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Early intervention in children at high risk of future criminal behaviour: Indications from neurocognitive and neuroaffective mechanisms

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Lisette van Zonneveld



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Early intervention in children at high risk of future criminal behaviour

Indications from neurocognitive and neuroaffective mechanisms

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CHAPTER

1



General Introduction



General introduction

Large cities are often plagued by serious criminal problems caused by (groups of) severe and persistent young offenders. The society, victims and their families suffer the consequences of this criminality in that the economic and immaterial costs are high and the feeling of safety is low. In an effort to minimize crime, targeting children at risk of persistent antisocial behaviour in an early stage for intervention may provide crucial opportunities. The chances of successfully influencing and redirecting children in a prosocial direction are greater when risk factors are identified early and their malleability is relatively high (Loeber, 1990; Loeber, Farrington, & Petechuk, 2003; Van Goozen & Fairchild, 2008). The aim of the studies in this dissertation is to explore whether the assessment of neurocognitive and neuroaffective mechanisms provides the necessary information that helps to shape early intervention in children at high risk of future criminal behaviour. Strengths and difficulties in the neurocognitive and neuroaffective mechanisms of the individual child may serve to customize interventions to the need of the child to prevent it to develop a criminal career. In the literature, many neurocognitive and neuroaffective mechanisms are identified to play a role in more persistent disruptive behaviour/antisocial behaviour. Knowledge about these mechanisms in a group of children at risk of persistent antisocial behaviour, but not yet offenders, might give directions for early preventive intervention and adds this knowledge to the existing literature.

Antisocial behaviour

Every newborn comes into the world with a certain predisposition and preferably develops into a social and lovable human being. Socially adequate behaviour can be seen as behaviour in which an individual pursues his or her own goals, while bearing in mind the other person. Socially adequate functioning is difficult because social situations are complex in nature; they often involve implicit information and are dynamic, fast and expire under time pressure. An unfavourable social development might lead to antisocial or aggressive behaviour. According to Tremblay, Hartup, and Archer (2005) aggression is a basic human inclination which does not need to be learned. Aggression has an evolutionary value in that our species would not have survived without the capacity to show aggressive behaviour (Schaffer, 1996). As a consequence, every typically developing child shows aggressive behaviour. Eventually, in interaction with the environment and with the transition from other-control to self-control,

children learn to control their aggression and learn to behave in a prosocial manner (Schaffer, 1996; Tremblay et al., 2005).

When social development proceeds differently and aggressive behaviour goes beyond occasional occurrences it might result in more serious antisocial behaviour (Van Goozen, 2015). Antisocial behaviour is generally defined as “behaviour that violates the basic rights of others” (Calkins & Keane, 2009). Antisocial behaviour is heterogeneous in nature what is reflected in different developmental pathways and differences in appearance (Hendriks, Bartels, Colins, & Finkenauer, 2018). Consequently, the same behaviour can materialize in different ways which makes it more difficult to get a grip on underlying mechanisms responsible for the behaviour. However, knowledge about these mechanisms will lead to more effective interventions, because it will facilitate to address the core of the problem behaviour (when setting up/designing the intervention).

Brain-behaviour model

To better understand how antisocial behaviour comes about, the neuropsychological “brain-behaviour” model is of great value (see Figure 1) may be helpful. This model states that problems in behaviour are associated with dysfunctions in the brain, assuming that behaviour originates from how the brain functions. These dysfunctions can be identified by neurocognitive assessment. Neurocognitive functions enable information processing and control of behaviour. Impairments in these functions can be reflected in the behaviour. In a similar way a certain biological or genetic predisposition may influence the behaviour, resulting in patterns of environmental feedback influencing social learning. Thus, behaviour is the resultant of predispositions, quality of the neurocognitive functions, and interactions with the environment (Swaab, Bouma, Hendriksen, & König, 2011). From a neuropsychological approach it is possible to make a strength and difficulties profile of the neurocognitive functions for each individual which may help to understand and clarify where the behaviour comes from. Furthermore, the origin of the problem behaviour has consequences for what type of intervention should be chosen. It might be relevant to use the knowledge about the underlying mechanisms in at-risk children as starting point to inform customized care.

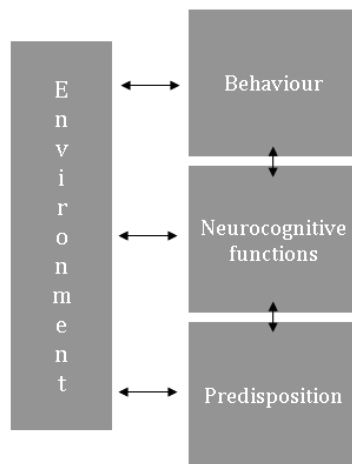


Figure 1. Brain-behaviour model adapted from Swaab et al. (2011)

Environment

The environment is of great influence on the development of a child, for instance on the maturation of the brain but also on the development of social scripts. Already from the first day of pregnancy onwards unfavourable environmental factors may harm the development of the brain, such as mood disorders, extreme or chronic stress of the mother or substance abuse (see review, Gao et al., 2018; Monk, Spicer, & Champagne, 2012; Tzoumakis et al., 2018). Also after birth environmental factors may similarly affect the development of a child, like parental offending or domestic and/or neighborhood violence (Labella & Masten, 2018; see review, Margolin & Gordis, 2000; Tzoumakis et al., 2018). These pre- and postnatal environmental factors influence the maturation of the brain as well as the shaping of ideas that individuals develop about themselves and the world around them, their future expectations and moral development (Ney, Fung, & Wickett, 1994).

Conversely, favourable environmental factors can have a protective role in the development of a child. For instance, parental warmth, prosocial parental values, providing structure, and sensitivity are linked to positive behavioural outcomes and less risk for antisocial behaviour (see review, Labella & Masten, 2018). During social development it is important that a child feels safe and understood. When the environment in which a child grows up is unsafe and unpredictable, a child will experience a lot of stress and will learn that other people are not to

be trusted and that it is better to be on guard. While processing information a child learns, based on experience, to associate what the meaning of the social information is (Crick & Dodge, 1994). Through experience, social examples, and the effect that the own behaviour has on the environment, social scripts are developed and stored in memory. These scripts are activated in similar (social) situations as in which the script was developed. This can be seen as the individual learning history which is formed by seeing examples, hearing instructions, and experiencing the consequences of one's own behaviour. The response of a child to a social situation is determined by the social learning history, reflected in the social scripts, the social expectations, and activated by the context of that moment.

Disadvantageous environmental circumstances can disrupt the preconditions for social learning that involve safety, acceptance, validation, and understanding. For instance, when a child develops scripts in which the interests of another person are not acknowledged. The child can be incited to antisocial behaviour by peers or the child does not have adequate scripts in a certain situation and shows inappropriate behaviour for that reason. Furthermore, criminality and antisocial behaviour, such as witnessing domestic violence or experiencing maltreatment in the close environment, affects a child's behaviour. In sum, the environment determines, to a large extent, the individual learning history of a child and the skills acquired eventually by a child. Although we realize that the environment is of influence on all aspects of the brain-behaviour model, the genetic and biological predisposition also play a role in the neurocognitive and neuroaffective mechanisms.

Genetic and biological predisposition

Genetic predisposition refers to hereditary characteristics as well as characteristics that are rooted in the genetic material but not hereditary. These characteristics have an important and guiding influence on the development of the brain (Swaab et al., 2011). In essence, at birth every child is equipped with the biological predisposition to develop social skills through the exchange of social information with the environment. More specifically, every newborn has an automatic orientation to faces (Swaab et al., 2011), they are able to process information from faces already very early in the development (Farah, Rabinowitz, Quinn, & Liu, 2000), and they prefer to watch social stimuli instead of non-social complex visual patterns (Goren, Sarty, & Wu, 1975). By focusing on faces the child provokes a reaction of another person, who, for example, starts talking to

the child and accordingly the social learning has started. This contact with other persons is very important for the social development and the learning process by which the child learns how to respond and handle social signals. When a child receives ambivalent signals or no contact is made, the child may develop problems with understanding and interpreting social signals, which in turn may result in behavioural problems (Deklyen & Greenberg, 2008). So, a child has the predisposition to develop socially but in interaction with unfavourable environmental circumstances its development may begin to deviate from a typically developing pathway. In sum, antisocial behaviour is strongly influenced by environmental factors as well as by genetic and biological predispositions (Porsch et al., 2016; van Beijsterveldt, Bartels, Hudziak, & Boomsma, 2003). We explicitly aimed to evaluate the underlying neurocognitive and neuroaffective functions that are involved in children's antisocial development for each child separately.

Neurocognitive functions

Important elements in the brain-behaviour model are the neurocognitive functions. These functions relate to the functionality of a particular brain network or area and help to clarify brain-behaviour relationships, hence facilitate the analysis of both the disturbed and the intact behavioral possibilities (Deelman & Eling, 2004). In this dissertation a distinction was made between neurocognitive and neuroaffective mechanisms, both important in social interaction. Neurocognitive mechanisms refer to cognitive non-emotional functions, such as memory, attention, perception, and problem solving, while neuroaffective mechanisms focuses on emotional functions, for instance recognition, theory of mind, and emotion regulation (Cacioppo & Gardner, 1999). Although they are seen as two different types of processes they often involve overlapping neural and mental mechanisms, what makes it challenging to get a grip on the underlying structures (Davidson, 2000). Elaborating on a theoretical model of the development of antisocial behaviour in children that focuses on the mediating role of neurocognitive and neuroaffective processes (Van Goozen, Fairchild, Snoek, & Harold, 2007), this processes is precisely what we want to investigate. This will help in revealing the vulnerabilities of children exhibiting externalizing behaviour and this knowledge can give direction to the care that must be offered to these children.

Executive functions

The cognitive processes that play a significant role in understanding social situations and in regulating behaviour and emotions are the executive functions (EFs). EF is an umbrella term for a collection of top-down control processes responsible for directing attention, monitoring activity, and integrating information and activities (Anderson, 2002; Anderson, Northam, Hendy, & Wrennal, 2001; Diamond, 2013). These processes are crucial to adapt to the social environment and regulate one's own behaviour in an efficient and goal-directed way (Anderson, 2002). The three core EFs, underlying higher-order executive functioning, are working memory, inhibition, and cognitive flexibility (Diamond, 2013). Besides the three core EFs also sustained attention was assessed. EFs develops as children grow older, every EF matures in a different pace, and determines the developmental tasks at different ages which need to be considered in evaluating behaviour regulation (Geurts & Huizinga, 2011; Rueda et al., 2004). Impairments in EFs are associated with behaviours which are inadequately adapted to the social environment, such as aggression and antisocial behaviour (Riccio, Hewitt, & Blake, 2011). Children who show aggressive and/or antisocial behaviour have been found to demonstrate a range of EF impairments (e.g. Hobson, Scott, & Rubia, 2011; Seguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Van Goozen et al., 2004). As an example, in case of EF impairments, it is difficult to develop a script during a dynamic situation which may result in inappropriate scripts that do not suit the situation and that are not efficient. As a result future behaviour is often not appropriate for the situation, since the inappropriate script is stored in memory for future similar situations, and this behaviour might be labeled as antisocial.

Although EFs are studied extensively, studies in samples of middle childhood are scarce and with inconsistent findings. This might be explained by the considerable differences in instruments, methods, and samples used across studies. In our research, we aimed to use a very strict operationalization of EFs in order to avoid multi interpretable results. Another understudied area of research concerning EFs, is the contribution of EFs to the severity of problem behaviour. Given the importance of EFs in social interaction and the relations found between antisocial behaviour and EF impairments it is important to know how and to what extent EF impairments contribute to the severity of externalizing problem behaviour.

Emotion

Emotion recognition is an important aspect of emotion processing which is needed for appropriate social behaviour and normal socialization. Emotions have a function and meaning in social interaction with others. Social interactions are shaped by the influence of one's own emotions on the thoughts and behaviours of others, besides understanding the affective signals of others (Van Rijn, 2011). A distinction can be made between recognition of facial expressions and emotions in the human voice (affective prosody). It is postulated that aggression or antisocial behaviour is the result of an inability to be guided by the social cues of others (Blair, 2003; Montagne et al., 2005). This assumption is supported by the Integrated Emotion System (IES) model of Blair (2005). This model explains that aversive stimuli, such as expressions of fear and sadness, serve as social reinforcements and that individuals who do not recognize these cues cannot take advantage of these cues to adapt their behaviour in a socially appropriate manner (Blair, 2003, 2005; Marsh & Blair, 2008).

Although facial affect recognition has already been studied extensively in samples of children and adolescents with behavioural problems (e.g. Blair & Coles, 2000; Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010; Martin-Key, Graf, Adams, & Fairchild, 2018), affective prosody recognition is an understudied area of research in antisocial or aggressive populations. In order to understand socioemotional functioning, it is considered crucial to investigate how social stimuli are processed, facial affect as well as affective prosody recognition. For that reason it is important to examine the role of emotion recognition in children at high-risk of future criminal behaviour.

Empathy

Like emotion recognition, empathy plays an important role in shaping social interaction. There is substantial evidence that individuals who engage in inappropriate interpersonal behaviour, such as aggression or antisocial behaviour, have problems with empathy and these empathy deficits underlie the impairments in social interaction related to antisocial behaviour (Blair, 2005; Marsh & Blair, 2008). Empathy is distinguished into affective and cognitive empathy (Singer, 2006). Affective empathy is the capacity of an individual to experience what it feels like for another person to experience a certain emotion (De Waal, 2008; Smith, 2009), while cognitive empathy is the capacity of an individual to understand what other's emotions and thoughts might be, without being emotionally involved (Bartoli & Wendt, 2014; Bons et al., 2013). Clearly,

before understanding someone's emotions and to be able to respond empathically, initial attention to social relevant cues is crucial. Therefore, social attention is an important factor that must be taken into account in empathy research.

Affective and cognitive empathy are previously studied in samples of children showing antisocial behaviour, however often measured with self-report questionnaires failing to measure empathy on a physiological level, while physiological arousal is a reliable, objective, and direct measure of affective empathy (Bons et al., 2013). In particular in samples of children showing antisocial behaviour, self-report measures are problematic, because these children are known to often have low verbal intelligence and problems with self-reflection, which could result in unreliable results. It is therefore considered important to add neurophysiological measures to self-report and to assess social attention in a dynamic social situation to assess empathy in a sensitive design that enables to unravel whether the vulnerabilities are a result of initial attention to social cues, affective empathy, cognitive empathy or a combination.

Preventive Intervention Trajectory (PIT)

To better understand the aggressive behaviour and to provide customized preventive interventions informed by the strengths and difficulties in these above-mentioned relevant mechanisms, neurocognitive and neuroaffective mechanisms should be assessed in an individual child. Our study was done as part of a project of the municipality of the city of Amsterdam, the Netherlands, named the Preventive Intervention Trajectory (PIT), which was established in May 2011. The project was designed for children aged between 5 and 18, but in our study only the children aged between 8 and 13 were included.

The PIT team consists of approximately 30 health care professionals. Their goal is to actively seek, target, and support children who are at high-risk of future criminal behaviour. Children recruited through the PIT are included because of high levels of aggression and rule-breaking behaviour. They are the underage siblings of young offenders, children of delinquent parents, children who fail at school due to severe unauthorized absenteeism (e.g. truancy) or because of extreme antisocial behaviour at school. They often come from multi-problem families which frequently operate off the radar from health and social services. Although these children have serious behavioural problems, they often have no formal diagnosis yet, because they have not seen a mental health professional, nor do their families actively seek help from social services or clinicians.

This substantially increases the risk of an unfavourable social developmental trajectory (Farrington, Piquero, & Jennings, 2013; Loeber & Stouthamer-Loeber, 1998). The motivation of the PIT project is to get this group on the radar to obtain insight into their socioemotional functioning in order to prevent antisocial development in an effort to take a generation out of crime. Without the PIT project there is a great risk that the children remain the blind spot of the social and health services and they will end up in crime.

To get this unique sample on the radar, cooperation with the schools they attend is of great importance. The school environment is a place where children are during a large part of the day and where professionals work who have an eye for the individual development of children. The first signals of antisocial behaviour were picked up through questionnaires filled in by the teacher, the Teacher Report Form (TRF; Achenbach & Rescorla, 2001). In addition, since the PIT professionals work with teachers who support the preventive intervention at school, the exposure to treatment is much higher than usual. Another factor of importance may be that the PIT professionals coach the families and children during two years, monitoring the development. Also, they do not only use individual treatment, they also take care of activities of the child like the way they spent leisure time.

