Chapter 1
General Introduction
1. General Introduction

Much debate has been going on about the extent to which the development of human behavior is influenced by innate individual characteristics (“nature”) and/or personal environmental experiences (“nurture”) since Francis Galton introduced the famous phrase “nature versus nurture” in the 19th century. Some scientific currents have stressed the importance of nature/biology (e.g., behavior genetics; Plomin & Rende, 1991), while others believed that nurture/experience mostly influences children’s development (e.g., behaviorism; Watson, 1924). More recently, however, authors have stressed that it is not so much nature vs. nurture, but the possible interplay between nature and nurture, such as person-environment correlations and interactions (Ridley, 2003; Rutter et al., 1997), that should be the focus of research. In fact, it may not be nature versus nurture, but “nature via nurture” (Lykken; in Ridley, 2003) that is a main path of influence in human behavior development. The object of this thesis is to focus on such “nature via nurture” pathways, by studying the pathways through which children’s neurocognitive abilities may express themselves into maladjustment problems such as disruptive behavior, delinquency and academic underachievement.

“Nature” encompasses innate or biological aspects such as genetic vulnerability, and endophenotypes including neurocognitive abilities such as verbal skills and executive functions, as they are related to brain structure and functioning (Binder et al., 1997; Fuster, 2008), and described to be highly heritable (Plomin, DeFries, McClearn, & Rutter, 1997). Such neurocognitive abilities have indeed been described to play a role in the development of (mal)adaptive behavior. More specifically, (minor) deficits in neurocognitive abilities are theorized to underlie the early manifestation of behavior problems, and the ensuing development of multiple types of increasingly severe problems including antisocial behavior and delinquency (Loeber & Hay, 1997; Moffitt, 1993; Nigg & Huang-Pollock, 2003). Neurocognitive functions such as working memory have also been described to be important for learning and academic achievement at school (Alloway & Alloway, 2010). Thus, children with poorer cognitive abilities are likely at increased risk of experiencing adjustment problems, including developing early externalizing behavior problems (e.g., aggression, destruction, oppositionality) and more serious antisocial and delinquent behavior across the life course, but also to experience difficulties in their academic development.

When trying to explain why children with neurocognitive impairments develop such undesirable outcomes, one possibility is that these children’s developmental pathways are directly influenced by their neurocognitive deficits. However, another possibility – congruent to the nature via nurture hypothesis – is that the social context plays a pivotal role in this process, as this social context may explain why the deficits manifest themselves into behavioral and academic problems, or may moderate the potential effects of these deficits. When regarding this possibility, particularly the developing relationships with peers (Parker, Rubin, Erath, Wojtlawowicz, & Buskirk, 2006; Rubin, Bukowski, & Parker, 2006) and parents (Collins, Madsen, & Susman-Stillman, 2002; Steinberg & Silk, 2002) may be
important avenues for research, as such relations represent the major social contextual agents in children’s and adolescents’ lives. For example, the behavior of a child with poorer cognitive abilities may evoke adverse responses from peers or parents, which in turn may accentuate this child’s development towards adverse outcomes. Similarly, the cognitive vulnerability may have its effects especially in a particular social context (Moffitt, 1993; Nigg & Huang-Pollock, 2003; Rutter et al., 1997). The nature of the social context may thus add to the explanation of the development of deviant behavior or achievement in children with poorer neurocognitive abilities.

This thesis aimed at testing whether social relationships with peers and parents play a role in the explanation of the phenomenon that children with poorer cognitive abilities are at increased risk of developing multiple types of problems, including symptoms of psychopathology, delinquency and academic problems. In the next sections of this chapter, several neurocognitive functions that may be important for behavioral and social development based on theories and empirical evidence are outlined. Subsequently, it is discussed that both the relationships with peers and parents may affect the developmental pathways of children with poorer cognitive abilities, and more importantly, how they may play a role in these vulnerable children’s development (i.e., do social relationships mediate and/or moderate the link between poorer cognitive functioning and deviant development?). The chapter finishes with an overview of this thesis’ research aims and design of the studies described in this thesis.

