empathy and Self-Regulation as Mediators Between Parenting and Adolescents' Prosocial Behavior Toward Strangers, Friends, and Family. *Journal of Research on Adolescence*, 21(3), 545-551. doi:10.1111/j.1532-7795.2010.00695.x

Putnam, S. P., & Rothbart, M. K. (2006). Development of short and very short forms of the Children's Behavior Questionnaire. *Journal of Personality Assessment*, 87(1), 102-112. doi:10.1207/s15327752jpa8701_09

- Ramani, G. B., Brownell, C. A., & Campbell, S. B. (2010). Positive and negative peer interaction in 3- and 4-year-olds in relation to regulation and dysregulation. *Journal of Genetic Psychology, 171*(3), 218-250. doi:10.1080/00221320903300353
- Ramchandani, P., Stein, A., Evans, J., O'Connor, T. G., & Team, A. S. (2005). Paternal depression in the postnatal period and child development: a prospective population study. *Lancet, 365*(9478), 2201-2205. doi:10.1016/S0140-6736(05)66778-5
- Razza, R. A., & Raymond, K. (2013). Associations among Maternal Behavior, Delay of Gratification, and School Readiness across the Early Childhood Years. *Social Development, 22*(1), 180-196. doi:10.1111/j.1467-9507.2012.00665.x
- Rebollo, I., de Moor, M. H., Dolan, C. V., & Boomsma, D. I. (2006). Phenotypic factor analysis of family data: correction of the bias due to dependency. *Twin Research and Human Genetics, 9*(3), 367-376. doi:10.1375/183242706777591326
- Reynolds, B., & Schiffbauer, R. (2005). Delay of Gratification and Delay Discounting: A unifying feedback model of delay-related impulsive behavior. *The Psychological Record, 55*(3), 439-460. doi:10.1007/BF03395520
- Riem, M. M., Bakermans-Kranenburg, M. J., Huffmeijer, R., & Van IJzendoorn, M. H. (2013). Does intranasal oxytocin promote prosocial behavior to an excluded fellow player? A randomized-controlled trial with Cyberball. *Psychoneuroendocrinology, 38*, 1418-1425. doi:10.1016/j.psyneuen.2012.12.023
- Rietveld, M. J., van Der Valk, J. C., Bongers, I. L., Stroet, T. M., Slagboom, P. E., & Boomsma, D. I. (2000). Zygosity diagnosis in young twins by parental report. *Twin Research, 3*(3), 134-141. doi:10.1375/twin.3.3.134

Rijksinstituut voor Volksgezondheid en Milieu. (n.d.). Retrieved October 30, 2017 from: <https://www.volksgezondheidenzorg.info/onderwerp/sociaaleconomische-status/cijfers-context/opleiding#node-opleidingsniveau>.

Rijlaarsdam, J., Stevens, G. W. J. M., van der Ende, J., Hofman, A., Jaddoe, V. W. V., Mackenbach, J. P., . . . Tiemeier, H. (2013). Economic Disadvantage and Young Children's Emotional and Behavioral Problems: Mechanisms of Risk. *Journal of Abnormal Child Psychology*, 41(1), 125-137. doi:10.1007/s10802-012-9655-2

Robbers, S. C., Bartels, M., van Oort, F. V., van Beijsterveldt, C. E., van der Ende, J., Verhulst, F. C., . . . Huizink, A. C. (2010). A twin-singleton comparison of developmental trajectories of externalizing and internalizing problems in 6- to 12-year-old children. *Twin Research and Human Genetics*, 13(1), 79-87. doi:10.1375/twin.13.1.79

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, Emotional, and Personality Development* (6th ed., Vol. 3). Hoboken, NJ: John Wiley & Sons Inc.

Rutgers, A. H., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Swinkels, S. H., van Daalen, E., Dietz, C., . . . van Engeland, H. (2007). Autism, attachment and parenting: a comparison of children with autism spectrum disorder, mental retardation, language disorder, and non-clinical children. *Journal of Abnormal Child Psychology*, 35(5), 859-870. doi:10.1007/s10802-007-9139-y

S

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W. T. (2011). Family socioeconomic status and child executive functions: the roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society*, 17(1), 120-132. doi:10.1017/S1355617710001335