In case a behavioural risk was identified, neuropsychological assessment took place, with written approval from the parent(s). During this assessment the neurocognitive and neuroaffective functions were assessed in three day parts at the schools of the children. Four domains of neurocognitive and neuroaffective functioning were defined, namely 1) social information processing, 2) social perspective taking, 3) social scripts, and 4) self-regulation. The assessment of these four domains resulted in an individual strength and difficulties profile clarifying the neurocognitive and neuroaffective functioning and therefore the specific origin of the behaviour which gave directions for customized care. The advices for customized care were discussed by the PIT professional with the parent(s), the teacher, and any other involved social workers (psychoeducation). They made a plan of action incorporating the advices in order to support the social development of the individual child. The provided care could vary, for instance, from making adjustments in the classroom (e.g. to support attention skills), to adjustments in teaching provisions, after-school day-care provision (to offer a social supportive environment) or to train emotion recognition. In general, the care provided is diverse because it was tailored to the child's needs,

supportive to the family resources to offer this, often off the beaten track if necessary, and without time restrictions. Six months after assessment an evaluation took place at which the teacher again completed the behavioural questionnaire TRF. Another 6 months later the second evaluation took place. The evaluations provided insight into behavioural problems. Ultimately, the goal is to early identify and redirect these children into a more prosocial pathway and to reduce or eliminate the antisocial behaviour and as a result prevent them from a criminal career.

Aims and outline of this dissertation

The central aim of the studies in this dissertation is to explore whether the assessment of neurocognitive and neuroaffective mechanisms is helping in early intervention in children at high risk of future criminal behaviour. We wanted to investigate whether the known neurocognitive and neuroaffective mechanisms that are related to antisocial behaviour can already be found in children who are at risk of future criminal behaviour. Moreover, we wanted to investigate whether these mechanisms could serve as input for preventive customized care in these children.

The first study (**Chapter 2**) identifies the contribution of specific EF impairments in explaining the severity of externalizing problem behaviour. To this end, the profile of EF impairments in children at high risk of future criminal behaviour was explored, in comparison to typically developing children and a normative sample. EFs were assessed with computerized tests from the Amsterdam Neuropsychological Tasks (ANT) battery and subtest of the Wechsler Intelligence Scale for Children (WISC-III). EF impairments are known to be involved in behaviours that are inadequately adapted to the social environment, such as aggression and antisocial behaviour. The next study (**Chapter 3**) investigates the facial affect and affective prosody recognition in children at high risk of future criminal behaviour compared to typically developing children. Emotion recognition is an important aspect of emotion processing which is needed for appropriate social behaviour and normal socialization. Recognition of happy, sad, angry, and fear was measured with the Facial Emotion Recognition (FER) test and the prosody test of the Amsterdam Neuropsychological Tasks (ANT), respectively. The third study (**Chapter 4**) focuses on the role of social attention and empathy in response to different emotionally meaningful events in children at high risk of future criminal behaviour compared to typically developing children. Empathy deficits are hypothesized to underlie impairments in social

interaction exhibited by those who engage in antisocial behaviour. Social attention is an essential precursor to empathy and was assessed by means of visual scanning patterns towards social relevant cues using eye tracking. The final study (**Chapter 5**) focuses on the effectiveness of the customized preventive interventions based on the neurocognitive and neuroaffective strength and difficulties of the children at high risk of future criminal behaviour compared to a low-risk group. To assess problem behaviour, the Teacher Report Form (TRF) was filled in at initial assessment, and at 6 and 12 months since the start of the intervention. Finally, in the last chapter (**Chapter 6**) the results of the studies are summarized and discussed in the context of previous literature, future directions and clinical implications.

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CHAPTER

2



Executive function impairments contribute to externalizing problem behaviour in children at high risk of future criminal behaviour

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Under review



Abstract

Background: Executive function (EF) impairments are involved in behaviours that are inadequately adapted to the social environment, such as aggression and antisocial behaviour. In this study, we aimed to investigate the contribution of impaired EF and attention in explaining externalizing behaviour in children at high risk of future criminal behaviour. *Methods:* Participants were 8- to 12-year-old children at high risk of future criminal behaviour ($N=219$, 83.1% boys) and typically developing controls ($N=43$, 72.1% boys). The high-risk group was recruited through an ongoing early identification and intervention project in the city of Amsterdam, focusing on the underage siblings or children of delinquents and those failing primary school because of severe unauthorized absenteeism or extreme antisocial behaviour. Working memory, inhibition, cognitive flexibility, and sustained attention were assessed with computerized tests from the Amsterdam Neuropsychological Tasks (ANT) battery and subtests of the Wechsler Intelligence Scale for Children (WISC-III). *Results:* The high-risk group performed significantly worse than controls on sustained attention, inhibition, cognitive flexibility, and working memory, after covarying for age and verbal IQ. The high-risk group performed between 1.4 and 1.9 standard deviations below the norm for inhibition, flexibility and sustained attention. Within the high risk group, 8 percent of the variation in externalizing behaviour was explained by inhibition, attention and working memory. *Conclusions:* Children at high risk of future criminal behaviour show a broad range of EF impairments and these help to explain externalizing problem behaviour. Implications for early identification and interventions in high-risk children are discussed.

Introduction

Large cities such as Amsterdam in the Netherlands are confronted by serious criminal activity caused by groups of severe and persistent young offenders with a history of externalizing behavior, however, they frequently are off the radar from health and social services. The Preventive Intervention Trajectory (PIT) is a project of the municipality of the city of Amsterdam that targets young children, who are at risk of future criminal behaviour. While these children have behavioural problems, they are often not identified by the care system, nor do their families actively seek help from clinicians or social services, which substantially increases the risk of an unfavourable social developmental trajectory (Farrington, Piquero, & Jennings, 2013; Loeber & Stouthamer-Loeber, 1998). Although different developmental processes are supposed to underlie the course and maintenance of aggressive and antisocial behaviour, a better insight into which aspects of executive functioning contribute to problem behaviour is needed; this may ultimately be helpful in the design of intervention programs that aim to redirect these children onto a more adaptive, prosocial pathway (Van Goozen & Fairchild, 2008).

Impairments in EFs are involved in behaviours, which are inadequately adapted to the social environment, such as aggression and antisocial behaviour (Riccio, Hewitt, & Blake, 2011). Children who show aggressive and/or antisocial behaviour have been found to have a range of EF impairments (e.g. Hobson, Scott, & Rubia, 2011; Seguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Van Goozen et al., 2004). EFs is an umbrella term for a collection of top-down control processes responsible for directing attention, monitoring activity, and integrating information and activities (Anderson, 2002; Anderson, Northam, Hendy, & Wrennal, 2001; Diamond, 2013). These processes are crucial to adapt to the social environment and to regulate one's own behaviour in an efficient and goal-directed way (Anderson, 2002).

This study focuses on the three core EFs, underlying higher-order executive functioning (Diamond, 2013), i.e. working memory, which encompasses the ability to hold information accessible in memory and to manipulate this information, secondly, cognitive flexibility which comprises the ability to adjust behaviour in response to feedback from the environment, and lastly, inhibition, which involves control over impulses, in behaviour as well as over emotions. Because of the increasing risk of comorbid attention problems for longer term

behavioural problems and the high correlation between attention problems and antisocial behaviour (Loeber, 1990; Moffitt, 1990; Schoemaker, Mulder, Deković, & Matthys, 2013; Thapar & van Goozen, 2018), we also examined the role of sustained attention. Sustained attention was defined as the ability to focus, direct and *maintain* cognitive activity on specific stimuli or tasks.

EFs develops from childhood into adulthood and have been studied extensively in relation to aggressive or antisocial behaviours. Systematic and meta-analytic reviews, in particular carried out with adolescents and adults, reveal a robust association between EF impairments and antisocial behaviour (Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011). Research into EFs in middle childhood is more scarce and shows inconsistent findings. Working memory impairments were found in samples of children with attention deficit hyperactivity disorder (ADHD; Oosterlaan, Scheres, & Sergeant, 2005) and disruptive behaviour disorder (DBD; Schoorl, van Rijn, de Wied, van Goozen, & Swaab, 2018), but not in samples of children with an oppositional-defiant disorder (ODD; Oosterlaan et al., 2005; Van Goozen et al., 2004) or with disruptive behaviour problems (DBP; Woltering, Lishak, Hodgson, Granic, & Zelazo, 2015). Cognitive flexibility impairments were found in samples of ADHD with and without comorbid ODD (Hobson et al., 2011; Van Goozen et al., 2004) but not in children with DBD and DBP (Schoorl et al., 2018; Woltering et al., 2015). Also, no inhibition impairments were found in samples of ODD, DBP, DBD or conduct disorder (Glenn et al., 2017; Schoorl et al., 2018; Van Goozen et al., 2004; Woltering et al., 2015), but Ellis, Weiss, and Lochman (2009) related impairments in response inhibition primarily to reactive aggression and Hobson et al. (2011) also found inhibition impairments in children with ODD with or without comorbid ADHD. Attention deficits were found in boys with DBD (Schoorl et al., 2018), but not in a sample of ODD (Van Goozen et al., 2004). The inconsistency in research findings might be explained by the considerable differences in instruments, methods, and samples used across studies. As opposed to previous research, in the current study a sample was examined of children who are at high risk of future criminal behaviour without formal clinical diagnoses, as in general their parents do not actively seek help from a clinician or even refuse assistance. They function off the radar of the health care system, which makes them vulnerable, elusive and at risk. Equally important, in order to avoid multi interpretable results, working memory, sustained attention, inhibition and cognitive flexibility have been very strictly operationalized. Task load varies in the extent that working memory (WM) capacity, inhibition or

flexibility is required, resulting in lower scores (WM) or less accurate and/or slower performance under higher load conditions (inhibition, flexibility). In case of significant task load by group interactions, group differences can be interpreted in terms of the manipulated process (working memory, inhibition, flexibility respectively). Sustained attention parameters pertain specifically to the variability in level of task performance.

Another question addressed in the current study is to what extent EFs help to explain variation in externalizing behaviour. Deater–Deckard, Dodge, Bates, and Pettit (1998) investigated several risk factors into four domains to explain externalizing problem behaviour in middle childhood. The four domains were child risk factors (e.g. temperament, sex, and medical problems), sociocultural risk factors (e.g. poverty), parenting factors (e.g. domestic violence), and peer experiences (e.g. daycare or neighborhood). They found that 36 to 45% variance of externalizing behaviour was explained by these four domains (Deater–Deckard et al., 1998). Child factors explained most (19%) of the variance. Obviously, EFs are important cognitive child factors in relation to behavioural problems. Though, the relation between EFs and problem behaviour has been studied, the contribution of EFs in explaining the variation in externalizing behaviour has not been addressed yet.

The first aim of the present study was to identify the profile of EF impairments in children at high risk of future criminal behaviour. Based on the literature, we hypothesized that high-risk children would perform less well than controls on working memory, inhibition, cognitive flexibility and sustained attention. Our second aim was to examine to what extent the different EF impairments identified contributed to variation in severity of externalizing behaviour.

Methods

Participants

Data were gathered from children recruited through the Preventive Intervention Trajectory. This is a large ongoing intervention project of the municipality of the city of Amsterdam, the Netherlands. Participants were the underage siblings of young offenders, children of delinquent parents ($N=45$) or children who fail at school due to severe unauthorized absenteeism (e.g. truancy) or because of extreme antisocial behaviour ($N=174$). The total sample consisted of 262 participants (213 boys and 49 girls) with a mean age of 10.46 years ($SD=1.34$).

The high-risk group consisted of 219 participants (182 boys and 37 girls) with a mean age of 10.49 years ($SD=1.35$). The control group ($N=43$; 31 boys and 12 girls; mean age of 10.27 years [$SD=1.29$]) was recruited through the same schools that were attended by the participants in the high-risk group. The Dutch version of the Teacher Report Form (TRF; Achenbach & Rescorla, 2001) was used to confirm risk status of the participants and to include children into the study; all participants in the high-risk group scored in the borderline or clinical range on the aggression and/or rule breaking behaviour scales ($T\text{-score} \geq 65$); and their average internalizing problem behaviour score was in the normal range. All participants in the control group scored within the normal range on all problem scales ($T\text{-score} < 65$). The Dutch version of the Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001) was used to identify the problem behaviour reported by the parents of the high-risk group. Children were eligible to participate if they were between 8 and 13 years old and spoke and understood the Dutch language. No exclusion criteria were used. Written informed consent was obtained from the parents and from the children if they were 12 years or older. Ethics approval for this study was obtained from Leiden University's Education and Child Studies Ethics Committee.

Procedure

Following informed consent, an appointment was made at school, where the tests were administered following a standard protocol. All participants were individually assessed in a quiet room. The assessors were two trained graduate students under supervision of a clinical investigator (LvZ).

Instruments

Inhibition and cognitive flexibility. Inhibition of a predominant response was assessed with the subtest "Shifting attentional Set – Visual" (SSV) of the Amsterdam Neuropsychological Tasks (ANT; De Sonneville, 1999). A detailed description of the task paradigm can be found in De Sonneville et al. (2016). Response inhibition leads to a slower and less accurate response, and this was operationalized as the contrast in speed/accuracy of performance between part one (fixed compatible condition, requiring no inhibition), and part two (fixed incompatible condition, requiring inhibition). Cognitive flexibility leads to a slower and less accurate response, and was operationalized as the contrast in speed/accuracy of performance between the compatible stimuli in part one (fixed compatible condition, requiring no flexibility), and part three (the random condition, requiring flexibility) (De Sonneville et al., 2016).

Working memory. Working memory was assessed with the subtest “Digit Span forward and backward” of the Dutch version of the Wechsler Intelligence Scale for Children (WISC-III; Kort et al., 2005). Working memory load was manipulated by requiring the subjects to reproduce the numbers in the presented order (forward condition) and in backward order (backward condition). These separate scores are used for evaluation.

Sustained attention. Sustained attention was assessed by the subtest “Sustained Attention Dots” (SAD) of the ANT (De Sonneville, 1999). A detailed description of the task paradigm can be found in De Sonneville et al. (2016). Main outcome parameters were speed (mean series time), fluctuation in speed (mean series time), and errors (false alarms and misses). The target to non-target ratio is 1:2, the paradigm thus invokes a response bias for the non-target signal which has to be inhibited. Failure to do so results in a disproportionate percentage of misses which variable can be interpreted as a measure of inhibition (De Sonneville et al., 2016). Furthermore, the 600 trials were divided into five blocks of 10 series. Speed, fluctuation in speed and errors were calculated per block to evaluate changes with time-on-task (TOT) on these parameters. Sustained attention is primarily operationalized as the fluctuation in speed during task performance and the change in fluctuation in speed with TOT, with higher scores denoting poorer sustained attention. Test–retest reliability, construct, and discriminant validity of the subtest used in this study are satisfactory and have been extensively described elsewhere (De Sonneville, 2014; Günther, Herpertz-Dahlmann, & Konrad, 2005).

Intellectual functioning. Intellectual functioning was assessed with the Dutch version of the WISC-III (Kort et al., 2005). Two subtests, Block Design (perceptual organization skills) and Vocabulary (verbal skills), were used to estimate full scale IQ (estimated FSIQ; Campbell, 1998).