**Neurocognitive Functioning**

Language skills and executive functions are two domains of neurocognitive functions that have been amply described with respect to deviant, antisocial developmental pathways as well as academic achievement (Hinshaw, 1992; Moffitt, 1993; Nigg & Huang-Pollock, 2003). With respect to language skills or deficits, theories on the development of antisocial development have stressed the importance of such language skills as a factor underlying the development of antisocial problems (Keenan & Shaw, 1997; Moffitt, 1990, 1993; Nigg & Huang-Pollock, 2003). Keenan and Shaw (1997) suggested for instance that a proper language development helps preschool children to interpret others and to communicate their needs. This is thought to help them feeling more in control of the environment, leading to less distress and frustration, which prevents the development of behavior problems. Moreover, in middle childhood, children tend to use internalized speech to regulate behavior (Nigg & Huang-Pollock, 2003). Children with poorer language skills may thus be at increased risk of showing behavior problems, because they have difficulties regulating their behavior and understanding others or communicating their thoughts or needs, which might lead to distress, frustration and aggressive responses instead of verbal solutions (Keenan & Shaw, 1997; Nigg & Huang-Pollock, 2003). Such difficulties might not only lead to behavior problems, but also
to other expressions of distress, including emotional problems (e.g., symptoms of depression and anxiety; Gallagher, 1999).

Executive functions represent a number of higher order cognitive processes that enable appropriate and goal-directed behavior, from initiation and planning to cognitive flexibility and decision-making (Ishikawa & Raine, 2003; Oosterlaan, Scheres, & Sergeant, 2005). Executive functions have their neurological basis mainly in the prefrontal cortices, which are important for organizing, executing and inhibiting behavior, and behaving appropriately (Ishikawa & Raine, 2003; Séguin, 2004). Deficits in such functions, including poor working memory and high cognitive impulsivity (i.e., problems with adaptively shifting between cognitive sets, disinhibition, acting without thinking/rapid cognitive tempo, and poor self-control and attention; see White et al., 1994), are hypothesized to lead to maladaptive outcomes, including behavior problems and academic difficulties. For instance, poorer neurocognitive abilities may not only hamper children’s learning processes, including learning and acquiring knowledge at school as well as learning that behaviors such as aggression and swearing are inappropriate, but also the ability to inhibit such inappropriate behaviors (Alloway & Alloway, 2010; Ishikawa & Raine, 2003; Moffitt, 1993; Nigg & Huang-Pollock, 2003). Because of these difficulties, children with poorer executive functions may be at increased risk of developing academic problems (Gathercole, Lamont, & Alloway, 2006), and behavior problems, which might increase in severity as they reach adolescence, resulting in more antisocial and delinquent behaviors (Loeber & Hay, 1997). Thus, in addition to poor language skills, deficits in executive functioning could also lead to deviant developmental outcomes, including externalizing, antisocial and delinquent behavior, and poorer academic achievement.

Results from empirical studies have indeed shown links between neurocognitive functioning, including language skills and executive functions, and children’s behavioral and academic development. For example, mainly cross-sectional but also some prospective associations have been found between language skills as well as executive functioning (e.g., working memory, set shifting, inhibition) and the development of behavioral problems, later antisocial/delinquent outcomes (Hill, 2002; Hinshaw, 1992; Moffitt & Caspi, 2001; Morgan & Lilienfeld, 2000; Nigg & Huang-Pollock, 2003; Ogilvie, Stewart, Chan, & Sum, 2011), and academic achievement (Alloway, Gathercole, Kirkwood, & Elliott, 2009; Aronen, Vuontela, Steenari, Salmi, & Carlson, 2005; Bull & Scerif, 2001).

However, as suggested by the nature via nurture hypothesis, it might be too simple to state that these neurocognitive factors have their influence on deviant behavioral and academic development in isolation. Social environmental factors may play a significant mediating or moderating role in this connection. The next section introduces several aspects of peer and parent relations that may act as important social agents adding to the explanation of the relation between neurocognitive functioning and behavioral/academic outcomes, and that are addressed in the present thesis.
Social Relations

Several social relational factors may play a role in explaining why children with poorer cognitive abilities are at increased risk of developing behavioral and academic problems. First, relationships with peers are discussed. From early childhood onwards, and particularly after the transition to elementary school when the time spent with peers increases and close adult supervision reduces, peers and the quality/type of peer relationships play an increasingly important role in children’s socialization and behavioral development (Parker et al., 2006; Rubin et al., 2006). Parker and colleagues (2006) stated that “relationships with peers provide rich opportunities for learning cooperation, gaining support, or developing interpersonal skills; or that persistent difficulties in getting along with childhood peers are likely to portend difficulties with others later in life and, in the extreme, clinically significant behavioral and affective disorders” (Parker et al., 2006, p. 419). Thus, proper peer relationships are likely beneficial for children’s development, but failures in establishing proper social relationships with peers may be harmful, increasing the risk of childhood maladjustment problems.