- Schachar, R. J., Forget-Dubois, N., Dionne, G., Boivin, M., & Robaey, P. (2011). Heritability of Response Inhibition in Children. *Journal of the International Neuropsychological Society*, 17(2), 238-247. doi:10.1017/S1355617710001463
- Schroeder, D. A., & Graziano, W. G. (2015). *The Oxford handbook of prosocial behavior*. New York, NY: Oxford University Press.
- Sektnan, M., McClelland, M. M., Acock, A., & Morrison, F. J. (2010). Relations between early family risk, children's behavioral regulation, and academic achievement. *Early Childhood Research Quarterly*, 25(4), 464-479. doi:10.1016/j.ecresq.2010.02.005
- Shamama-tus-Sabah, S., Gilani, N., Kamal, A., & Batool, S. (2012). Chaotic Home Conditions and Children's Adjustment: Study of Gender Differences. *Pakistan Journal of Psychological Research*, 27, 297-313.
- Shelleby, E. C., Votruba-Drzal, E., Shaw, D. S., Dishion, T. J., Wilson, M. N., & Gardner, F. (2014). Income and Children's Behavioral Functioning: A Sequential Mediation Analysis. *Journal of Family Psychology*, 28(6), 936-946. doi:10.1037/fam0000035
- Shoenberger, N., & Rocheleau, G.C. (2017). Effective Parenting and Self-Control: Difference by Gender. *Women & Criminal Justice*. 27(5), 271-286. doi:10.1080/08974454.2016.1261071
- Simons, D. J. (2014). The Value of Direct Replication. *Perspectives on Psychological Science*, 9(1), 76-80. doi:10.1177/1745691613514755
- Soderstrom, M., & Wittebolle, K. (2013). When Do Caregivers Talk? The Influences of Activity and Time of Day on Caregiver Speech and Child Vocalizations in Two Childcare Environments. *Plos One*, 8(11). doi:10.1371/journal.pone.0080646

Spinrad, T. L., Eisenberg, N., Gaertner, B., Popp, T., Smith, C. L., Kupfer, A., . . . Hofer, C. (2007). Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology*, 43(5), 1170-1186. doi: 10.1037/0012-1649.43.5.1170

Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: a nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology*, 54(5), 768-777. doi:10.1037/0022-3514.54.5.768

Strayhorn, J. M., Jr. (2002). Self-control: theory and research. *Journal of the American Academy of Child & Adolescent*, 41(1), 7-16. doi:10.1097/00004583-200201000-00006

Sturmer, S., Snyder, M., Kropp, A., & Siem, B. (2006). Empathy-motivated helping: The moderating role of group membership. *Personality and Social Psychology Bulletin*, 32, 943-956. doi:10.1177/0146167206287363

Sturmer, S., Snyder, M., & Omoto, A. M. (2005). Prosocial emotions and helping: the moderating role of group membership. *Journal of Personality and Social Psychology*, 88, 532-546. doi:10.1037/0022-3514.88.3.532

T

Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). New York, NY: Harper Collins.

Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social Categorization and Intergroup Behavior. *European Journal of Social Psychology*, 1, 149-177.

Tamis-LeMonda, C. S., Shannon, J. D., Cabrera, N. J., & Lamb, M. E. (2004). Fathers and mothers at play with their 2-and 3-year-olds: Contributions to language and cognitive development. *Child Development*, 75(6), 1806-1820. doi:10.1111/j.1467-8624.2004.00818.x

- Tillman, C. M., Thorell, L. B., Brocki, K. C., & Bohlin, G. (2008). Motor response inhibition and execution in the stop-signal task: development and relation to ADHD behaviors. *Child Neuropsychology*, 14(1), 42-59. doi:10.1080/09297040701249020
- Towe-Goodman, N. R., Willoughby, M., Blair, C., Gustafsson, H. C., Mills-Koonce, W. R., Cox, M. J., & Family Life Project Key, I. (2014). Fathers' sensitive parenting and the development of early executive functioning. *Journal of Family Psychology*, 28(6), 867-876. doi:10.1037/a0038128
- Treur, J. L., Boomsma, D. I., Ligthart, L., Willemsen, G., & Vink, J. M. (2016). Heritability of high sugar consumption through drinks and the genetic correlation with substance use. *American Journal of Clinical Nutrition*, 104(4), 1144-1150. doi:10.3945/ajcn.115.127324

U

- Ullman, J. B. (2001). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using Multivariate Statistics* (4th ed., pp. 653- 771). Needham Heights, MA: Allyn & Bacon.