Statistical analyses

Before testing the hypotheses, all variables were examined for outliers and violations of assumptions applying to the statistical tests used. Data were not available for one control participants (inhibition and flexibility) and three high-risk participants (flexibility), and twelve control and seven high-risk participants (working memory). First, we examined whether the high risk and control group differed on age, sex, estimated FSIQ and the CBCL and TRF behavioral scores. Estimated FSIQ differed between the two groups, as well as Vocabulary and Block

Design. Based on arguments by Dennis et al. (2009), in particular that executive functions are needed to perform on IQ tests, we decided not to include estimated FSIQ as a covariate. However, we included Vocabulary as covariate, because verbal intelligence has been reported to be associated with antisocial behaviour (e.g.; Camp, 1977; Warr-Leeper, Wright, & Mack, 1994). Age was also included as covariate, because it is correlated with the outcome variables as EFs develop with age. In order to examine how the level of performance on the different EF tasks differed from the norm, performance expressed as z-scores were reported. These z-scores are the results of computations, based on nonlinear regression functions that describe the relation between test age and task performance. These functions are implemented in the ANT program, based on norm samples of 3.190 (SAD) and 3.000 (SSV) typically developing controls (De Sonneville, 2014). For sustained attention, we performed a multivariate analysis of covariance to investigate differences in speed and fluctuation in speed between the groups. In all two-way repeated measures analyses of covariance (RM-ANCOVAs), Group (controls vs. high-risk) was entered as between-subjects factor. A two-way RM-ANCOVA was performed with Error type (misses vs. false alarms) as within-subject (WS) factor and error percentage as dependent variable. Two RM-ANCOVAs were performed with TOT as WS factor and speed and fluctuation in speed as dependent variables, respectively. Four RM-ANCOVAs were performed with Inhibition (part 2 vs. part 1) and Flexibility (part 3, compatible condition vs. part 1), respectively as WS factor, and speed and errors as dependent variables, respectively. Also, for working memory a RM-ANCOVA was performed with Condition (forward vs. backward) as WS factor and test score as dependent variable. Within the high-risk group we performed an exploratory analysis, computing partial correlations to identify candidate contributors for inclusion in a multiple regression analysis. The EF variables that correlated (trend) significantly with TRF externalizing behaviour and age were entered in a multivariate regression analysis (Enter method) with TRF externalizing behaviour as dependent variable. Effect sizes were calculated using partial eta squared (η_p^2) with $\eta_p^2 \sim .03$ representing a small effect, $\eta_p^2 \sim .06$ representing a moderate effect, and $\eta_p^2 \sim .14$ a large effect (Cohen, 1992).

Results

Descriptive statistics

Descriptive data for sex, age, estimated FSIQ, Block Design, Vocabulary, and the TRF scales are shown in Table 1. The high-risk and control groups did not differ in age or sex distribution. However, the high-risk group had a significantly lower estimated FSIQ, lower scores on Vocabulary and Block Design, and scored significantly higher on TRF attention problems, aggression, rule-breaking behaviour, total externalizing behaviour and total internalizing behaviour (see Table 1). As expected, parents of the high-risk group reported less problem behaviour on the CBCL ($M_{\text{aggression}}=59.31, SD=8.53; M_{\text{rule-breaking}}=58.19, SD=7.05$) compared to teachers for aggression ($t(1,215)=18.47, p<.001, d=1.7$) and rule-breaking behaviour ($t(1,215)=19.74, p<.001, d=1.7$).

Table 1. Descriptive statistics for sex, age, estimated FSIQ, Block Design, Vocabulary, and TRF scales for the two groups

	High-risk group (N=219)		Control group (N=43)		χ^2 / t test	p	d
	M	SD	M	SD			
Sex (% boys)	83.1 %		72.1 %		χ^2 (1, 262) = 2.87	.090	
Age (years)	10.49	1.35	10.27	1.29	t (1,260) = 0.98	.327	
Estimated FSIQ	84.49	12.58	104.45	15.43	t (1,260) = -9.15	< .001	1.4
Block Design (norm score)	6.32	2.76	10.19	4.07	t (1,258) = -5.96	< .001	1.1
Vocabulary (norm score)	8.33	2.40	11.35	2.42	t (1,258) = -7.52	< .001	1.3
Aggression (T-score)	75.85	11.02	52.51	4.35	t (1,260) = 23.41	< .001	2.8
Rule-breaking (T-score)	69.94	6.73	52.33	3.90	t (1,260) = 23.53	< .001	3.2
Total Externalizing (T-score)	73.64	7.37	48.49	7.09	t (1,260) = 20.59	< .001	3.5
Attention problems (T-score)	67.51	8.74	51.77	3.30	t (1,260) = 20.28	< .001	2.4
Total Internalizing (T-score)	60.57	7.87	49.84	8.14	t (1,260) = 8.13	< .001	1.3

The z-scores for the level of performance on the EFs are presented in Figure 1. On all variables of interest the control group performed within 0.4 SD above or below the norm, indicating average performance compared with the normative sample. The high-risk group performed above +1.3 SD on fluctuation in speed during sustained attention and even above +1.8 SD on inhibition and cognitive flexibility compared to the normative sample.

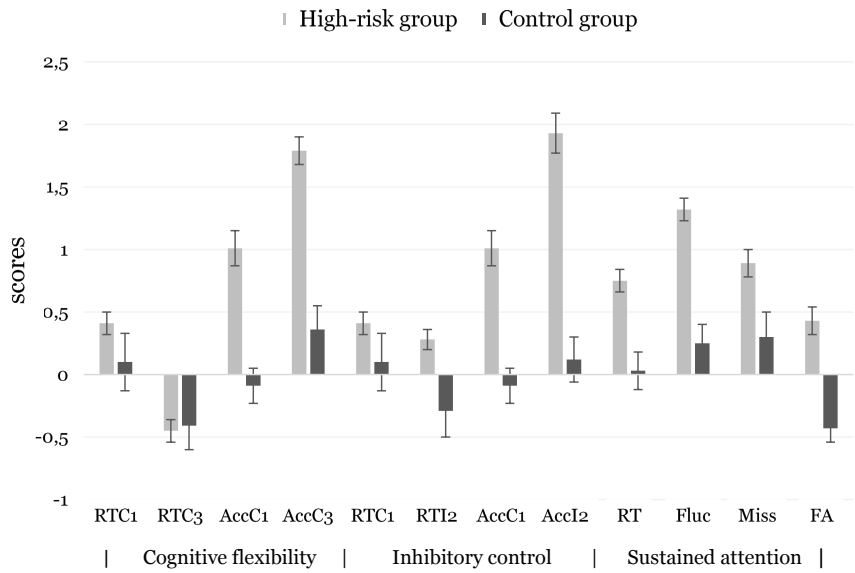


Figure 1. Mean z-scores and standard errors of the means (SEM) for the performance on sustained attention, cognitive flexibility and inhibition.

Note. Acc = accuracy; FA = false alarm; Fluc = fluctuation; RT = reaction time. With regard to the numbers used on the x-axis, C1 and C3 = the compatible condition in part 1 and part 3 of the cognitive flexibility task, I2 = the incompatible condition in part 2 of the inhibition task.

Inhibition

Regarding response speed, the results showed a significant main effect of Group ($F(1,255)=5.58$, $p=.019$, $\eta_p^2=.021$), no main effect of Inhibition ($p=.724$), and a significant Inhibition by Group interaction ($F(1,255)=7.62$, $p=.006$, $\eta_p^2=.029$). As shown in Figure 2, Panel A, the results indicate that the high-risk group performed generally slower compared to the control group, while differences between groups increased when demands for inhibition increased. Regarding accuracy, the results showed a significant main effect of Group ($F(1,255)=13.65$, $p<.001$, $\eta_p^2=.051$), of Inhibition ($F(1,255)=7.59$, $p=.006$, $\eta_p^2=.029$), and a significant Inhibition by Group interaction ($F(1,255)=7.12$, $p=.008$, $\eta_p^2=.027$). As shown in Figure 2, Panel B, the results indicate that the high-risk group made more errors than the control group and showed a greater decrease in accuracy compared to the control group when inhibition was required.

Cognitive flexibility

Regarding response speed, there was no main effect of Group ($p=.766$), or Flexibility ($p=.730$), and no significant Flexibility by Group interaction ($p=.688$). Regarding accuracy, the results showed a main effect of Group ($F(1,254)=14.35$, $p<.001$, $\eta_p^2=.053$), of Flexibility ($F(1,254)=18.13$, $p<.001$, $\eta_p^2=.067$), and a significant Flexibility by Group interaction ($F(1,254)=9.50$, $p=.002$, $\eta_p^2=.036$). The results reflect no differences in speed but as shown in Figure 2, Panel C, the high-risk group made more errors than the control group and showed a greater decrease in accuracy when flexibility was required.

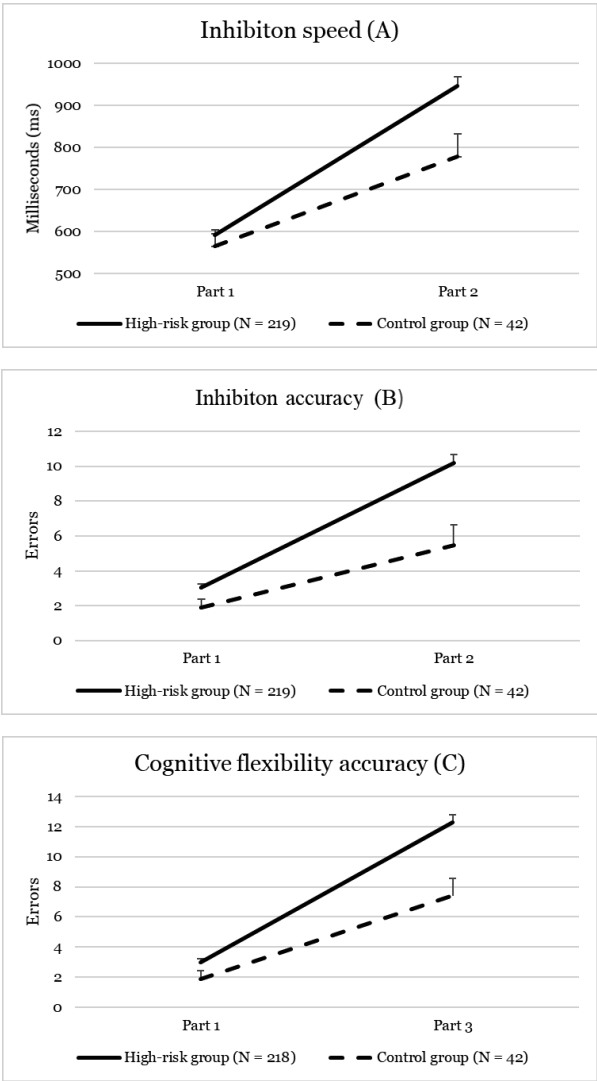


Figure 2. Means and SEM for speed of inhibition (Panel A), accuracy of inhibition (Panel B) and accuracy of Cognitive flexibility (Panel C). Part 1 = compatible condition, Part 2 = incompatible condition, Part 3 = random condition, compatible trials.

Working memory

The results showed a significant main effect of Group ($F(1,239)=6.05, p=.015, \eta_p^2=.025$), no main effect of Working Memory condition ($p=.115$), and no Working Memory by Group interaction ($p=.635$). The results indicate that the high-risk group had generally lower working memory scores.

Sustained attention

There was a significant main effect of Group for response speed ($F(1,256)=6.11$, $p=.014$, $\eta_p^2=.023$) and for fluctuation of speed ($F(1,256)=14.32$, $p<.001$, $\eta_p^2=.053$). These results indicate that the high-risk group performed slower and had a greater fluctuation in speed compared to the control group. Regarding accuracy, there was a main effect of Group ($F(1,256)=5.41$, $p=.021$, $\eta_p^2=.021$), reflecting that the high-risk group made more errors than the controls. A main effect of Error type ($F(1,256) = 13.53$, $p<.001$, $\eta^2=.050$) was also found, but no Error type by Group interaction ($p=.194$). These results reflect that both groups made more misses compared to false alarms. Regarding changes with Time on Task (TOT), a TOT by Error type interaction was found ($F(4,960) = 4.77$, $p=.001$, $\eta^2=.019$), indicating that the increase in TOT error rate was larger for the misses compared to the false alarms. No TOT by Error type by Group interaction was found ($p=.381$) indicating that the differential changes in error rate with TOT was shown by both groups. Regarding fluctuation in speed, a TOT by Group interaction was found ($F(4,960)=2.75$, $p=.027$, $\eta^2=.011$). As shown in Figure 3, these results indicate that the fluctuation in speed increased with TOT and this deterioration was larger in the high-risk group compared to the control group.

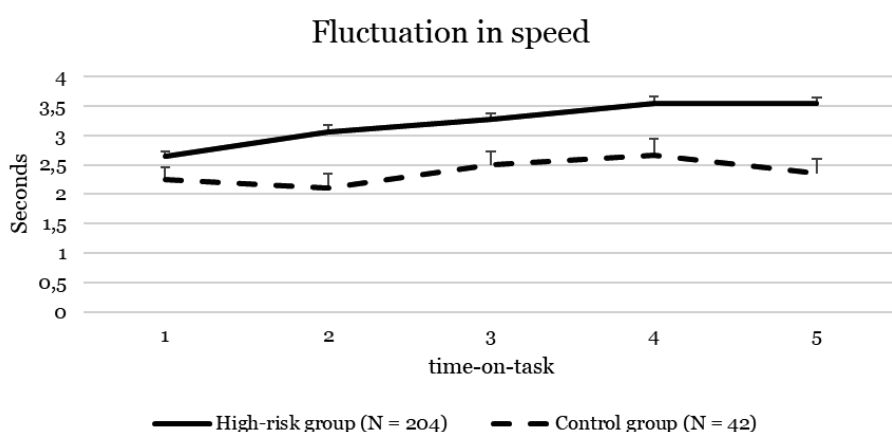


Figure 3. Means and SEM for fluctuation in speed with TOT for the high-risk and control group.

Does EF explain variation in externalizing behaviour?

Three EF parameters and one attention parameter were significantly correlated with TRF externalizing problem behaviour within the high-risk group: working memory (digit span backwards) ($r(206)=-.203, p=.003$) and two measures of inhibition (percentage of misses, SAD task) ($r(206)=.197, p=.004$), and the decrease in accuracy in part 2 (SSV task) ($r(206)=.127, p=.066$), and attention (Fluctuation in speed) ($r(206)=.177, p=.010$). These EF variables were entered in a multivariate regression analysis (Enter method), with TRF externalizing behaviour, see Table 2, as dependent variable. The model explained 8% of the variance in externalizing behaviour ($R^2=.08, F(4,211)=4.38, p=.002$).

Table 2. Multivariate regression (Enter method) with TRF externalizing behaviour as dependent variable

	B	SE B	β	t	p	R ²
						0.078
Constant	72.208	2.29		31.55	<.001	
Working memory	- 0.594	0.30	-.14	- 1.95	.052	
Inhibition (SSV)	0.096	0.07	.10	1.43	.154	
Inhibition (SAD)	0.110	0.05	.15	2.14	.033	
Attention	0.478	0.38	.09	1.27	.207	

Discussion

Our sample of children at high-risk of future criminal behavior showed impairments in inhibition, cognitive flexibility, working memory, and sustained attention compared to controls. The results are consistent with reported EF impairments in other studies (e.g. Ellis et al., 2009; Hobson et al., 2011). This study demonstrates that EF in the high risk group is poorer than in the controls, and is the first to address the severity of these EF impairments by comparing performance to norm data, which indicate that deviations from the norm range from 1.3 to 1.9 standard deviations.

The second aim was to investigate to what extent specific EFs can explain variation in severity of externalizing behaviour. The results indicate that working memory, attention and inhibition contributed eight percent of the variation in externalizing behaviour; inhibition contributed somewhat more to the variation. More severe externalizing problem behaviour was related to poorer inhibition,

working memory, and attention regulation. To the authors' knowledge, this is also the first study that examined the explained variation in externalizing behaviour through EFs in a high-risk sample. Although replication is needed, the findings support the idea that EF impairments can be seen as important risk factor in the development of antisocial behaviour and it might be useful to add EF to risk assessment of individuals. The clear involvement of inhibition in the explanation of aggression is not surprising given that inhibition problems predict aggression in preschool children (Raaijmakers et al., 2008). We did not find that cognitive flexibility contributed to explaining variation in severity of aggression, similar to a recent study (Thomson & Centifanti, 2018).

Although our results show that EF impairments contribute to the explanation of externalizing behaviour, another 90% of the variance remains unexplained. Results of previous research in the same sample suggest that affective empathy (Van Zonneveld, Platje, de Sonnevile, van Goozen, & Swaab, 2017), facial emotion recognition, and affective prosody recognition (van Zonneveld, de Sonnevile, van Goozen, & Swaab, 2018) are other potential candidate variables to explain variation in externalizing problem behaviour. In addition, Deater-Deckard et al. (1998) showed that 36 – 45% of the variance in externalizing problem behaviour was explained by four domains of risk factors; child factors, sociocultural factors, parenting and caregiving factors, and peer experiences. Although child factors explained 19% of the variance (i.e., temperament, medical problems, and sex), cognitive child factors were not assessed in that study. Whilst 8% may seem a rather small contribution, it was based on objective, child-performance based data rather than mother - reported impressions. We therefore think that the present study highlights the important role that cognitive factors play in the development of severe problem behavior; however, in order to do justice to the complexity of this problem, emotional and sociocultural factors need to be taken into account as well (Van Goozen, Fairchild, Snoek, & Harold, 2007).