Different aspects of peer relations could be considered to be important with respect to children’s behavioral and academic development. The first is on the group level, that is, a child’s sociometric status in the larger peer group (i.e., the extent to which a child is liked or disliked by its peers; Coie & Dodge, 1988; Coie, Dodge, & Coppotelli, 1982; Parker et al., 2006). When children enter the peer group for example in early elementary school, peers evaluate each other; part of the children are liked by most (i.e., accepted), yet some children are disliked, or rejected (Deater-Deckard, 2001; Rubin et al., 2006). As it is an important human motive to form and maintain interpersonal relationships and to be accepted by other people (Baumeister & Leary, 1995), being rejected by peers likely has a negative impact on children’s development, for example resulting in multiple psychopathological problems (Parker et al., 2006). Being rejected by peers might lead to feelings and expressions of frustration of anger (Hubbard, 2001), or feelings of loneliness, depression, or social distress (Crick & Ladd, 1993), being expressed as behavioral and/or emotional problems. Rejection by peers/classmates likely not only affects the development of symptoms of psychopathology, but also children’s school performance. Children who are rejected by their classmates are more likely to have academic difficulties, for instance because they are less motivated for school work, have negative school attitudes, participate less in classroom activities, and avoid school more often (Buhs, Ladd, & Herald, 2006; Osterman, 2000). The reasoning that poor acceptance or rejection by the larger peer group increases the risk of developing deviant outcomes has been supported by empirical evidence, as predictive associations were found between peer rejection and symptoms of externalizing and internalizing psychopathology (Ladd, 2006; Parker et al., 2006; Van Lier & Koot, 2010), and academic problems in elementary school (Buhs & Ladd, 2001; O’Neil, Welsh, Parke, Wang, & Strand, 1997).
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The second peer relational factor is the type of friends a child affiliates with. Friends are described to play an important role in the socialization of children and adolescents, as certain behaviors and thoughts are learned, modeled and reinforced between friends (Deater-Deckard, 2001; Hartup & Stevens, 1997). When children affiliate with friends who show predominantly prosocial behavior, they are more likely to show these behaviors as well. However, affiliation with deviant friends has been described to increase a child’s risk of developing deviant behavior (Deater-Deckard, 2001; Parker et al., 2006). Children who affiliate with aggressive and antisocial friends are more likely to develop such behaviors themselves, as these behaviors are encouraged, imitated and learned in the peer group (i.e., deviancy training; Dishion, Spracklen, Andrews, & Patterson, 1996). In contrast, prosocial and proper behaviors, including behaving and working well at school, are likely not encouraged by deviant friends, for instance because academic success is viewed as “not cool” (Kindermann, 2007). Thus, through the process of “deviancy training”, and no or limited reinforcement by peers of prosocial behavior, affiliation with deviant friends might result in multiple negative outcomes, including externalizing, antisocial and delinquent behaviors as well as academic difficulties (Parker et al., 2006). Indeed, affiliation with deviant, aggressive friends has been found to predict the development of antisocial outcomes including antisocial and delinquent behavior (Deater-Deckard, 2001; Matsueda & Anderson, 1998), and poorer academic performance (Battin-Pearson et al., 2000; Li, Lynch, Kalvin, Liu, & Lerner, 2011).