V

- Valiente, C., Lemery-Chalfant, K., & Reiser, M. (2007). Pathways to problem behaviors: Chaotic homes, parent and child effortful control, and parenting. *Social Development*, 16(2), 249-267. doi:10.1111/j.1467-9507.2007.00383.x
- Valiente, C., Lemery-Chalfant, K., Swanson, J., & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology*, 100(1), 67-77. doi:10.1037/0022-0663.100.1.67

- Van der Graaff, J., Branje, S., De Wied, M., Hawk, S., Van Lier, P., & Meeus, W. (2014). Perspective taking and empathic concern in adolescence: gender differences in developmental changes. *Developmental Psychology*, *50*, 881-888. doi:10.1037/a0034325
- Van der Mark, I. L., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2002). The role of parenting, attachment, and temperamental fearfulness in the prediction of compliance in toddler girls. *British Journal of Developmental Psychology*, *20*, 361-378. doi:10.1348/026151002320620299
- Van Noorden, T. H., Haselager, G. J., Cillessen, A. H., & Bukowski, W. M. (2015). Empathy and involvement in bullying in children and adolescents: a systematic review. *Journal of Youth and Adolescence*, *44*, 637-657. doi:10.1007/s10964-014-0135-6
- Van Widenfelt, B. M., Goedhart, A. W., Treffers, P. D. A., & Goodman, R. (2003). Dutch version of the Strengths and Difficulties Questionnaire (SDQ). *European Child & Adolescent Psychiatry*, *12*, 281-289. doi:10.1007/s00787-003-0341-3
- Van Zeijl, J., Mesman, J., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Juffer, F., Stolk, M. N., . . . Alink, L. R. A. (2006). Attachment-based intervention for enhancing sensitive discipline in mothers of 1-to 3-year-old children at risk for externalizing behavior problems: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *74*(6), 994-1005. doi:10.1037/0022-006x.74.6.994
- Verweij, K. J., Mosing, M. A., Zietsch, B. P., & Medland, S. E. (2012). Estimating heritability from twin studies. *Methods in Molecular Biology*, *850*, 151-170. doi:10.1007/978-1-61779-555-8_9
-

- Wachs, T. D. (1989). The Nature of the Physical Microenvironment - an Expanded Classification-System. *Merrill-Palmer Quarterly-Journal of Developmental Psychology*, 35(4), 399-419.
- Wachs, T. D., & Evans, G. W. (2010). Chaos and its influence on children's development: An ecological perspective. In G. W. Evans & T. D. Wachs (Eds.), *Chaos in context* (pp. 3–13). Washington, DC: American Psychological Association.
- Wagenmakers, E. J., Beek, T., Dijkhoff, L., & Gronau, Q. F. (2016). Registered Replication Report: Strack, Martin, & Stepper (1988). *Perspectives on Psychological Science*. doi:10.1177/1745691616674458
- Wang, J., Iannotti, R. J., & Nansel, T. R. (2009). School bullying among adolescents in the United States: physical, verbal, relational, and cyber. *Journal of Adolescent Health*, 45, 368-375. doi:10.1016/j.jadohealth.2009.03.021
- Wentzel, K. R. (2014). Prosocial behavior and peer relations in adolescence. In L. M. Padilla-Walker & G. Carlo (Eds.), *Prosocial Development: A Multidimensional Approach* (pp. 178-200). New York, NY: Oxford University Press.
- Wesselmann, E. D., Williams, K. D., & Hales, A. H. (2013). Vicarious ostracism. *Frontiers in Human Neuroscience*, 7, 1-2. doi:10.3389/fnhum.2013.00153
- Wesselmann, E. D., Wirth, J. H., Pryor, J. B., Reeder, G. D., & Williams, K. D. (2013). When Do We Ostracize? *Social Psychological and Personality Science*, 4, 108-115. doi:10.1177/1948550612443386
- Williams, K. D., Cheung, C. K. T., & Choi, W. (2000). Cyberostracism: Effects of being ignored over the Internet. *Journal of Personality and Social Psychology*, 79, 748-762. doi:10.1037/0022-3514.79.5.748

Willoughby, M., Kupersmidt, J., Voegler-Lee, M., & Bryant, D. (2011). Contributions of hot and cool self-regulation to preschool disruptive behavior and academic achievement. *Developmental Neuropsychology*, 36(2), 162-180. doi:10.1080/87565641.2010.549980