Our findings should be interpreted in light of several limitations. Besides the three core EFs and attention we did not include other EFs, such as planning, reasoning or hot 'reward-related' EFs, which potentially contribute to the prediction of externalizing behaviour (Hobson et al., 2011; Schoorl et al., 2018). Another limitation is that we did not include any environmental variables in our study. Although caregivers play a substantial role in the development of the skills of their child and different developmental processes underlie the course and maintenance of antisocial behaviour we explicitly aimed to study the individual

and underlying neurocognitive mechanisms that are involved in children's antisocial development (Dishion, French, & Patterson, 1995). As reasoned earlier, we decided to not covariate for estimated FSIQ. If we do, the group differences would have remained the same.

The findings of the current study emphasize the importance of early identification of risk factors for future criminal behaviour. The chances of successfully influencing and redirecting children in a prosocial direction are greater when risk factors are identified early when their malleability is still relatively high (Loeber, 1990; Van Goozen & Fairchild, 2008). Those who work with young children, including teachers, social workers, and clinicians, should be aware of evidence of EF impairments. A potential implication is to offer these children an intervention aimed at strengthening their EFs. Studies in young children using such interventions provide evidence for their effectiveness whether they use computerized or behavioural training (see review; Diamond & Lee, 2011). It may also be worthwhile to consider implementing EF training in the school curriculum given its protective role and the positive effect of EF on later success in life (Diamond & Lee, 2011; Waller, Hyde, Baskin-Sommers, & Olson, 2017).

Conclusion

This study identified specific EF impairments in a group of children at high risk of future criminal behaviour. The comparison with typically developing children, but also in particular the comparison with a normative sample, highlight the seriousness of their EF impairments. In addition, it was found that specific EF impairments explained 8% of the variation in externalizing behaviour. These results indicate not only that EF impairments are an important risk factor in antisocial development but also that interventions should target these EF impairments to redirect the development of problem behaviour in a more prosocial direction.

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CHAPTER

3



Recognition of facial emotion and affective prosody in children at high risk of criminal behavior

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Abstract

Objective: Emotion recognition is an important aspect of emotion processing, which is needed for appropriate social behavior and normal socialization. Previous studies in adults with antisocial personality disorder or psychopathy, in those convicted of criminal behavior, or in children with conduct disorder show impairments in negative emotion recognition. The present study investigated affective facial and prosody recognition in a sample of children at high risk of developing future criminal behavior. *Methods:* Participants were 8- to 12-year-old children at high risk of developing criminal behavior ($N = 219$, 83.1% boys) and typically developing controls ($N = 43$, 72.1% boys). The high-risk children were recruited through an ongoing early intervention project of the city of Amsterdam, that focuses on the underage siblings or children of delinquents, and those failing to attend school. Facial and vocal recognition of happy, sad, angry, and fear was measured with the Facial Emotion Recognition (FER) test and the prosody test of the Amsterdam Neuropsychological Tasks (ANT), respectively. *Results:* The high-risk group was significantly worse in facial affect recognition and had particular problems with fear and sadness recognition. No hostile attribution bias was found. The high-risk group did not differ from controls in affective prosody recognition but needed significantly more time to recognize emotions. *Conclusions:* The emotion-specific deficits found in forensic and clinical populations are already present in a sample of children at high risk of developing future criminal behavior. These findings help us understand a possible underlying mechanism of antisocial behavior that could provide directions for tailored interventions.

Introduction

Large cities such as Amsterdam in the Netherlands are confronted by serious criminal problems caused by groups of severe and persistent juvenile offenders, who come from families, which frequently operate off the radar from health, educational, and social services. While these children might have behavioral problems, they often have no diagnosis because they have not seen a mental health professional, nor do their families actively seek help from social services or clinicians, which substantially increases the risk of an unfavorable social developmental trajectory (Farrington et al., 2013; Loeber & Stouthamer-Loeber, 1998). The Preventive Intervention Trajectory (PIT) is a project of the municipality of the city of Amsterdam that targets young children who are at risk of future criminal behavior (van Zonneveld et al., 2017). The motivation behind the project is to get this group on the radar to obtain insight into their socioemotional functioning in order to prevent antisocial development in an effort to take a generation out of crime.

To understand socioemotional functioning, it is crucial to investigate how social stimuli are processed (Corden et al., 2006). In a recent study with the same population of high risk children, evidence was found for impaired affective empathy but intact social attention and cognitive empathy (van Zonneveld et al., 2017). Emotion recognition is another important aspect of emotion processing. Evidence has been found that impairments in emotion processing contribute to behavioral and social problems in at-risk children (Izard et al., 2001). Emotion recognition is particularly crucial when it comes to engaging in social behavior; it is fundamental for normal social interaction and socialization (Blair et al., 2001; Montagne et al., 2005). The aim of the present study was to examine the role of emotion recognition in children at high risk of developing future criminal behavior, which may serve as an underlying mechanism of antisocial behavior. It is proposed that aggression or antisocial behavior is the result of an inability to be led by the social cues of others (Blair, 2003; Montagne et al., 2005). This assumption is supported by the Integrated Emotion System (IES) model of Blair (2005). The IES model explains that aversive stimuli, such as expressions of fear and sadness, serve as social reinforcements and that individuals who do not recognize these cues cannot take advantage of these cues to adapt their behaviors in a socially appropriate manner (Blair, 2005; Blair, 2003; Marsh & Blair, 2008). Adequate recognition of fear and sadness evokes empathy and inhibits aggressive and/or antisocial behavior (Marsh et al., 2005; Marsh & Blair, 2008),

whereas someone will continue with behavior that causes distress when that individual is unable to recognize distress in others (Hubble et al., 2015). One of the best-replicated findings is the inability to recognize fear and sadness in facial expressions across populations of children and (early) adolescents presenting with behavioral problems (Blair & Coles, 2000; Schwenck et al., 2014; Walker & Leister, 1994), conduct disorder (CD) (Fairchild et al., 2010; Fairchild et al., 2009; Martin-Key et al., 2015; Sully et al., 2015), psychopathic tendencies (Blair et al., 2001; Montagne et al., 2005; Stevens et al., 2001), young offenders (Bowen et al., 2014; Carr & Lutjemeier, 2005; Hubble et al., 2015), or callous/unemotional (CU) traits (Dadds et al., 2006; Leist & Dadds, 2009; Woodworth & Waschbusch, 2008). Székely et al. (2014) found that preschoolers with externalizing problem behaviors were generally less skilled in emotion recognition, but did not find any emotion-specific deficits. The current study extends the current literature by investigating facial affect recognition in a non-clinical sample of children who are at risk of future antisocial or criminal behaviors.

Another phenomenon with respect to facial affect recognition is the hostile attribution bias, which has been linked to aggression and antisocial behavior (De Castro et al., 2002). Individuals who have a hostile attribution bias attribute hostile intent to others when the stimulus or situation is actually neutral or ambiguous (De Castro et al., 2002; Dodge, 2006; Schönenberg & Jusyte, 2014). Research into this phenomenon in children is scarce (Mellentin et al., 2015). The result of a study, which used ambiguous stimuli showed that antisocial children were less skilled in interpreting neutral faces and often misinterpret them as anger (Dadds et al., 2006). In the current study, the existence of a hostile attribution bias was investigated using neutral faces to find out whether at-risk children interpret these faces in a negative way.

In contrast to facial affect recognition, affective prosody recognition is an understudied area of research in antisocial or aggressive populations, and research seems to be limited to the study of children or adults with psychopathic tendencies. From a meta-analysis by Dawel et al. (2012), it appears that affective prosody recognition in psychopathic individuals is impaired in positive as well as negative emotions. However, in one of these studies in boys with psychopathic tendencies, impairments in sadness recognition were observed (Stevens et al., 2001), whereas another of these studies found impairments in fear recognition (Blair et al., 2005).

The main aim of the present study was to investigate facial affect and affective prosody recognition in children at high risk of developing future criminal behaviors. In line with previous research (Bowen et al., 2014; Dawel et al., 2012; Marsh & Blair, 2008), we predicted that high-risk children would have impaired facial affect and prosody recognition, and show specific impairments in fear and sadness recognition. We also predicted a hostile attribution bias in response to neutral faces compared with typical control children (Mellentin et al., 2015).

Methods

Participants

Data were gathered from children recruited through the PIT. This is a large ongoing project of the municipality of the city of Amsterdam, the Netherlands. Participants were the underage siblings of young offenders, children of delinquent parents ($N = 45$, familial high-risk), or children who fail at school due to severe unauthorized absenteeism (e.g., truancy) or because of extreme antisocial behavior ($N = 174$, school high-risk). The total sample consisted of 262 participants (213 boys and 49 girls) with a mean age of 10.46 years ($SD = 1.34$). The high-risk group consisted of 219 participants (182 boys and 37 girls) with a mean age of 10.49 years ($SD = 1.35$). The control group ($N = 43$; 31 boys and 12 girls; mean age of 10.27 years [$SD = 1.29$]) was recruited through the same schools that were attended by the participants in the high-risk group, which make them a representative group. The Dutch version of the Teacher Report Form (TRF; Achenbach & Rescorla, 2001; Verhulst et al., 1997) was used to confirm risk status of the participants and to include children into the study; all participants in the high-risk group scored in the borderline or clinical range on the aggression and/or rule breaking behavior scales (T -score ≥ 65); and their average internalizing problem behavior score was in the normal range. All participants in the control group scored on average within the normal range on all problem scales (T -score < 65). The Dutch version of the Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001; Verhulst et al., 1996) was used to identify the problem behavior reported by the parents of the high-risk group.

Children were eligible to participate if they were between 8 and 13 years old and spoke and understood the Dutch language. No exclusion criteria were used. Written informed consent was obtained from the parents and from the children if they were 12 years or older. Ethical approval for this study was obtained from Leiden University's Education and Child Studies Ethics Committee.

Procedure

Following informed consent, an appointment was made at school, where the tests were administered following a standard protocol. All participants were individually assessed in a quiet room. The assessors were two trained graduate students under supervision of a clinical investigator (LvZ).

Instruments

Facial emotion recognition. Facial emotion recognition was assessed with the Facial Emotion Recognition (FER) test (Bowen et al., 2014). This computerized task consists of 108 slides presented on a laptop, displaying facial expressions. Six target faces, three male and three female, were used. Each target displayed a neutral expression or one of six basic emotions (happy, sad, anger, fear, disgust, or surprise). The intensity of the emotional expression varies between 25%, 50%, 75%, and 100%, because they are morphed with their corresponding neutral expression (0% intensity). The question “What emotion is this person showing?” accompanies the target face, along with numbered and labeled options. Percentage correct recognition scores (accuracy) was calculated for each emotion at every intensity.

Affective prosody recognition. Affective prosody recognition was assessed with the subtest “Prosody” of the computerized test battery Amsterdam Neuropsychological Tasks (ANT; De Sonneville, 1999, 2014; Oerlemans et al., 2014). This test consists of 48 sentences of neutral content (12 for each basic emotion: happy, sad, anger, fear; 6 spoken by a male and 6 spoken by a female) and presented through a headphone. The original material, used in previous studies (Van Rijn et al., 2007; Van Rijn et al., 2005), consisted of 24 sentences that are presented twice in random order to obtain more observations. Sentences were spoken with a happy, sad, angry, or frightened intonation. The participants were asked to verbally (into a microphone) identify the emotion expressed in the sentence spoken. Reaction times of the correct responses were recorded using a voice-key response. The mean reaction time (speed) and percentage correct recognition scores (accuracy) were calculated for each emotion.

Intellectual functioning. Intellectual functioning was assessed with the Dutch version of the Wechsler Intelligence Scale for Children (WISC-III; Kort et al., 2005). Two subtests, Block Design (perceptual organization skills) and Vocabulary (verbal skills), were used to estimate full scale intelligence quotient (FSIQ; Campbell, 1998).

Statistical Analysis

There were no outliers or violations of statistical assumptions. Facial emotion recognition data were not available for five participants (high-risk group), and affective prosody recognition data were not available for two participants (high-risk group) due to time restrictions. For another 11 participants (high-risk group), one or more of the mean reaction times on the prosody test could not be calculated because they did all 12 trials of one emotion wrong. For these 11 participants, the accuracy data were available. A priori, the high-risk group, and control groups were compared on age, sex, estimated FSIQ, Vocabulary, Block Design, and the different TRF scales. Since estimated FSIQ was significantly different between the groups, correlations with affective facial and prosody recognition were computed, resulting in three significant but small correlations ($.19 < r < .26$) out of 12. Repeating the analyses with estimated FSIQ as covariate resulted in two non-significant effects of the covariate and one significant effect, but, in this case, the outcome did not change. We decided to not include estimated FSIQ as covariate in subsequent analyses based on these results and the arguments of Dennis et al. (2009). We have examined whether there was a differential relationship between estimates of verbal and nonverbal ability (Vocabulary and Block Design) between groups as well as whether the nonverbal measure related to the facial and prosody scores. Furthermore, preliminary analyses revealed that the 25% intensity recognition and the emotions, disgust and surprise, of FER were too difficult for this age group and we decided to exclude these from our analyses. Because we were interested in specific emotion recognition and not in emotion specific intensity recognition, we calculated a mean emotion recognition score for each of the four emotions across the three intensities (50%, 75%, and 100%). Next, we performed three two-way repeated measures analyses of variance (RM-ANOVAs) to investigate differences between groups in facial affect and affective prosody recognition. Mean reaction times and percentage correct were calculated for Emotion (happiness, sadness, fear, anger) as within-subjects' factors and Group as between-subjects' factor. *Post hoc* group differences by emotions were examined in case of a significant interaction effect. Two RM-ANOVAs were performed to examine the distribution of the selected emotions in case the target emotion was not recognized, for facial as well as vocal affect recognition. Emotion (target emotion) and Confusion type as within-subjects' factors and Group as between-subjects factor were used. The existence of a hostile attribution bias was examined with a t-test by using the responses when neutral was the target emotion. Because antisocial behavior is notoriously heterogeneous *post hoc*, analyses were performed to compare control

participants, familial high-risk, and school high-risk participants. Effect sizes were calculated using partial eta squared (η^2) with $\eta^2 \sim .03$ representing a small effect, $\eta^2 \sim .06$ representing a moderate effect, and $\eta^2 \sim .14$ a large effect (Cohen, 1992).

Results

Descriptive Statistics

Descriptive data for sex, age, estimated FSIQ, and the different scales of the TRF are shown in Table 1. The high-risk and control groups did not differ in age or sex. However, the high-risk group had a significantly lower estimated FSIQ and scored lower on Vocabulary and Block Design, but group differences were independent of the subtest. Furthermore, the nonverbal measure was not significantly correlated to the facial and prosody scores. Last, the high-risk group scored significantly higher on the different TRF scales (Table 1). As expected, parents of the high-risk group reported fewer problem behaviors on the CBCL ($M_{aggression} = 59.31, SD = 8.53$; $M_{rule-breaking} = 58.19, SD = 7.05$) compared with teachers for aggression $\{t[1,215] = 18.47, p < .001, d = 1.7\}$ and rule-breaking behavior $\{t[1,215] = 19.74, p < .001, d = 1.7\}$.

Facial Emotion Recognition

The results showed a significant main effect of Group $\{F[1,255] = 9.37, p = .002, \eta^2 = .035\}$, of Emotion $\{F[3,765] = 187.32, p < .001, \eta^2 = .423\}$, and a significant Emotion by Group interaction $\{F[3,765] = 2.82, p = .038, \eta^2 = .011\}$. As shown in Figure 1, Panel A, the results indicate that the high-risk group generally performed less accurate compared to the control group, that there were clear differences between the emotions in recognition rates, and that the high-risk group performed particularly worse compared to the control group with respect to sadness and fear (significant interaction, confirmed by *post hoc* analyses, $p \leq .003$). In case the target emotion was not recognized, the groups did not differ in distribution of the errors across the non-target emotions ($p = .484$).