In addition to influences by peers, parenting behaviors and the parent-child relationship are important influences during childhood and adolescence. Parents have amply been described to play a role in their children’s socialization and behavioral development (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Maccoby, 1992). Although the parent-child relationship or parenting behaviors likely affect the behavioral development across childhood and adolescence, this thesis focuses only on the influence of parenting on delinquency, which becomes more prevalent in adolescence (Blumstein, Cohen, Roth, & Visher, 1986; Farrington, 1986). Indeed, various forms of parenting have been linked with the development of antisocial and delinquent behavior (Loeber, 1990; Loeber & Hay, 1997; Loeber & Stouthamer-Loeber, 1986; Rutter, 2003). For instance, parenting behaviors such as supervision or knowledge of the youth’s whereabouts, parental persistence of discipline and parental support/reinforcement may all affect the child’s risk of showing delinquent behavior, as was found in two meta-analyses (Hoeve et al., 2009; Loeber & Stouthamer-Loeber, 1986).

Towards Understanding Why Child Cognitive Functions Result in Problem Behavior and Academic Underachievement

Thus, both relations with peers and parenting behaviors may influence the development of psychopathological problems, delinquency and academic achievement. More importantly for this thesis, they may be a key factor in our understanding of why children’s neurocognitive functions are linked to psychopathological problems, delinquency and their
academic success. There are several possible mechanisms through which these social
relationships may exercise their influence.

First, a child’s neurocognitive functions might influence the social experience the
child encounters, which in turn may affect the behavioral and academic development. In
other words, the social environment may act as a mediator in the link between the child’s
neurocognitive functions and its behavioral and academic outcomes. For example, the child’s
status in the peer group may (partly) be a consequence of his or her neurocognitive abilities.
Neurocognitive abilities, including language skills and executive functioning, likely
contribute to the success of a child in building satisfying relationships with mainstream peers
and in preventing peer rejection (Hay, Payne, & Chadwick, 2004). Poor neurocognitive
functioning may hamper peer socialization by impeding children’s ability to learn, recognize
and understand social norms and (game) rules, to follow conversations and understand peers,
to cope with the demands of complex peer interactions, or to inhibit inappropriate and
disturbing behavior in the peer group (Beauchamp & Anderson, 2010; Ishikawa & Raine,
2003; Nigg & Huang-Pollock, 2003). As a consequence, these cognitively impaired children
are less attractive for mainstream peers to associate with and at increased risk of becoming
rejected. Similarly, the selection of friends might be influenced by the child’s neurocognitive
abilities, such as working memory and impulsivity, as they may affect the decision-making
process in befriending peers. For instance, having a poorer working memory capacity might
limit the access to and consideration of multiple options with their possible consequences,
resulting in impulsive choices (Finn, 2002). Children with poorer cognitive functions may
thus have difficulties in foreseeing the consequences of affiliating with deviant peers, and
impulsively choose to befriend them instead of mainstream peers. As described earlier, both
peer rejection and affiliation with deviant friends are in turn likely to contribute to the
development of multiple types of problems (e.g., Ladd, 2006; Parker et al., 2006), making the
hypothesized indirect pathway plausible.

Parts of the hypothesized indirect pathway from cognitive functioning to behavioral
outcomes through peer relations have been tested. Some studies found a link between
cognitive functioning and social/peer relational problems (Newcomb, Bukowski, & Pattee,
1993; Rinsky & Hinshaw, 2011; Snyder, Prichard, Schrepferman, Patrick, & Stoolmiller,
2004), as well as impulsive decision-making (Hinson, Jameson, & Whitney, 2003). As
described earlier, problematic peer relations have amply been found to affect children’s
development (e.g., Ladd, 2006; Parker et al., 2006). In addition to evidence for the separate
links, peer rejection has also been found to explain why inattentive/impulsive children
developed conduct problems in kindergarten and first grade (Snyder et al., 2004). Thus, it is
plausible, yet largely untested, that peer relationships in part explain why children with
poorer neurocognitive abilities are at increased risk of following deviant developmental
pathways.
Second, social relational factors such as the behavior of parents or the type of friends a child/adolescent affiliates with might also influence the extent to which cognitive impairments pose a risk of following a deviant or delinquent developmental pathway. In other words, the effects of cognitive functioning on the development of delinquency might be moderated by the behavior of parents and friends. As theorized by Moffitt (1993), neurocognitive deficits may be exacerbated or disproportionally higher in an at-risk social environment, for example by poor parenting or affiliation with deviant friends. Parents who are for instance inconsistent in disciplining and who do not know the whereabouts of their children might fail to provide the external control that cognitively vulnerable children may need to compensate for the weaker internal regulatory processes that put them at increased risk of becoming delinquent (Henry, Caspi, Moffitt, & Silva, 1996; Lynam et al., 2000). Affiliation with prosocial friends might perhaps compensate for the lack of internal control of cognitively impulsive children (e.g., by reducing unstructured time; Booth, Farrell, & Varano, 2008), whereas delinquent peers may even disproportionally increase the risk of being delinquent, because their higher impulsivity might make them more susceptible to negative peer influences (Grosbras et al., 2007).