Wirth, J. H., & Williams, K. D. (2009). 'They Don't Like Our Kind': Consequences of Being Ostracized While Possessing a Group Membership. *Group Processes & Intergroup Relations*, 12, 111-127. doi:10.1177/1368430208098780

X

Xing, X., Wang, M., & Wang, Z. (2016). Parental corporal punishment in relation to children's executive function and externalizing behavior problems in China. *Social Neuroscience*, 1-6. doi:10.1080/17470919.2016.1258009

Y

Yagmur, S., Mesman, J., Malda, M., Bakermans-Kranenburg, M. J., & Ekmekci, H. (2014). Video-feedback intervention increases sensitive parenting in ethnic minority mothers: a randomized control trial. *Attachment & Human Development*, 16(4), 371-386. doi:10.1080/14616734.2014.912489

Yamagata, S., Takahashi, Y., Kijima, N., Maekawa, H., Ono, Y., & Ando, J. (2005). Genetic and environmental etiology of effortful control. *Twin Research and Human Genetics*, 8(4), 300-306. doi:10.1375/1832427054936790

Z

Zadro, L., Williams, K. D., & Richardson, R. (2004). How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology*, 40, 560-567. doi:10.1016/j.jesp.2003.11.006

- Zelazo, P. D., & Carlson, S. M. (2012). Hot and Cool Executive Function in Childhood and Adolescence: Development and Plasticity. *Child Development Perspectives*, 6(4), 354-360. doi:10.1111/j.1750-8606.2012.00246.x
- Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Handbook of childhood cognitive development* (pp. 445–469). Oxford, England: Blackwell.
- Zwirs, B. W. C., Szekely, E., Herba, C. M., Verhulst, F. C., Jaddoe, V. W. V., Hofman, A., . . . Tiemeier, H. (2015). Social and non-social fear in preschoolers and prospective associations with lying about cheating. *International Journal of Behavioral Development*, 39(5), 477-484. doi:10.1177/0165025414553136

APPENDICES

Nederlandse samenvatting

De mate waarin je in staat bent om je gedrag te reguleren en om te gaan met anderen is van grote invloed op je persoonlijk en maatschappelijk succes in het leven. Kinderen die hun gedrag goed kunnen reguleren en prosociaal zijn, laten weinig externaliserend probleemgedrag zien, presteren goed op school en hebben goede relaties met leeftijdsgenoten (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Razza & Raymond, 2013). Daarnaast groeien deze kinderen op tot volwassenen die mentaal en fysiek gezond zijn, een hoge sociaaleconomische status (SES) hebben, weinig in aanraking komen met de politie en weinig problemen hebben met alcohol of drugs (Jones, Greenberg, & Crowley, 2015; Moffitt et al., 2011). Daarom is het belangrijk om kinderen zo goed mogelijk te ondersteunen bij het ontwikkelen van deze vaardigheden.

Met gedragsregulatie bedoelen we de vaardigheid om uit eigen beweging je gedrag aan te passen, zodat het overeen komt met regels en sociale verwachtingen of bijdraagt aan de realisatie van doelen op de lange in plaats van op de korte termijn (Baumeister, Vohs, & Tice, 2007; Duckworth & Kern, 2011). Gedragsregulatie kan worden gezien als een multidimensionaal construct; het bestaat uit meerdere vaardigheden die onderling samenhangen maar wel van elkaar verschillen. Voorbeelden daarvan zijn het uitstellen van behoeftebevrediging (*delay of gratification*) en het afwisselend onderdrukken en uitvoeren van een reactie (*response inhibition*) (Duckworth & Kern, 2011; Moffitt et al., 2011). Ook prosociaal gedrag kan worden gezien als een multidimensionaal construct en omvat vaardigheden als delen, helpen en troosten (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011). Met prosociaal gedrag worden alle gedragingen bedoeld die iemand uit eigen beweging vertoont en aan een ander voordeel opleveren.