Table 1. Descriptive statistics for sex, age, estimated FSIQ, Vocabulary, Block Design and TRF scales for the two groups

	High-risk group (N=219)		Control group (N=43)		χ^2 / t test	p	d
	M	SD	M	SD			
Sex (% boys)	83.1 %		72.1 %		χ^2 (1, 262) = 2.87	.090	
Age (years)	10.49	1.35	10.27	1.29	t (1,260) = 0.98	.327	
Estimated FSIQ	84.49	12.58	104.45	15.43	t (1,260) = -9.15	< .001	1.4
Block Design (norm score)	6.32	2.76	10.19	4.07	t (1,258) = -5.96	< .001	1.1
Vocabulary (norm score)	8.33	2.40	11.35	2.42	t (1,258) = -7.52	< .001	1.3
Aggression (T-score)	75.85	11.02	52.51	4.35	t (1,260) = 23.41	< .001	2.8
Rule-breaking (T-score)	69.94	6.73	52.33	3.90	t (1,260) = 23.53	< .001	3.2
Total Externalizing (T-score)	73.64	7.37	48.49	7.09	t (1,260) = 20.59	< .001	3.5
Withdrawn/ depressed (T-score)	60.51	6.88	54.72	5.16	t (1,260) = 5.23	< .001	1.0
Anxious/ depressed (T-score)	60.15	7.49	53.23	4.46	t (1,260) = 8.16	< .001	1.1
Somatic complaints (T-score)	54.52	7.17	51.42	3.74	t (1,260) = 2.76	< .001	0.5
Total Internalizing (T-score)	60.57	7.87	49.84	8.14	t (1,260) = 8.13	< .001	1.3
Social problems (T-score)	65.47	7.02	52.98	4.00	t (1,260) = 16.16	< .001	2.2
Attention problems (T-score)	67.51	8.74	51.77	3.30	t (1,260) = 20.28	< .001	2.4
Thought problem (T-score)	60.00	9.12	51.14	3.03	t (1,260) = 11.51	< .001	1.3

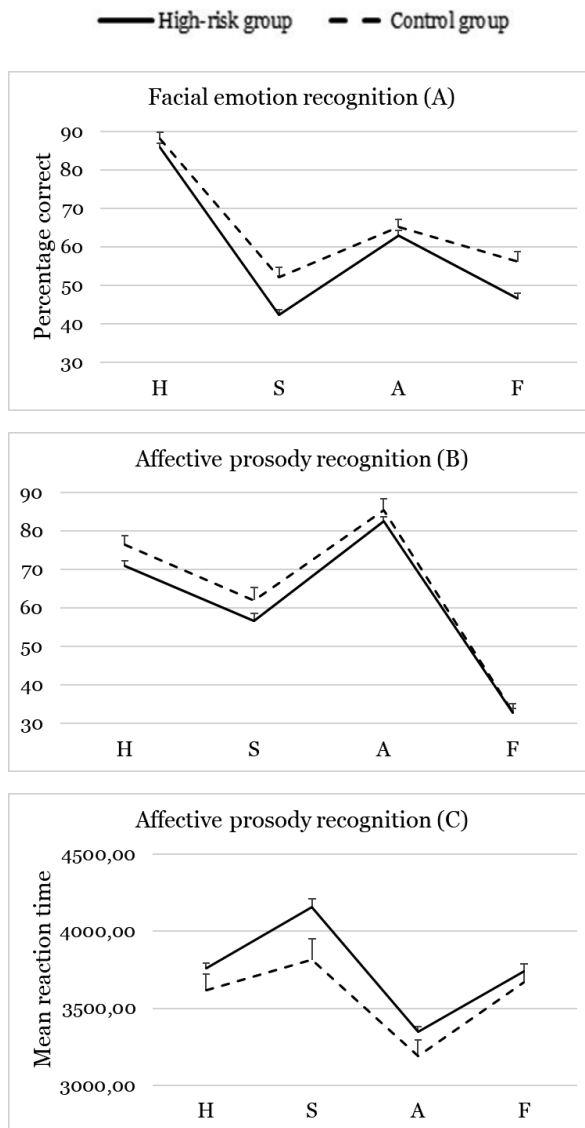


Figure 1. Means and standard errors of the means (SEM) for percentage correct of facial emotion recognition (Panel A; $N=214$ high-risk and 43 control), percentage correct of affective prosody recognition (Panel B; $N=217$ high-risk and 41 control) and for the mean reaction time (Panel C; $N=208$ high-risk and 41 control). H=happiness, S=sadness, A=anger, F=fear.

Hostile Attribution Bias

No group difference in neutral recognition was found; the high-risk and control group also did not differ in the number of times they misattributed a neutral face for another emotion (see Table 2).

Table 2. Means and standard deviations for the percentage response by emotion when neutral was the target emotion

	Happiness	Sadness	Anger	Fear	Neutral
High-risk group (<i>N</i> =214)	2.67 (7.09)	4.61 (10.76)	12.82 (15.09)	2.80 (6.62)	70.56 (25.15)
Control group (<i>N</i> =43)	1.99 (5.90)	2.66 (6.43)	11.30 (15.76)	0.66 (3.04)	78.07 (23.61)

Affective Prosody Recognition

Regarding accuracy, no Group effect ($p = .124$) was found. The results show a significant main effect of Emotion $\{F[3,774] = 234.84, p < .001, \eta^2 = .477\}$, indicating that both groups were less accurate in sadness and especially fear recognition (see Figure 1, Panel B). There was no Emotion by Group interaction ($p = .536$). In case the target emotion was not recognized, the groups did not differ in the distribution of errors across the non-target emotions ($p = .364$). In terms of speed, a significant effect of Group $\{F[1,247] = 4.43, p = .036, \eta^2 = .018\}$ and Emotion $\{F[3,741] = 50.84, p < .001, \eta^2 = .171\}$ was found, but there was no Emotion by Group interaction ($p = .117$). These results indicate that the high-risk group responded significantly slower across emotions compared with the control group (see Figure 1, Panel C). The comparisons between the control participants, familial high-risk, and school high-risk participants are shown in Table 3. The results indicate that the school group and the familial group do not differ from each other on both tasks. In case the familial and school group differ from the control group, effect sizes were comparable. On Prosody (speed) the school group differed from the control participants, while the familial group versus the control group did not differ ($p = .176$), although effect sizes were of similar magnitude.

Table 3. *Post hoc* group comparisons for the Facial Emotion Recognition (FER) task and the Prosody (PR) tasks with the Means (*M*) and Standard Deviations (*SD*) calculated over the four emotions

	M (±SD)	F	p	η²_p
FER				
School (<i>N</i> =169) vs. Familial	59.06 (± 17.82) vs. 61.12 (± 19.17)	<i>F</i> (1, 212) = 1.06	.304	.005
School vs. Controls (<i>N</i> =43)	59.06 (± 17.82) vs. 65.37 (± 14.85)	<i>F</i> (1, 210) = 10.14	.002	.046
Familial (<i>N</i> =45) vs. Controls	61.12 (± 19.17) vs. 65.37 (±14.85)	<i>F</i> (1, 86) = 4.01	.048	.045
PR (accuracy)				
School (<i>N</i> =172) vs. Familial	61.06 (± 20.04) vs. 59.86 (± 20.37)	<i>F</i> (1, 215) = 0.28	.595	.001
School vs. Controls (<i>N</i> =43)	61.06 (± 20.04) vs. 64.24 (± 17.64)	<i>F</i> (1, 213) = 1.92	.167	.009
Familial (<i>N</i> =45) vs. Controls	59.86 (± 20.37) vs. 64.24 (± 17.64)	<i>F</i> (1, 86) = 2.58	.112	.029
PR (speed)				
School (<i>N</i> =167) vs. Familial	3749.85 (± 610.69) vs. 3749.08 (± 635.74)	<i>F</i> (1, 206) = 0.00	.992	.000
School vs. Controls (<i>N</i> =41)	3749.85 (± 610.69) vs. 3572.98 (± 743.08)	<i>F</i> (1, 206) = 4.40	.037	.021
Familial (<i>N</i> =41) vs. Controls	3749.08 (± 635.74) vs. 3572.98 (± 743.08)	<i>F</i> (1, 80) = 1.86	.176	.023

Discussion

The aim of the present study was to examine evidence for weaknesses in facial and vocal emotion recognition in a sample of children at high risk of future criminal behavior. Emotion recognition is an important underlying mechanism of emotion processing and related to social interaction and socialization (Blair et al., 2001; Montagne et al., 2005). The present study is embedded within the PIT project that targets children with behavioral problems who often have no diagnosis or whose families do not actively seek help. It is of great importance to examine emotion recognition in these children, because their behavior is characterized by inappropriate social behavior, including problems with social interaction. Early intervention may prevent these children from developing in an antisocial way and protect society from its detrimental effects (Van Goozen, 2015). The results of the study indicate that the high-risk group performed less accurately in facial affect recognition, in particular fear and sadness recognition, while they performed equally accurate in affective prosody recognition, although they needed significantly more time than controls to correctly identify these emotions. No hostile attribution bias was found.

The present findings are consistent with previous research showing impaired fear and sadness recognition in populations of children and (early) adolescents with CD, high levels of psychopathic tendencies, and young offenders (e.g., Blair & Coles, 2000; Dadds et al., 2006; Fairchild et al., 2009; Hubble et al., 2015). The results of the present study strongly suggest that children who are at high risk of developing criminal behavior, because they are the underage siblings or children of delinquents and those failing primary school, exhibit emotion-specific deficits in facial emotion recognition that could impair their prosocial development leading to future antisocial behavior. Recognition of others' emotions is learned through experience and based on the gradual refinement with age of children's production and recognition of emotional signals (van Goozen, 2015). Caregivers play a substantial role in developing their child's emotion recognition proficiency. The influence of parenting on the development of emotion recognition may help explain why children who show aggressive and antisocial behavior have emotion recognition impairments (Bowen et al., 2014). Poor parenting is a known risk factor in the development of aggressive behavior, affecting – among others – emotional appraisal processes and predisposing children to attribute hostile intent (Dishion et al., 1995; Nelson & Coyne, 2009). These results underpin the importance of early detection of at-risk children in order to provide tailored

interventions to prevent them from drifting toward a criminal career (Van Goozen & Fairchild, 2008).

In the literature, explanations for the emotion-specific impairments can be found in the IES model of Blair (2005). Fear and sadness should serve as social reinforcements leading to appropriate social behavior and evoking empathy (Marsh et al., 2005; Marsh & Blair, 2008). The current findings, together with the earlier reported impairments in affective empathy (van Zonneveld et al., 2017), help explain problems in socioemotional functioning in these children. The high-risk group appears to have problems with empathizing and experiencing others' negative emotions, but they are also less able to recognize the distress-related emotions in others. When a child does not empathize and recognize the distress of another caused by their behavior, it is likely that they will not be able to adapt their behavior (Marsh & Blair, 2008).

In contrast to our hypothesis, the results showed no hostile attribution bias. The high-risk group and the control group did not differ in the number of times they misinterpreted a neutral face as angry. Although the literature on this phenomenon in children is scarce, previous studies have linked this bias to aggression and antisocial behavior (De Castro et al., 2002). A plausible explanation for the absence of a hostile attribution bias might be ascribed to the different methods used across studies. For example, some studies used videos, others vignettes, or morphed faces from one emotion to another (De Castro et al., 2002). In our study, we used neutral faces and emotions were morphed with their corresponding neutral face. Because of this method, we were able to differentiate between neutral faces and emotional ones. Another possible explanation is the existence of a publication bias, since non-significant results happen to be underreported in the literature. Future studies in this area need to examine this issue further in a range of high-risk groups.

To the authors' knowledge, this is the first study that examined affective prosody recognition in a group at high risk of future criminal behavior. Although in previous studies impairments in sadness and fear recognition were found in populations of children with psychopathic tendencies (Blair et al., 2005; Stevens et al., 2001), the present study found that both the high-risk group and control group showed significant difficulties in the vocal recognition of sadness and fear, but only the high-risk group needed significantly more time to accurately recognize emotions in voices. Social situations are complex in nature; they

often involve implicit information and are dynamic, fast, and expire under time pressure. Since social communication often develops in a time frame, the delay in emotion recognition might compromise the possibility of these children to effectively adjust their behavior, which results in difficulties with social interaction.

This study has some limitations that should be addressed. It would have been worthwhile to differentiate within the high-risk group using a measure of CU-traits, and explore the effect of CU traits on affect recognition. We did not include a measure of CU-traits, or any other self-report measures, due to time limitations related to testing in schools, but future studies should aim to do this. Another limitation is the heterogeneity in our sample, which makes it more difficult to generalize to the general population. For instance, the small amount of girls in our sample, especially in the control group, makes it difficult to examine the possible influence of sex in our sample. Also, the participants are recruited in two ways; one group also had a familial risk factor. Nevertheless, a *post-hoc* analyses between the “familial” and “school” risk groups resulted in non-significant outcomes on the variables of interest.

For the clinical practice, the results clearly indicate a need for early screening and a focus on training of emotion recognition skills. The current study adds to knowledge about the characteristics of antisocial behavior by finding emotion-specific recognition impairments in children with externalizing behavior problems at high risk of developing future criminal behavior. Research challenges the notion that high-risk children *inevitably* mature into adult offenders, thereby raising the possibility that well-targeted treatments could create a turning point in the development of antisocial behavior in high-risk children. The period between childhood and early adolescence is a time when children are particularly receptive to social and emotional learning. This provides a natural opportunity to promote prosocial development in high-risk children and creates a window of opportunity for intervention. Emotion recognition training programs are beginning to show reductions in antisocial behavior in samples of young offenders (Hubble et al., 2015).

Conclusion

This study found emotion-specific impairments in facial emotion recognition, particularly fear and sadness recognition, but intact affective prosody recognition in a sample of children considered to be at high risk of future criminal behavior, even though they needed significantly more time to recognize the vocal emotions, compared with control children. These findings may partly explain the problems they experience with social communication, which is frequently reflected in the occurrence of inadequate behavior. There are currently interventions available that target these impairments and strengthen emotion recognition skills. For now, more research is needed to investigate whether these well-targeted treatments can create a turning point in the development of antisocial behavior in high-risk juveniles.

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CHAPTER

4



Affective empathy, cognitive empathy and social attention in children at high risk of criminal behaviour

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Abstract

Background: Empathy deficits are hypothesized to underlie impairments in social interaction exhibited by those who engage in antisocial behaviour. Social attention is an essential precursor to empathy; however, no studies have yet examined social attention in relation to cognitive and affective empathy in those exhibiting antisocial behaviour. *Methods:* Participants were 8- to 12-year-old children at high risk of developing criminal behaviour (N = 114, 80.7% boys) and typically developing controls (N = 43, 72.1% boys). The high-risk children were recruited through an ongoing early identification and intervention project of the city of Amsterdam, focusing on the underage siblings or children of delinquents and those failing primary school. Video clips with neutral and emotional content (fear, happiness and pain) were shown, while heart rate (HR), skin conductance level (SCL) and skin conductance responses (SCRs) were recorded to measure affective empathy. Answers to questions about emotions in the clips were coded to measure cognitive empathy. Eye-tracking was used to evaluate visual scanning patterns towards social relevant cues (eyes and face) in the clips. *Results:* The high-risk group did not differ from the control group in social attention and cognitive empathy, but showed reduced HR to pain and fear, and reduced SCL and SCRs to pain. *Conclusions:* Children at high risk of developing criminal behaviour show impaired affective empathy but unimpaired social attention and cognitive empathy. The implications for early identification and intervention studies with antisocial children are discussed.

Introduction

A small group of children is at high risk of persistent antisocial behaviour, including future involvement in the criminal justice system. More effective strategies for targeting these children at an early sensitive period for intervention may provide crucial opportunities, not only to help these children attain a more positive developmental trajectory but also to diminish the enormous negative impact their behaviour can have on society. Recent reviews of evidence from neuroscience (Fairchild, van Goozen, Calder, & Goodyer, 2013), clinical science, forensic psychology and criminology (Skeem, Scott, & Mulvey, 2014) indicate that high-risk children have poorer parental supervision, come from more disadvantaged neighbourhoods, have greater problems with emotional functioning, and exhibit alterations in brain structure and function compared to other young people. However, research challenges the notion that high-risk children inevitably mature into adult offenders (Odgers et al., 2007), which raises the possibility that well-targeted intervention could create a turning point in antisocial behaviour for high-risk children. The period between childhood and early adolescence is a time when children are particularly adept at specific kinds of social and emotional learning. This creates a window of opportunity for intervention.