Empirical support has been found for the hypothesized interaction between neurocognitive functioning and social environmental risk variables. Impulsive boys were for example found to be most delinquent in disadvantaged neighborhoods, whereas being impulsive did not affect delinquency in better neighborhoods (Lynam et al., 2000). Moreover, boys with poorer neurocognitive functions in an adverse home environment were most likely to show aggressive behavior, as compared to boys with either a neurocognitive risk or an adverse home environment (Moffitt, 1993). It thus seems plausible that the risk of a cognitively vulnerable child to be delinquent also depends on social relational factors.

*The Present Thesis: Research Aims and Design*

Both theory and empirical evidence reviewed in the previous sections indicate the plausibility of a significant mediating and/or moderating role of peer and parent relations in the association between cognitive functioning and behavioral and academic outcomes. However, most of the empirical studies on this role examined only part of the hypothesized developmental processes or with neurocognitive or social environmental factors that are not comparable across studies, and often in a cross-sectional design, making it impossible to draw definitive conclusions on the developmental mechanisms. The one study by Snyder and colleagues (2004) that found evidence for an indirect pathway from inattention/impulsiveness to conduct problems via peer rejection (tested in a longitudinal design) used a combination of ratings and tests to measure neurocognitive functions, making it impossible to know whether it were the subjective ratings and/or the more objective test scores that actually drove the results. Therefore, this thesis’ aim was to examine the social relational processes underlying or influencing the developmental pathways of children with poorer neurocognitive abilities.
into externalizing behavior problems and delinquency, as well as academic failure. Although not a main objective of this thesis, in one chapter we included emotional problems as well. In addition, possible sex differences were examined. The studies reported in this thesis had longitudinal designs, one even using an experimental design, using standardized psychometric test scores to obtain a more objective view of children’s cognitive functions, and using multiple informants for social relational, behavioral and academic variables (e.g., peer nominations; self, parent, and teacher reports; official arrest data; end of primary school test scores).

The developmental pathways were examined in four longitudinal observational studies and one longitudinal experimental study, using two different samples of participants. In Table 1.1, an overview is presented of the designs, samples and measures used in the studies reported in this thesis’ chapters. The first two studies focused on the elementary school period, using a Dutch general population sample of children longitudinally followed across elementary school. In the first study in chapter 2, we examined whether the association between language skills and the development of externalizing behavior problems, such as aggressive, destructive and oppositional behavior, was explained by peer rejection. In chapter 3, the role of social relationships with peers as well as children’s own conduct problems in the link between working memory and academic achievement was examined. More specifically, we tested whether behavioral and social relational factors could add to the explanation why children with poorer working memory skills are at increased risk of lower academic achievement at the end of elementary school.

The study in chapter 4 focused on the long term effects of cognitive impulsivity and intelligence assessed in late childhood/early adolescence on the development of adolescents’ delinquency into their late twenties, using Pittsburgh Youth Study data, an American enriched inner city sample of boys followed from late childhood into adulthood. The study in chapter 5, also using Pittsburgh Youth Study data, examined whether the risk of cognitively impulsive boys of showing delinquency in adolescence and adulthood would be moderated by parenting behaviors and peer relationships.

Finally, in chapter 6, an experimental design was used to test whether manipulation of peer acceptance with a preventive intervention influenced the development of both behavioral and emotional problems in a sample of Dutch early elementary school children. More specifically, we explored the effect of a preventive intervention (Good Behavior Game; Barrish, Saunders, & Wolf, 1969) on the development of behavioral and emotional problems. We tested whether this effect was explained/mediated by improved peer acceptance, and whether this mediational pathway applied equally to all children or particularly to children with poorer language skills.
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