Kennis over factoren die samenhangen met individuele verschillen in de ontwikkeling van gedragsregulatie en prosociaal gedrag is essentieel voor zowel opvoeders als de maatschappij. Met behulp van deze kennis kunnen kinderen die risico lopen op dit gebied worden geïdentificeerd en kunnen interventies worden ontwikkeld om deze vaardigheden succesvol te stimuleren in kinderen. Factoren die samenhangen met de ontwikkeling van gedragsregulatie en prosociaal gedrag kunnen kenmerken

van het kind zijn, zoals karaktereigenschappen of geslacht, maar het kunnen ook omgevingsfactoren zijn. Daarbij kan gedacht worden aan factoren in de sociale omgeving van een kind, zoals kenmerken van de ouders of van de interactie met ouders of leeftijdgenoten, maar ook aan factoren in de sociaaleconomische en fysieke omgeving van het kind, waaronder kenmerken van de thuisomgeving, zoals de mate van chaos. In het huidige proefschrift is de samenhang getoetst tussen factoren uit elk van de bovengenoemde categorieën en individuele verschillen in gedragsregulatie bij kinderen van 2 tot 7 jaar en prosociaal gedrag bij (jong) adolescenten van 9 tot 17 jaar.

Leiden Consortium on Individual Development

De studies die in het huidige proefschrift zijn beschreven maken deel uit van een onderzoek met een experimenteel cohort-sequentieel design dat uitgevoerd wordt door het Leiden Consortium on Individual Development (L-CID). Het primaire doel van dit onderzoek is het toetsen van de effecten van de Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) op ouderlijke sensitiviteit in spel- en disciplineringsituaties en de ontwikkeling van zelfregulatie en prosociaal gedrag van tweelingen. Momenteel wordt onderzoek gedaan in twee cohorten: een peuter-/kleutercohort en een basisschoolcohort. Voor beide cohorten zijn ongeveer 250 gezinnen geworven via gemeenteregisters van gemeenten in de randstad. Alleen gezinnen met een tweeling van hetzelfde geslacht kwamen in aanmerking voor deelname. De gezinnen worden allemaal zes jaar lang gevolgd. Ieder jaar is er één meetmoment per gezin, bij het gezin thuis of op de universiteit, en worden er door de ouders vragenlijsten ingevuld. Daarnaast worden er door het gezin thuis vier dagen ambulante metingen uitgevoerd. Tijdens de jaarlijkse meetmomenten worden er verschillende taken afgenomen bij de kinderen om, onder andere, gedragsregulatie en prosociaal gedrag op een objectieve manier te meten. Daarnaast worden er video-opnames gemaakt van de interactie tussen de primaire ouder (de ouder die de meeste tijd met de kinderen doorbrengt) en de kinderen tijdens verschillende spel- en disciplineringsituaties.

De data die gebruikt zijn voor de studies beschreven in Hoofdstuk 2 en 3 zijn afkomstig uit de eerste twee jaar van het peuter-/kleutercohort. De data die gebruikt zijn in Hoofdstuk 4 zijn afkomstig uit een pilotstudie voor het basisschoolcohort.

Deze pilot is opgezet om enkele taken te valideren, waaronder de taak waarmee het prosociaal compenseren in reactie op de buitensluiting van een leeftijdsgenoot wordt gemeten. Dit is gedaan in een groep van 136 (jong) adolescenten van 9 – 17 jaar oud die zijn geworven via een aantal basis- en middelbare scholen in de omgeving van Leiden. Er werden scholieren van het VMBO, de HAVO en het VWO geïncludeerd.

Factoren die gerelateerd zijn aan de gedragsregulatie van kinderen

Uit Hoofdstuk 2 blijkt dat de gedragsregulatie van kinderen zoals gerapporteerd door hun ouders gerelateerd is aan factoren in de sociale omgeving van het kind, terwijl het vermogen om regels te internaliseren samenhangt met kenmerken van de fysieke omgeving waarin kinderen opgroeien. Ouders die minder opvoedstress en depressieve symptomen ervaren, hebben kinderen die hun gedrag volgens hen beter konden reguleren. De opvoedstress en depressieve symptomen van ouders hingen echter niet samen met de vaardigheid van kinderen om regels te internaliseren, zoals geobserveerd tijdens een *dart game*. In dit spel mochten de kinderen zonder aanwezigheid van een onderzoeker drie balletjes gooien naar een dartbord op ongeveer drie meter afstand zonder daarbij over de lijn op de grond te stappen. Voor ieder balletje dat op het bord zou blijven plakken zouden zij een mooie stempel krijgen. Het gedrag van de kinderen werd geobserveerd en geclassificeerd als: 1) niet vals spelen, 2) een mogelijke intentie tot vals spelen of 3) vals spelen. Hierbij werd er vanuit gegaan dat kinderen die vals speelden minder goed in staat waren de regel te internaliseren en dus om hun gedrag te reguleren. De kinderen die een mogelijke intentie hadden tot vals spelen maar zich inhielden hadden mogelijk de hoogste mate van zelfregulatie. Kinderen die opgroeiden in een meer chaotische thuisomgeving bleken vaker vals te spelen dan kinderen die opgroeiden in een minder chaotische thuisomgeving. Daarnaast was de SES van het gezin mogelijk relevant, aangezien in één van de twee groepen binnen deze studie werd gevonden dat kinderen uit gezinnen met een hogere SES beter in staat waren hun gedrag te reguleren dan kinderen uit gezinnen met een lagere SES. Dit werd gevonden voor zowel de door ouder gerapporteerde gedragsregulatie als vals spelen. Tot slot werden individuele verschillen in de door ouders gerapporteerde gedragsregulatie en in vals spelen voor een klein deel verklaard door genetische factoren (respectievelijk 16% en 31%), en kwam in één van de twee groepen naar voren dat meisjes en oudere kinderen minder vals speelden.