Large cities such as Amsterdam in the Netherlands are confronted by serious criminal problems caused by groups of severe and persistent offenders, who come from families, which frequently operate off the radar from health and social services. The Preventive Intervention Trajectory (PIT) is a project of the municipality of the city of Amsterdam that targets children at risk of future criminal behaviour. These children are the underage siblings of young offenders, have delinquent parents or fail at school because of severe absenteeism or extreme antisocial behaviour. While these children might have behavioural problems, they often have no diagnosis, nor do their families actively seek help from clinicians, which substantially increases the risk of an unfavourable social developmental trajectory (Farrington, Piquero, & Jennings, 2013; Loeber & Stouthamer-Loeber, 1998). Building on a theoretical model of the development of antisocial behaviour in children that focuses on the mediating role of neurocognitive and emotional processes (Van Goozen, Fairchild, Snoek, & Harold, 2007), the aim of the PIT project is to actively seek and target these children, assess their socioemotional functioning and provide them with an opportunity to redirect them onto a

more adaptive, prosocial pathway through directed interventions (Van Goozen & Fairchild, 2008).

Recognition of others' emotions and empathy are learned through experience and based on the gradual refinement with age of children's production and recognition of emotional signals (Klinnert & Campos, 1987). Young children who are good in recognizing other people's emotions are more socially skilled and popular (Manstead & Edwards, 1992), but the reverse process also exists. Children who are adversely treated or exposed to aberrant emotional signals exhibit a range of emotional difficulties (Pollak, Cicchetti, Hornung, & Reed, 2000). There is substantial evidence that individuals who engage in inappropriate interpersonal behaviour, such as aggression or antisocial behaviour, have problems in emotion recognition and empathy (Marsh & Blair, 2008). The reasoning is that if one cannot correctly identify distress caused to another person, one is more likely to continue with the harmful or distressing behaviour. As it is assumed that empathy deficits underlie the impairments in social interaction related to antisocial behaviour (Blair, 2005), the aim of the present study was to examine the role of empathy in children at high risk of developing future criminal behaviour.

Empathy is distinguished into affective and cognitive empathy (Singer, 2006). Affective empathy is the capacity of an individual to experience what it feels like for another person to experience a certain emotion (e.g. Blair, 2005; De Waal, 2008; Smith, 2009), while cognitive empathy is the capacity of an individual to understand what others' emotions and thoughts might be, without being emotionally involved (e.g. Bartoli & Wendt, 2014; Blair, 2005; Bons et al., 2013; Dadds, El Masry, Wimalaweera, & Guastella, 2008; De Vignemont & Singer, 2006; Lovett & Sheffield, 2007; Singer, 2006). Several studies have examined both affective and cognitive empathy in children with antisocial behaviour and found impaired affective empathy but unimpaired cognitive empathy in children with conduct disorder and high levels of callous-unemotional (CU) traits (Anastassiou-Hadjicharalambous & Warden, 2008; Schwenck et al., 2012), in children with conduct disorder with or without ADHD (Van Goozen et al., 2016), in those with conduct problems and high levels of CU-traits (Psalich, Dadds, & Hawes, 2014) and in children with psychopathic tendencies or conduct problems recruited from the community (Jones, Happe, Gilbert, Burnett, & Viding, 2010), in line with the empathy imbalance theory of Smith (2009, 2010). In addition, studies that examined only cognitive empathy showed normal cognitive empathy (Sutton, Reeves, & Keogh, 2000; Woodworth & Waschbusch, 2008). However,

these studies investigated empathy by using questionnaires and failed to measure affective empathy with physiological measures. Although physiological arousal is not synonymous with affective empathy, it certainly represents a reliable, objective and direct measure of affective empathy (Bons et al., 2013), and has often been related to antisocial behaviour (e.g. Gao, Raine, Venables, Dawson, & Mednick, 2010; Van Goozen, 2015). Furthermore, verbal reports of one's own experienced emotion(-s) are difficult, especially for antisocial boys, who are known to have low verbal IQ and problems with self-reflection, which could result in unreliable self-reported affective empathy (Bowen, Morgan, Moore, & van Goozen, 2014; Tyson, 2005). Similarly, studies that used physiological measures to assess affective empathy often did not include measures of cognitive empathy. These affective empathy studies reported that children with disruptive behaviour disorders (De Wied, Boxtel, Posthumus, Goudena, & Matthys, 2009; De Wied, van Boxtel, Matthys, & Meeus, 2012; De Wied, van Boxtel, Zaalberg, Goudena, & Matthys, 2006), and children with conduct disorder with and without CU-traits (Marsh, Beauchaine, & Williams, 2008) displayed decreased physiological responses and thus less affective empathy in response to negative emotions. With the present study, we extend the existing literature by using objective physiological measures for affective empathy, combined with both cognitive and affective empathy.

In order to understand someone's emotions and respond empathetically, initial attention to socially relevant cues is crucial. From early age on, humans have a preference towards social information (Chita-Tegmark, 2016), which can be referred to as social attention. Faces, in particular the eyes, play a key role in providing information about the mental and emotional state of another person during social interaction (Emery, 2000; Klein, Shepherd, & Platt, 2009), and attention to the eyes is considered necessary for the recognition of facially expressed emotions (Bons et al., 2013). Social attention can therefore be seen as an essential precursor of an empathic response. In a previous study, community children with high CU-traits showed deficits in attention to the eyes compared to children low on CU-traits, particularly for fearful faces (Dadds et al., 2008). When these children were instructed to direct their attention to the eyes, their fear recognition was as accurate as that of controls. The authors therefore concluded that the fear recognition problems in children with CU-traits are partly due to a failure in attention towards the eyes (Dadds et al., 2006).

Although previous studies on social attention often used static (facial) stimuli, we used stimuli that represent dynamic social situations to evoke an empathetic response, making the current design more sensitive to examine the role of social attention in cognitive and affective empathy (Chevallier et al., 2015). The current study examined the role of social attention and empathy in response to different emotionally meaningful events in children at high risk of future criminal behaviour, and predicted in line with Herpers, Scheepers, Bons, Buitelaar, and Rommelse (2014) and Dadds et al. (2006) that the high-risk children would have impaired social attention and affective empathy, but unimpaired cognitive empathy compared to typically developing controls.

Methods

Participants

Data were gathered from children recruited through the PIT. This is a large ongoing project of the municipality of the city of Amsterdam, the Netherlands. Participants were the underage siblings of young offenders, children of delinquent parents or children who fail at school due to severe unauthorized absenteeism (e.g. truancy) or because of extreme antisocial behaviour. The total sample consisted of 157 children (123 boys and 34 girls) with a mean age of 10.37 years ($SD = 1.35$). The high-risk group consisted of 114 children (92 boys and 22 girls) with a mean age of 10.40 years ($SD = 1.38$). The control group [$N = 43$; 31 boys and 12 girls; mean age of 10.27 years ($SD = 1.29$)] was recruited through the same schools that were attended by the children in the high-risk group. The Dutch version of the Teacher Report Form (TRF; Achenbach & Rescorla, 2001; Verhulst, Van der Ende, & Koot, 1997) was used to confirm risk status of the participants; all high-risk children scored in the borderline or clinical range on the aggression and/or rule-breaking behaviour scales ($t\text{-score} \geq 65$); and their average internalizing problem behaviour score was in the normal range. All control children scored within the normal range on all problem scales ($t\text{-score} < 65$). The Dutch version of the Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001; Verhulst, Van der Ende, & Koot, 1996) was used to identify the problem behaviour reported by the parents of the high-risk group. Children were eligible to participate if they were between 8 and 13 years old and spoke and understood the Dutch language. Other exclusion criteria were the use of stimulants and a known DSM classification; based on these criteria, three participants were excluded. Written informed consent was obtained from the parents and from the children if they

were 12 years or older. Ethics approval for this study was obtained from Leiden University's Education and Child Studies Ethics Committee.

Procedure

Following informed consent, an appointment was made at school, where the tests were administered following a standard protocol. All participants were individually assessed in a quiet room. The assessors were two trained graduate students under supervision of a clinical investigator (LvZ).

Instruments

Stimuli. We showed four video clips: a neutral baseline clip (180 s) displayed an aquarium with fishes (Coral Sea Dreaming, Small World Music Inc.) to obtain baseline cardiovascular and electrodermal activity; three emotional clips with different emotional contents were presented in random order. The target emotions in these clips were fear (103 s), happiness (87 s) and pain (101 s). The three clips were derived from existing movies (for details, see Van Rijn, Barendse, van Goozen, & Swaab, 2014).

Social attention. Social attention was assessed by means of visual scanning patterns towards social relevant cues, that is eyes and face. The visual scanning patterns were measured with a Tobii T120 eye-tracker (Tobii Technology, Sweden) using the I-VT fixation filter. After a 5-point calibration procedure, the clips were shown on a LCD screen, placed at approximately 65 cm distance from the participant. In Tobii Studio (version 3.0.2.), dynamic areas of interest (AOIs) were drawn by hand in all clips for the eyes and face (without the eyes) (Hessels, Kemner, Boomen, & Hooge, 2015). To control for slight differences in AOI durations between clips, total fixation duration was computed as the percentage of the total AOI duration for each clip separately. These percentages of total fixation were used as indices of social attention.

Affective empathy. Affective arousal was operationalized as the contrast between baseline and the emotional clips in cardiovascular and electrodermal activity. Electrodes to measure electrodermal activity were placed on the middle phalanges of the ring finger and index finger of the nondominant hand. Before the electrodes were attached, the participants were asked to wash their hands carefully. Two electrodes measuring cardiovascular activity were placed on the chest and left ribs underneath the clothes. Participants were instructed not to move or talk during the measurement. Physiological data were recorded

continuously with AcqKnowledge software version 4.3.1. (BIOPAC Systems Inc., Goleta, CA, USA). Recordings were acquired through a galvanic skin response amplifier (GSR100C), electrocardiogram amplifier (ECG100C) and aBIOPACdata acquisition system (MP150 Windows) with a sampling rate of 200 Hz. The physiological monitoring equipment was synchronized with the Tobii software by manually assigned event markers representing the start and end of each clip. In AcqKnowledge, a 0.5 Hz highpass filter and a 50 Hz notch filter were applied to stabilize the cardiovascular signal. The recorded physiological data were further processed with a script in MATLAB Release 2012b (The MathWorks, Inc., Natick, MA). A forward and reverse first order lowpass digital Butterworth filter with a cut-off frequency of 0.33 Hz was used on the raw electrodermal signal, which removed all high frequency noise while ensuring precisely zero phase distortion. To detect skin conductance responses (SCRs), a phasic channel was created by filtering the tonic channel using a zero-phase forward and reverse digital infinite impulse response filter with a cut-off frequency of one. Each section on the phasic channel that lies above the threshold was considered a SCR. The SCR peak was located at the maximum value of this interval, as measured on the tonic channel (Boucsein, 1992; Society for Psychophysiological Research Ad Hoc Committee on Electrodermal Measures, 2012). Motion artefacts were visually identified and excluded from the data. We used heart rate (HR) as cardiovascular response variable and skin conductance level (SCL) and skin conductance responses (SCRs) as electrodermal response variables.

Cognitive empathy. After each clip, participants were asked questions concerning the type and intensity of the emotions of the main character in the clip and the reasons for these emotions. The answers were scored with a coding system taking into account four elements of empathy: (a) the correct target emotion, (b) correct similar and relevant other emotion(-s), (c) the intensity of the emotion(-s) and (d) the explanation for the causes of the emotion (for details see, Van Goozen et al., 2016; Van Rijn et al., 2014). Answers were independently coded by two coders; the interrater agreement was 73.1%.

Intellectual functioning. Intellectual functioning was assessed with the Dutch version of the Wechsler Intelligence Scale for Children (WISC-III; Kort et al., 2005). Two subtests, Block Design (perceptual organization skills) and Vocabulary (verbal skills), were used to estimate full scale IQ (FSIQ; Campbell, 1998).

Statistical analyses

There were no outliers or violations of statistical assumptions. Due to technical difficulties, HR data were not available for one participant, SCL and SCR data were not available for 54 participants (44 high risk; no differences in aggression ($p = .638$) or rule-breaking behaviour ($p = .472$) within the high-risk group between those with and without data), and eye-tracking data were unavailable for five participants. A priori, the high-risk and control groups were compared on age, gender and intellectual functioning. We next examined total fixation duration on the total screen to control for potential differences in attention. To analyse group differences, we performed a two-way repeated measures analysis of variance (RM-ANOVA) with AOI (eyes, face) and Emotion (fear, happiness, pain) as within-subject factors and Group as between-subjects factor. Subsequently, we performed three RM-ANOVAs to investigate differences between groups in HR, SCL and SCR, respectively, in response to the emotion clips, with Emotion (fear, happiness, pain) as within-subject factor and Group as between-subjects factor. A simple contrast was used with baseline as reference for each of the three emotions. Post hoc group differences in baseline were examined. Lastly, we compared mean cognitive empathy scores for the two groups with a MANOVA. Significance level was set at $\alpha < .05$. A false discovery rate (FDR) control as described by Glickman, Rao, and Schultz (2014) to correct for multiple testing was used. Effect sizes were calculated using partial eta squared (η^2) with $\eta^2 \sim .03$ representing a small effect, $\eta^2 \sim .06$ representing a moderate effect, and $\eta^2 \geq .14$ a large effect (Cohen, 1992).

Results

Descriptive statistics

Descriptive data for gender, age, FSIQ, externalizing problem behaviour and internalizing problem behaviour are shown in Table 1. The high-risk and control groups did not differ in age or gender, but the high-risk group had a significantly lower estimated FSIQ; the high-risk group also scored significantly higher on TRF aggression, rule-breaking behaviour, total externalizing behaviour and total internalizing behaviour (Table 1). As expected, parents of the high-risk children reported less problem behaviour ($M_{\text{aggression}} = 58.81, SD = 8.80$; $M_{\text{rule-breaking}} = 58.30, SD = 6.85$) compared to teachers for aggression ($t(1,112) = 14.21, p < .001, d = 1.7$) and rule-breaking behaviour ($t(1,112) = 13.13, p < .001, d = 1.6$). Because IQ was not correlated with any of the social attention or empathy variables, IQ was not included as a covariate in subsequent analyses.

Table 1. Descriptive statistics for gender, age, FSIQ, aggression, rule-breaking behaviour, total externalizing behaviour, and total internalizing behaviour for the two groups

	Risk group		Control group		<i>t</i> / χ^2 test	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Gender (% boys)	80.7%		72.1%		χ^2 (1,157) = 1.36	.243
Age (years)	10.40	1.38	10.27	1.29	<i>t</i> (155) = 0.53	.598
FSIQ	83.01	12.54	104.45	15.43	<i>t</i> (155) = -8.95	<.001
Aggression TRF (<i>t</i> -score)	75.64 (61.4%)	10.77	52.51 (0.0%)	4.35	<i>t</i> (1,155) = 19.17	<.001
Rule-breaking TRF (<i>t</i> -score)	69.98 (50.8%)	7.54	52.33 (2.33%)	3.90	<i>t</i> (1,155) = 19.12	<.001
Total Internalizing (<i>t</i> -score)	61.09 (43.9%)	7.76	49.84 (4.65%)	8.14	<i>t</i> (1,155) = 7.99	<.001
Total externalizing (<i>t</i> -score)	73.51 (93.0%)	7.58	48.49 (2.33%)	7.09	<i>t</i> (1,155) = 18.76	<.001

Note. Between the brackets are the percentages of the children within the clinical range displayed

Social attention

First, we examined the total fixation duration to the total screen, controlled for the duration of the clips. The groups did not differ in attention to the total screen ($.30 < p < .82$). In Figure 1, the means and standard errors of measurement (SEM) are shown for the percentages of total fixation as a function of Group, AOI and Emotion. The RM-ANOVA results revealed no main effect of Group on social attention ($p = .527$); however, there was a significant effect of Emotion ($F(2,300) = 358.43, p < .001, \eta^2 = .823$), AOI ($F(1,150) = 290.92, p < .001, \eta^2 = .66$) and a significant Emotion by AOI interaction ($F(2,300) = 137.36, p < .001, \eta^2 = .662$), indicating that differences in fixation duration between eyes and face were largest for the negative emotions (Figure 1). No significant Group by Emotion ($p = .135$), or Group by AOI ($p = .152$) interactions were found.