Hoofdstuk 3 beschrijft de studie naar de invloed van twee factoren in de sociale omgeving van het kind op twee andere typen van gedragsregulatie: het uitstellen van behoeftebevrediging en respons inhibitie. Het uitstellen van behoeftebevrediging werd geobserveerd met behulp van de *marshmallow test*. In deze taak kunnen kinderen ervoor kiezen om één door hen gekozen snoepje direct op te eten of te wachten tot de onderzoeker terug komt (8 minuten) en er dan twee te krijgen. Hoe langer een kind wacht, hoe hoger de mate van gedragsregulatie. Kinderen van ouders die op een meer sensitieve manier grenzen stellen bleken langer te wachten. Daarnaast bleken deze kinderen ook sneller hun reactie te kunnen onderdrukken tijdens een *stop-signal taak*. In deze taak moeten kinderen telkens zo snel mogelijk op een auto klikken wanneer deze op het scherm van de tablet verschijnt (75% van de trials), maar niet wanneer er een stopbord naast de auto verschijnt (25% van de trials). Kinderen die de dominante reactie (klikken) beter kunnen onderdrukken, hebben meer gedragsregulatie. Meisjes en oudere kinderen bleken dit beter te kunnen. Daarnaast speelt ook de sensitiviteit van de primaire ouder in spelsituaties een rol; kinderen van meer sensitieve ouders konden hun reactie beter onderdrukken. Deze factor bleek echter niet gerelateerd aan het uitstellen van behoeftebevrediging. De sensitiviteit van ouders in een disciplinerings situatie bleek dus gerelateerd aan beide typen zelfregulatie, terwijl de sensitiviteit van ouders tijdens spel alleen gerelateerd was aan respons inhibitie.

Factoren die gerelateerd zijn aan prosociaal gedrag van (jong) adolescenten

De resultaten van de studie beschreven in Hoofdstuk 4 laten zien dat het prosociaal compenseren van (jong) adolescenten ten opzichte van een leeftijdsgenoot die buitengesloten wordt, samenhangt met kenmerken van de adolescenten zelf en van de interactie met anderen. Prosociaal compenseren werd geobserveerd in de *Prosocial Cyberball Game*, een virtueel balspel met 4 spelers; de participant en drie leeftijdsgenoten. De adolescenten wisten niet dat de andere spelers feitelijk computergestuurde spelers waren. In het eerste deel van het spel spelen de computergestuurde spelers even vaak naar alle andere spelers, maar in het tweede en derde deel sluiten twee van deze spelers de andere computergestuurde speler buiten. Door de spelers verschillende kleuren te geven worden tijdens het tweede en derde deel van het spel impliciet groepen gecreëerd. Tijdens het tweede deel behoort de buitengesloten speler tot dezelfde groep als de participant (*ingroup*), en in het derde deel bij een andere groep dan die van de participant (*outgroup*), of andersom. Tijdens het spel wordt geobserveerd hoe vaak de

adolescent de bal gooit naar de verschillende spelers. De meeste adolescenten bleken te compenseren voor de buitensluiting van een leeftijdsgenoot door de bal vaker te gaan gooien naar de speler die buitengesloten werd in het tweede en derde deel van het spel dan in het eerste deel. Het maakte daarbij niet uit of de buitengesloten speler tot dezelfde of een andere groep behoorde. Daarnaast werd gevonden dat adolescenten die vaker pestten minder compenseren voor de buitensluiting van de speler die tot de andere groep behoort, terwijl adolescenten die meer empathie rapporteerden mogelijk meer compenseren voor de buitensluiting van een leeftijdsgenoot die tot dezelfde groep behoort. De relatie tussen empathie en prosociaal compenseren in reactie op de buitensluiting was echter net niet significant. Tot slot werd gevonden dat jongens mogelijk meer compenseren voor de buitensluiting van een leeftijdsgenoot die tot dezelfde groep behoort dan meisjes. Deze relatie werd echter niet in alle verschillende analyses gevonden.