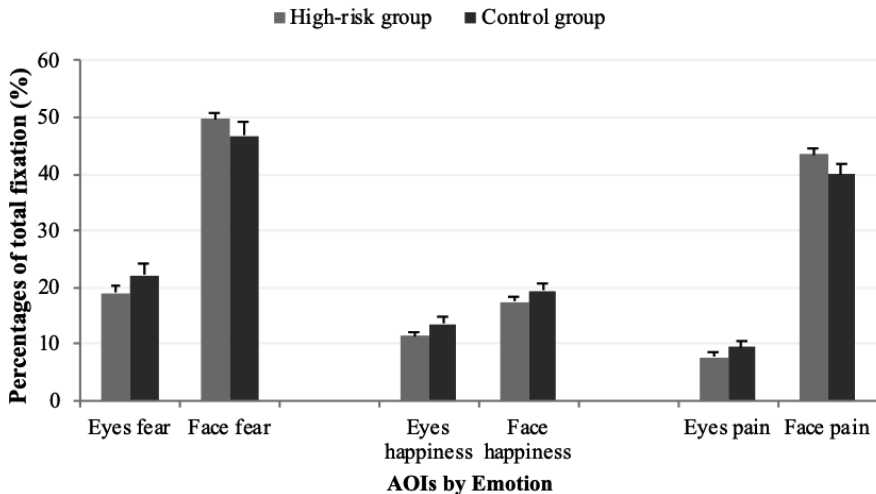


Figure 1. Percentages of total fixation (M, SEM) for Areas of Interest and Emotion for the high-risk group and control group.

Affective empathy

There were no group differences in HR ($p = .431$), SCL ($p = .135$), or SCR ($p = .087$) at baseline. With regard to HR, there was no effect of Group ($p = .971$), but there was a significant main effect of Emotion ($F(3,462) = 8.37, p < .001, \eta^2 = .052$) and a significant Emotion by Group interaction ($F(3,462) = 5.08, p = .003, \eta^2 = .032$). Subsequent simple contrasts showed a significant Emotion by Group interaction effect for fear ($F(1,154) = 7.70, p = .006, \eta^2 = .048$) and pain

($F(1,154) = 9.62, p = .002, \eta^2 = .059$), but not for happiness ($p = .023$). Figure 2 illustrates that HR increased during emotion exposure in the control group, whereas it decreased in the high-risk group. With regard to SCL, the results showed no main effect of Group ($p = .655$), but a significant effect of Emotion ($F(3,291) = 134.10, p < .001, \eta^2 = .58$), and a significant Emotion by Group interaction ($F(3,291) = 7.86, p = .001, \eta^2 = .075$). Subsequent simple contrasts showed a significant Emotion by Group interaction effect for pain ($F(1,97) = 17.37, p < .001, \eta^2 = .152$), reflecting a smaller increase in SCL during the pain clip in the high-risk group than in the control group, but no such pattern was observed for fear ($p = .086$) or happiness ($p = .105$). With regard to SCR, the results showed no main effect of Group ($p = .492$), but a significant effect of Emotion ($F(3,291) = 130.90, p < .001, \eta^2 = .574$), and a significant Emotion by Group interaction ($F(3,291) = 3.69, p = .012, \eta^2 = .037$). Subsequent simple contrasts showed a significant Emotion by Group interaction effect for pain ($F(1,97) = 5.79, p = .018, \eta^2 = .056$), but not for fear ($p = .234$) or happiness ($p = .916$), reflecting fewer SCRs during the pain clip in the high risk group than in the control group.

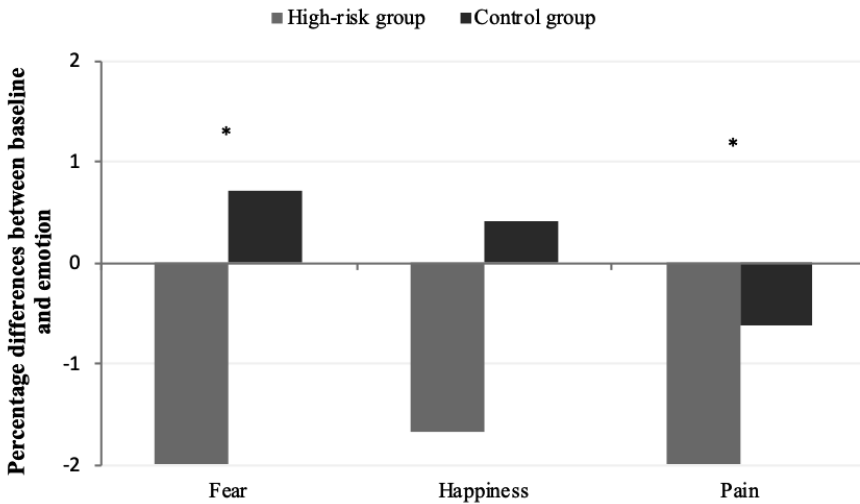


Figure 2. The differences in percentage of Heart Rate responses for the three clips versus baselines for the two groups. * $p < .01$

Note. For visualization purposes the *differences* in percentage between the emotions and baselines are shown.

Cognitive empathy

Mean cognitive empathy scores for the two groups and the three emotions are shown in Table 2. No group differences were found ($p = .887$).

Table 2. Means, standard deviations, and ANOVAs for the three emotions

	High-risk group (N = 114)		Control group (N = 42)		F	p
	M(SD)	Range	M(SD)	Range		
Fear	4.70 (1.52)	0-7	4.50 (1.76)	0-7	(1,155) = .46	.483
Happiness	4.75 (1.13)	0-7	4.64 (1.19)	0-6	(1,155) = .29	.589
Pain	4.82 (1.53)	0-8	4.79 (1.42)	2-8	(1,155) = .02	.886

Note. Maximum range was 0-9. Scores were normally distributed and there were no ceiling effects, skewness ranged between -0.4 and -1.5.

Discussion

A small group of children is at high risk of persistent antisocial behaviour and a criminal career. Early intervention may provide crucial opportunities to prevent the detrimental effects on the children themselves as well as on society (Van Goozen, 2015). The current study is embedded within the PIT, a project that targets children at risk of future criminal behaviour. The current study specifically focused on empathy deficits underlying the impairments in social interaction related to antisocial behaviour (Blair, 2005). The results show that the high-risk children had impaired affective empathy when viewing emotional clips. Specifically, they showed reduced HR to pain and fear, and reduced SCL and SCRs to pain compared to controls. However, importantly, they did not differ from controls on measures of social attention and cognitive empathy, nor in affective empathy to happiness.

To the authors' knowledge, this is the first study that examined the role of social attention using eyetracking methodology and empathy in response to different emotionally meaningful events in a group of children at high risk of developing criminal behaviour. Although social attention to emotionally charged events is required to ensure an empathic response, we did not find evidence of impaired social attention in the high-risk group, suggesting that social attention does not account for the deficits in affective empathy that we observed in these children. These results are in contrast to some studies, for example Dadds et al. (2008,

2006) who reported that fear recognition problems in children with CU-traits are partly due to a failure in attention towards the eyes. Correcting attention towards the eyes subsequently seemed to correct some of the recognition impairments (Dadds et al., 2006). It is possible that the attentional mechanisms underlying CU-traits differ from those underlying aggressive, antisocial or criminal behaviour, and future research would need to examine this. However, we found no deviance in social attention and this suggests that the type of training for children with CU-traits, as recommended by Dadds et al. (2006), would not necessarily benefit all children with conduct problems and/or who are at high risk of future criminal behaviour. These results are in need of replication. Future studies should also include children at high risk of developing criminal behaviour and assess their levels of CU-traits to cross-validate these findings.

In line with previous studies on cognitive and affective empathy (see review; Herpers et al., 2014), and Smith's empathy imbalance theory (Smith, 2009, 2010), our results revealed significant differences in affective empathy but not in cognitive empathy. These results indicate that high-risk children showed adequate recognition and good understanding of the emotions presented in the video clips but had specific problems with empathizing and experiencing others' negative emotions. These results in combination with our findings on unimpaired social attention suggests that impaired affective empathy is the key empathy component that is related to antisocial behaviour (Blair, 2005).

Elaborating on these results, when a child does not empathize with the distress caused by their aggressive behaviour, they are more likely to continue the display of harmful behaviour (Marsh & Blair, 2008). Our results show that the affective response was significantly smaller for high-risk children, in particular in response to seeing someone else in pain or fear. Problems in affective empathy in children with CD (Van Goozen et al., 2016) or psychopathic traits in response to negative emotions have been observed before (Lockwood, Bird, Bridge, & Viding, 2013). However, we observed similar deficits in children who are not psychopathic and also do not have a diagnosis of CD, showing that these affective processes could play a role in a much larger range of problem behaviours. Future research would benefit from incorporating not only social attention and physiological assessments but also fMRI, to investigate the possible relation between functional brain networks and affective empathy. This would eventually increase our insight in the underlying brain mechanisms of empathy.

The study also had several limitations. First, we did not assess motor empathy, which precluded obtaining information about the ability to express empathic facial reactions. As this is an important component of empathy (Van der Graaff et al., 2015), information on motor empathy could confirm the finding that affective empathy is the key empathy component related to antisocial behaviour. Future research on high-risk samples should therefore aim to incorporate this measure of empathy. Another limitation is the loss of data on electrodermal activity due to technical difficulties. However, it was verified that the data loss was random, and that participants without electrodermal data did not differ from those for whom data were available on key outcome measures. Third, we were not able to include a questionnaire measure of CU-traits, nor did we obtain information about affective empathy using a self-report measure. Future studies should aim to include these self-report measures.

Our sample consisted of children who are at high risk of developing criminal behaviour. The high risk consists of the severity of their externalizing behaviour as reported by their teachers in combination with the parental ignorance of these problems as they reported their child's behaviour to be in the normal range, which might explain why they did not actively seek help. Teachers are often considered more reliable informants; their report of children's behaviour is more objective and they can compare the behaviour of each child against that of many others. The severe behavioural problems of these children as reported by the teachers, in combination with their parents' unawareness of these problems, could negatively impact their future social development (Van Goozen et al., 2007). Early identification of these children is crucial in order to provide tailored interventions to prevent them from drifting towards a criminal career (Van Goozen & Fairchild, 2008).

The findings of the current study indicate that the empathy impairment that presumably plays a significant role in antisocial development is primarily a deficit in affective empathy rather than in social attention or cognitive empathy. This has implications for the development of interventions, which focus specifically on enhancing emotional awareness and affective empathy. For example, emotion awareness programs in clinical samples of aggressive children (Van Baardewijk, Stegge, Bushman, & Vermeiren, 2009) and young offenders (Hubble, Bowen, Moore, & van Goozen, 2015) have been found to be successful in attenuating aggression or severity of crimes committed. Moreover, there are preliminary indications that empathy and compassion training result in increased affective

response and functional activity in brain areas involved in emotion processing (Klimecki, Leiberg, Ricard, & Singer, 2014). Programs that target an increase in emotion awareness could thus be an important component in future intervention and prevention research.

Conclusion

This study found impaired affective empathy but unimpaired social attention and cognitive empathy in a sample of children considered to be at high risk for future criminal behaviour because they are the underage siblings of young offenders, they have delinquent parents or fail at school because of severe absenteeism or extreme antisocial behaviour. The findings highlight not only the important role of emotion function, specifically reduced affective response, in the development of antisocial behaviour, but also suggest that interventions should directly target these affective processes in order to influence the development of behaviour in a more prosocial direction.

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CHAPTER

5



Customized preventive interventions reduce externalizing behaviour in at-risk children

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Submitted



Abstract

Background: Interventions to reduce aggression and criminal behaviour come in various forms with varying rates of effectiveness. Much is expected from customized care because it addresses individual differences in the development and appearance of antisocial behaviour. The Preventive Intervention Trajectory (PIT), a large ongoing identification and intervention project of the municipality of the city of Amsterdam, offers customized preventive care, informed by assessment of neurocognitive strengths and difficulties, for children at high risk of future criminal behaviour. In this study, we investigate whether customized preventive care is effective in reducing the problem behaviour of these high-risk children. *Methods:* Participants were 8- to 12-year-old children at high risk of future criminal behaviour ($N=173$, 80.3% boys) and low-risk control participants ($N=64$, 62.5% boys). Both groups were recruited through the PIT project and consisted of the underage siblings or children of delinquents and those failing primary school because of severe unauthorized absenteeism or extreme antisocial behaviour. We created profiles of neuropsychological strengths and difficulties for each child in the high-risk group to inform their individual customized care plan. The Teacher Report Form (TRF) was filled in by the teachers to assess problem behaviour at initial assessment, and at 6 and 12 months since the start of the intervention. *Results:* Problem behaviour in the high-risk group was significantly reduced after 6 months, with 70-80% of the participants showing less problem behaviour. This effect was stable at 12 months. Importantly, the low-risk group, who did not receive an intervention, exhibited an increase in externalizing problem behaviour after 6 months. *Conclusions:* Customized preventive care, informed by a neuropsychological strengths and difficulties profile, is effective in reducing problem behaviour in children at high risk of future criminal behaviour. Future directions and implications are discussed.

Introduction

Since 2007, a downward trend has been observed in registered juvenile crime in the Netherlands, which is comparable to other international reports of similar declines (Van der Laan & Beerthuizen, 2018). Although this trend is promising, large cities such as Amsterdam in the Netherlands are plagued by serious criminal problems caused by groups of severe and persistent young offenders. From the youth in the city, only a small group is at high risk of persistent antisocial behaviour, including future involvement in the criminal justice system (Moffitt, 1990). More effective strategies for targeting these children for intervention at an early age may provide crucial opportunities, not only to help these children attain a more positive developmental trajectory but also to diminish the enormous negative impact their behaviour can have on society. The chances of successfully influencing and redirecting children in a prosocial direction are greater when risk factors are identified early, and their malleability is still relatively high (Loeber, 1990; Loeber, Farrington, & Petechuk, 2003; Van Goozen & Fairchild, 2008). Accordingly, interventions with a preventive approach might create a window of opportunity to reduce persistent antisocial behaviour (De Kogel & Alberda, 2018; Piquero et al., 2016).

Interventions to prevent antisocial development can start from an early age or even during pregnancy. One preventive approach are family/parent intervention programs, aiming to improve parenting practices by reducing negative and increasing positive parenting behaviours (Weber, Kamp-Becker, Christiansen, & Mingebach, 2018). It is hypothesized that positive parenting can serve as a protective factor and consequently improve child and parental outcomes (Piquero et al., 2016; Weber et al., 2018). Results from meta-analyses show that family/parent intervention programs are effective (with small to large effects) in preventing antisocial behaviour, delinquency and reducing problem behaviour (e.g. Eyberg, Nelson, & Boggs, 2008; Furlong et al., 2013; Mingebach, Kamp-Becker, Christiansen, & Weber, 2018; Piquero et al., 2016; Weber et al., 2018). An often applied and effective intervention is Parent Management Training - Oregon (PMTO). A recent Dutch study, showed that 45.8% of the clinically referred children showed a reduction in externalizing behaviour versus 42.8% in care as usual (including family therapy, psychiatric intensive home care, parent therapy, or other treatments), which was not significantly different (Thijssen, Vink, Muris, & de Ruiter, 2017). These results indicate that, although effective, PMTO is not more effective than care as usual. Similar results were found for another

parenting program, Primary Care Triple P (Spijkers, Jansen, & Reijneveld, 2013). Moreover, these family/parent interventions require extensive parental effort and willingness to participate, which not every parent is capable of (Lösel & Beelmann, 2003; Webster-Stratton, Reid, & Hammond, 2001).