Implicaties voor onderzoek en praktijk

De effecten van de relaties die in het huidige proefschrift zijn gevonden zijn doorgaans klein. Dit betekent dat de bijdrage van de onderzochte factoren aan het verklaren van individuele verschillen in gedragsregulatie en prosociaal gedrag bescheiden is. Er zijn dus nog andere factoren die samenhangen met gedragsregulatie en prosociaal gedrag dan de factoren die hier zijn onderzocht. Meer onderzoek is dus nodig om individuele verschillen te verklaren. Dit geldt met name voor het prosociale gedrag van (jong) adolescenten in reactie op de buitensluiting van een leeftijdsgenoot. Vervolgonderzoek naar individuele verschillen in gedragsregulatie zou zich vooral moeten richten op het identificeren van factoren in de unieke omgeving van kinderen, omdat een groot deel van de variatie in gedragsregulatie verklaard werd door unieke omgevingsfactoren (Hoofdstuk 2 en 3). Hiermee worden factoren in de omgeving bedoeld die niet gedeeld worden door de tweeling, bijvoorbeeld het beoefenen van een bepaalde sport, dit kan voor beide kinderen verschillen. Ook de interactie met mensen in hun omgeving kan gezien worden als unieke omgeving aangezien dit voor beide kinderen kan verschillen.

De onderlinge relaties tussen de verschillende typen van gedragsregulatie en prosociaal gedrag zijn klein of zelfs afwezig. Daarnaast laten de resultaten zien dat de factoren die onderzocht zijn op andere wijze gerelateerd zijn aan de verschillende typen

gedragsregulatie en prosociaal gedrag. Dat benadrukt de multidimensionale aard van de concepten gedragsregulatie en prosociaal gedrag. Wij raden dan ook aan om in onderzoeken naar gedragsregulatie en prosociaal gedrag meerdere meetinstrumenten mee te nemen die verschillende soorten gedragsregulatie en prosociaal gedrag meten. Daarnaast adviseren wij om de data van ieder type gedrag los te analyseren, in plaats van de data van de verschillende typen samen te voegen en één totaalscore te berekenen voor het overkoepelende construct. Op die manier gaat er minder informatie verloren.

De taken die beschreven zijn in het huidige proefschrift zijn in sommige gevallen aangepast om deze beter te laten aansluiten bij de leeftijd van de kinderen. Uit onze studies blijkt dat deze taken genoeg variatie laten zien in gedrag en dat individuele verschillen gerelateerd zijn aan kenmerken van het kind en omgevingsfactoren zoals op basis van de literatuur verwacht mag worden. De aanpassingen aan de taken zijn dus succesvol en kunnen dan ook in andere studies worden gebruikt. Voor zover wij weten, zijn wij een van de eersten die succesvol een *stop-signal taak* hebben afgenomen bij 4 jarigen en prosociaal gedrag hebben gemeten met de *Prosocial Cyberball Game* in een sample van (jong) adolescenten. Mogelijk kan de *Prosocial Cyberball Game* worden opgenomen als onderdeel van een screeningsinstrument voor prosociaal gedrag, of als onderdeel van een screenings-instrument voor het identificeren van kinderen die (een verhoogd risico lopen op) pesten.

Wanneer men op jonge leeftijd de ontwikkeling van gedragsregulatie van kinderen wil stimuleren, lijkt het op basis van de resultaten in het huidige proefschrift, belangrijk om ouderschapsvaardigheden zoals sensitiviteit en sensitief disciplineren te bevorderen, opvoedstress en depressieve symptomen bij ouders te verminderen en een gestructureerde, rustige thuisomgeving te creëren. Hiermee kan rekening worden gehouden in preventieprogramma's en in de hulpverlening aan gezinnen. Welke factoren samenhangen met prosociaal gedrag is minder eenduidig, maar aangezien kinderen die hun gedrag beter kunnen reguleren vaak ook meer prosociaal zijn, loont het investeren in deze factoren wellicht ook met betrekking tot de ontwikkeling van prosociaal gedrag.

Dankwoord

“Dat is een grote koffer! Ga je op vakantie?” Buren, receptiemedewerkers van het FSW of zomaar iemand op straat; vaak werd mij deze vraag gesteld. Soms was er van de kinderen die ik bezocht de aandoenlijke variatie *“Blijf je vannacht bij ons slapen?”*. Het gesleep met speelgoed voor de bezoeken ga ik niet missen, de interactie met de ouders en kinderen die meedoen aan ons onderzoek zeker wel! Ik ben alle gezinnen die de afgelopen jaren mee hebben gedaan aan Samen Uniek ontzettend dankbaar voor hun inzet, zonder hen was dit alles niet mogelijk geweest.

Daarnaast wil ik graag alle studenten en collega's van Samen Uniek bedanken. Ik had mij geen fijner team kunnen wensen! In het bijzonder wil ik allereerst Saskia en Bianca bedanken. De prettige begeleiding die ik van jullie heb gehad de afgelopen jaren heeft mij veel gebracht! Ilse (de V) en Brigitte, bedankt voor alle hulp bij de werving en bezoeken en uiteraard voor de gezellige praatjes op het secretariaat. Ilse (v. W), Laura, Mara en Michelle, jullie mogen uiteraard niet in dit rijtje ontbreken. Dank jullie wel voor alle steun en gezelligheid zowel op werk als daarbuiten, wat heb ik met jullie gelachen!

Ook de collega's van AGP wil ik hartelijk bedanken. In het bijzonder Mariëlle en Anja voor hun statistisch advies, Gea en Esther voor de praktische ondersteuning en gezelligheid en Claudia, Nikita en Femmie voor de overdracht van alle VIPP kennis.

Ik wil natuurlijk ook mijn vrienden bedanken voor de interesse in mijn onderzoek en de gezellige avonden waar het juist eens even niet over werk ging. En uiteraard mijn familie. In de eerste plaats mijn ouders, voor de opvoeding die zij mij hebben gegeven en de thuisomgeving die zij hebben geboden. Dat ik over de gedragsregulatie en sociale vaardigheden beschik die nodig zijn om een promotietraject te laten slagen, heb ik grotendeels aan jullie te danken! Ik wil ook graag mijn schoonouders bedanken voor de gesprekken op pedagogisch vlak en de vormgeving van mijn proefschrift! En last, but definitely not least: Olivier. Mede dankzij jouw steun, aanmoediging en vertrouwen heb ik mijn promotietraject succesvol kunnen afronden. En dat allemaal terwijl er huizen gekocht en verbouwd werden, we onze bruiloft hebben gevierd en inmiddels ook onze eerste kleine op komst is. Bedankt dat je er altijd voor me bent!

Curriculum Vitae

Claudia Vrijhof werd geboren op 29 oktober 1988 in Utrecht. In 2007 behaalde zij haar Gymnasiumdiploma aan het Christelijk Gymnasium Utrecht. Aansluitend begon zij aan de bacheloropleiding Pedagogische Wetenschappen aan de Universiteit Leiden en in 2011 aan de masteropleiding Child and Family Studies aan dezelfde universiteit. Naast de verplichte onderzoeksstage heeft Claudia tijdens haar masteropleiding ook een praktijkstage gelopen bij Stek Jeugdzorg in Rotterdam. Na haar afstuderen in 2012 heeft Claudia korte tijd bij de GGD Midden Nederland gewerkt alvorens zij aan de slag ging als onderzoeks- en onderwijsmedewerker op de afdeling Algemene en Gezinspedagogiek van de Universiteit Leiden. Op deze afdeling is zij in 2013 gestart als promovenda. Claudia deed onderzoek naar individuele verschillen in gedragsregulatie en prosociaal gedrag en de samenhang met kenmerken van het kind en factoren in de sociale, fysieke en sociaaleconomische omgeving van het kind. De resultaten van haar onderzoek zijn beschreven in dit proefschrift. De studies in het huidige proefschrift maken deel uit van een onderzoek met een experimenteel cohort-sequentieel design dat uitgevoerd wordt door het Leiden Consortium on Individual Development (L-CID). Tijdens haar aanstelling als promovenda is Claudia getraind in het uitvoeren van de Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) en gestart met de opleiding tot VIPP-SD trainer. Claudia blijft werkzaam als onderzoeker binnen L-CID.