Other preventive approaches are child-centered intervention programs, such as cognitive behaviour therapy, after school day treatment, or self-regulation training. Based on the synthesis of reviews and meta-analyses of Hendriks, Bartels, Colins, and Finkenauer (2018) the overall effects of child-centered interventions are small (effects sizes between small to medium). This might be explained by the heterogeneity in problem behaviour and its underlying causes and risks. Additionally, most interventions are based on a “one size fits all approach” (Hunnikin & van Goozen, 2018). There is a clear need to adopt a tailored and more customized approach in which individual differences in the nature of the problems as well as the surrounding circumstances are taken into account when deciding upon a course of action (Hendriks et al., 2018; Hunnikin & van Goozen, 2018), and ideally, family, parental, clinical, school and child centered techniques are combined.

In order to optimize the effect of preventive intervention in children at high risk for antisocial development, it is hypothesized that assessment of strengths and difficulties in executive function, and social cognition can help to tailor the intervention to the developmental needs of the children. A customized approach, informed by a neurocognitive assessment, has been adopted by the Preventive Intervention Trajectory (PIT). PIT is a project that has been set up to prevent and reduce juvenile crime in the city of Amsterdam, the Netherlands. The professionals of the PIT actively identify and target children at high-risk of future criminal behaviour, based on their levels of aggressive and rule breaking behaviour. These children often come from families that operate off the radar from health and social services, and can be characterized as multi-problem families (Asscher & Paulussen-Hoogeboom, 2005; Evenboer, Reijneveld, & Jansen, 2018). While these children demonstrate significant behavioural problems, they often have no formal diagnosis yet, often because their families do not actively seek help from clinicians because their parents fail to recognize the behaviour as problematic or prefer to ignore it.

The individual profiles for executive function and social cognition form the basis for a customized care plan to support their social development and to prevent

them from drifting off towards a criminal career. Customized care means doing what is necessary given the behaviour problems and the neurocognitive capacities of the child to reduce problem behaviour and to stimulate adequate social development. This could vary from making adjustments in the class (e.g. by supporting attention skills), to adjustments in teaching provisions, after-school day care provision (to offer a social supportive environment) or to train emotion recognition. In general, the care provided is diverse because it was tailored to the child's needs, supportive of the family sources to offer this, often off the beaten track if necessary, and without time restrictions. In the current study we examined whether the PIT approach, of offering customized care, is effective in reducing problem behaviour in high-risk children.

Methods

Participants

Children recruited through the PIT are included because of high levels of aggression and rule-breaking behaviour. They are the underage siblings of young offenders and children of delinquent parents ($N=78$) or children who fail at school due to severe unauthorized absenteeism (e.g. truancy) or because of extreme antisocial behaviour at school ($N=159$). The total sample consisted of 237 children (179 boys and 58 girls) with a mean age of 10.39 years ($SD=1.33$). The high-risk (HR) group was composed of children with a (sub)clinical score on the externalizing scale of the Teacher Report Form (Achenbach & Rescorla, 2001) and consisted of 173 children (139 boys and 34 girls) with a mean age of 10.40 years ($SD=1.34$). The low-risk (LR) group consisted of 64 children (40 boys, 24 girls; mean age 10.35 years [$SD=1.31$]), who just failed to pass the cut-off score for inclusion.

Children were eligible to participate if they were between 8 and 13 years old and spoke and understood the Dutch language. No exclusion criteria were used. Written informed consent was obtained from the parents and from the participants if they were 12 years or older. Ethics approval for this study was obtained from Leiden University's Education and Child Studies Ethics Committee.

Procedure

Following informed consent behavioural questionnaires were filled out by parents and teachers on problem behaviour. If the problems scores of the teachers

were in the (sub)clinical range, an appointment was made at school, where tests were administered following a standard protocol. All participants of the HR group were individually assessed in a quiet room. The assessors were two trained graduate students under supervision of a senior experienced assessor (LvZ). Within four weeks following the assessment a report was written describing the strengths and difficulties in the neurocognitive profile for each participant, also providing advices to support the social development based on the analyses of the individual profiles. Staff members of the PIT, including social workers, discussed the outcomes with the parents and the teachers. During these appointments the individual profile was explained (psychoeducation) and a plan of action was made incorporating the advices provided, resulting in customized care. The first follow-up assessment on behavioural problems (TRF2) took place at six months after the first assessment. The second follow-up assessment (TRF3) was done at 12 months. The LR group received care as usual or no care at all. Their behavioural problems were also assessed 6 and 12 months after the first assessment.

Instruments

Problem behaviour. Teachers were asked to complete the Dutch version of the Teacher Report Form (TRF; Achenbach & Rescorla, 2001; Verhulst, Van der Ende, & Koot, 1997), to confirm HR or LR status (TRF1) and was repeated twice with the aim of evaluating the behaviour at 6 and 12 months (TRF2 and TRF3). The TRF is a questionnaire containing 113 statements describing certain behaviour. Teachers rated to what extent a statement described the particular child on a three point scale ranging from zero (not true) to two (very or often true). The statements are subdivided into eight domains of problem behaviour (i.e. anxious/ depressed, withdrawn/ depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviour, and aggressive behaviour). These domains are also clustered into three scales (i.e. internalizing problems, externalizing problems, and total problems). The scores are standardized (*T*-scores) to facilitate comparison with a normative sample and to determine whether increased scores on a particular domain fall in a subclinical or clinical range. All children in the HR group scored in the borderline or clinical range on the aggression and/ or rule-breaking domains (*T*-score ≥ 65). All participants in the LR group scored within the normal range on the externalizing domains (*T*-score < 65). In the current study we were interested in the internalizing problems, externalizing problems, and social problems. We decided to use teacher reports instead of parents reports, because the parent(s) often fail to recognize the behaviour as problematic or prefer to ignore it, resulting

in unreliable and incomparable reports (Van Zonneveld, Platje, de Sonnevile, van Goozen, & Swaab, 2017).

Neurocognitive assessment. Neurocognitive assessment took place in order to find neurocognitive underpinnings of the problem behaviour exhibited by the participants. Four domains were defined based on which the customized intervention was based. The first domain is social information processing, meaning the capacity of an individual to understand and interpret the world with visual and verbal information and including tasks for emotion recognition and passive and active language skills. If children have difficulties in this domain they, for instance, receive language training or emotion recognition training (Hunnikin & van Goozen, 2018), and more structure, and visual support for assignments in the classroom is given. The second domain is called social perspective taking, meaning the capacity of an individual to put oneself in someone else's shoes, mentalize, and empathize, including tasks for theory of mind and empathy. If difficulties in this area are found, programs start in which taking perspective can be learned in social training and supported by specific attention of the teacher. The third domain refers to the social scripts, which are the scripts that someone learns from the environment what adequate behaviour is or scheme's, measuring social norms and self-confidence. In social training, scripts can be adjusted and expanded with respect to society and to one's own behavior, based on principles of behavioural therapy. The last domain is the self-regulation, meaning the capacity of an individual to regulate one's own behaviour. In this domain we assessed the Executive Functions (EF) attention, inhibition, cognitive flexibility, and frustration toleration. Upon problems in this area, executive function training is given in the classroom.

The individual neurocognitive profiles are used to design customized intervention programs. In addition to this, the parents and teachers are coached to support the individual treatment. Also, the PIT professionals take care of evaluation of other sources of care in these multi-problem families and see to it that the children have adequate leisure programs. The PIT professionals frequently visit the school and the parents, depending on the urgency of their needs, at least during a period of 2 years to monitor the social development of the child.

Statistical Analyses

All variables were examined for outliers and violations of assumptions applying to the statistical tests used. A priori, we examined whether the HR and LR

group differed in age, sex distribution, and TRF behavioural scores. To assess the effectiveness of the intervention, a two-way repeated measures analyses of variance (RM-ANOVA) was carried out with Domain (externalizing behaviour, internalizing behaviour, and social problems) and Time (TRF1 and TRF2) as within-subject (WS) factors and Group (HR and LR group) as between-subjects (BS) factor. Post hoc, paired samples t-test were performed to examine the differences in effect by domain of problem behaviour in case of a significant Time*Domain*Group interaction. Subsequently, a new continuous variable was created by subtracting the *T*-score of TRF2 from the *T*-score of TRF1; a positive score meant an improvement and a negative score a deterioration in behaviour. To assess individual differences in behavioural changes, a frequency table was produced. To assess the stability of the effectiveness, a RM-ANOVA was performed with Domain (externalizing behaviour) and Time (TRF1, TRF2, and TRF3) as WS factors for the HR group only. A simple WS contrast was used with TRF1 as baseline reference for the other two test phases. The first contrast tested change in behaviour from initial test to the first evaluation, the second contrast tested the change in behaviour from initial test to second evaluation. A significant Domain x Time contrast would indicate that changes in behaviour depended on domain. Significance level was set at $\alpha < .05$. Effect sizes were calculated using partial eta squared (η_p^2) and Cohen's (Cohen, 1992).

Results

Descriptive statistics

Data for sex, age, and several domains of the TRF are shown in Table 1. The HR and LR groups did not differ in age, but did differ in sex distribution. Not surprisingly, the HR group scored significantly higher on TRF aggression, rule-breaking behaviour, total internalizing behaviour, externalizing behaviour, and social problems

Table 1. Descriptive statistics for sex, age, and several TRF domains for the HR and LR groups at first point of contact (i.e., TRF1)

	HR group (N=173)		LR group (N=64)		χ^2 / t test	p	d
	M	SD	M	SD			
Sex (% boys)	80.3		62.5		$\chi^2(1,237) = 8.05$	.005	
Age (years)	10.40	1.34	10.35	1.31	$t(1,235) = 0.24$	.813	
Aggression TRF (<i>T</i> -score)	75.99	10.76	55.28	4.79	$t(1,235) = 20.43$	<.001	2.5
Rule-breaking TRF (<i>T</i> -score)	69.78	6.89	55.38	4.67	$t(1,235) = 15.46$	<.001	2.5
Total externalizing TRF (<i>T</i> -score)	73.73	7.30	53.91	6.95	$t(1,235) = 18.81$	<.001	2.8
Total internalizing TRF (<i>T</i> -score)	59.87	8.17	51.72	10.65	$t(1,235) = 5.55$	<.001	0.9
Social problems TRF (<i>T</i> -score)	65.08	7.16	53.72	4.89	$t(1,235) = 13.88$	<.001	1.9

Effectiveness of the intervention

A first evaluation (TRF2) was used to investigate the initial effectiveness of the intervention. The results showed a significant main effect of Domain ($F(2, 470)=98.27, p<.001, \eta^2=.295$), of Time ($F(1, 235)=5.63, p=.018, \eta^2=.023$), of Group ($F(1, 235)=188.22, p<.001, \eta^2=.445$), and a significant Domain by Time by Group interaction ($F(2, 470)=10.90, p<.001, \eta^2=.044$). These results indicate a significant difference in TRF scores between Time 1 and Time 2, which was dependent of Group and Domain. Post hoc analyses revealed that for the HR group problem behaviour decreased across the three domains, whereas for the LR group problem behaviour increased, which was significant for externalizing behaviour, see Table 2.

Table 2. Effectiveness of the intervention expressed in TRF1 scores (pre-intervention) and TRF2 scores (first behavioural evaluation) for three domains of problem behaviour for both groups

HR group (N=173)	TRF 1		TRF 2		<i>t-test</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Social problems (<i>T</i> -score)	65.08	7.16	61.23	7.60	$t(1,172)=6.15$	<.001	0.52
Internalizing (<i>T</i> -score)	59.87	8.17	56.80	8.47	$t(1,172)=3.87$	<.001	0.37
Externalizing (<i>T</i> -score)	73.73	7.30	66.39	8.83	$t(1,172)=9.42$	<.001	0.91
LR group (N=64)							
Social problems (<i>T</i> -score)	53.72	4.89	55.23	6.37	$t(1,63)= -1.46$	.150	0.27
Internalizing (<i>T</i> -score)	51.72	10.65	53.08	10.05	$t(1,63)= -0.92$	.363	0.13
Externalizing (<i>T</i> -score)	53.91	6.95	56.84	8.88	$t(1,63)= -2.75$	.008	0.37

Improved versus deteriorated

We next investigated within the HR group the proportion of children that improved in problem behaviour. For a majority of children a reduction in problem behaviour was reported at 6 months (Time 2): 72.3% of the children showed a reduction in social problems, 67.6% in internalizing behaviour, 79.8% in externalizing behaviour, 75.7% in rule-breaking behaviour, and 78.0% in aggressive behaviour.

Stability of the effect of the intervention at 12 months

With regard to the stability of the effect, there was a significant main effect of Time ($F(2,136)=32.70$, $p<.001$, $\eta^2=.325$). Subsequent simple contrasts showed a significant TRF1 versus TRF2 interaction effect ($F(1,68)=35.01$, $p<.001$, $\eta^2=.340$), and a significant TRF1 versus TRF3 interaction effect ($F(1,68)=52.27$, $p<.001$, $\eta^2=.435$). As shown in Figure 1, these results indicate that the mean reduction in externalizing problem behaviour was significant for both evaluation time points relative to TRF1. There was no further decrease in reported problem behaviour between TRF2 and TRF3 ($p=.099$).

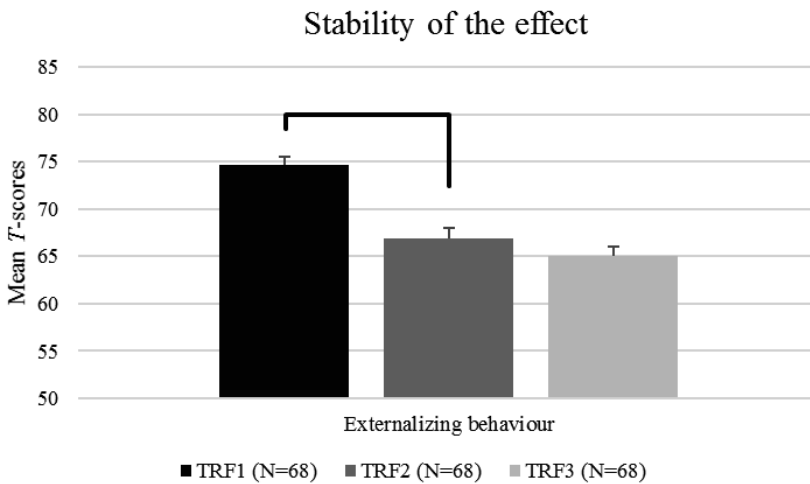


Figure 1. Stability of the intervention effect for externalizing problem behaviour over TRF1, TRF2, and TRF3 with means and standard error of the means (SEM)

Discussion

The Preventive Intervention Trajectory (PIT) has been set up to identify children at high-risk of future criminal behaviour at an early stage in order to provide them with preventive care with the aim to eventually reduce crime in the city of Amsterdam. This has resulted in an approach in which individual strengths and difficulties in neurocognitive function inform the type of preventive customized care received. The purpose of the current study was to examine whether this individualized approach is effective in reducing problem behaviour, in particular externalizing behaviour, in children at high risk of future criminal behaviour.

The results show that children with serious behavioural problems benefit from this customized care and show less problem behaviour after 6 months and 12 months. At the same time, children from the same community sample with less severe behavioural problems showed an increase in problem behaviour at 6 months, particularly in the domain of externalizing problem behaviour. From our results we can conclude that about 80% of the children exhibited a reduction in problem behaviour after 6 months of customized care. In contrast with other reputable interventions such as Parent Management Training – Oregon (PMTO; Thijssen et al., 2017) and Primary Care Triple P (Spijkers et al., 2013) these results are quite promising. In other effectiveness studies it was found that PMTO is effective in 45.8% of the children, and both PMTO and Primary Care Triple P are not more effective than care as usual (Spijkers et al., 2013; Thijssen et al., 2017). These interventions rely heavily on parents' involvement and motivation; the parents in our study often mistrust support and are less keen to cooperate.

Our first data support the hypothesis that neurocognitive function as a target for intervention might be important in support of the social development of children at high risk. Moreover, the PIT acts at school and immediately after signals of persistent aggression and problem behavior, which might be a strength. In addition, since the PIT professionals work with parents and with teachers who support the intervention at school, the exposure to treatment is much higher than usual. Another factor of importance may be that the PIT professionals stay with the families and children during two years, monitoring the development. Also, they do not only use individual treatment, they also take care of activities of the child like the way they spent leisure time. Just involving different settings and thus addressing different risk factors might be important to increase effectiveness of the intervention (Herrenkohl et al., 2001; Herrenkohl et al., 2000; Loeber et al., 2003). More research is needed to help explain the working mechanisms in the PIT intervention.

Several limitations of the study should be noted. First, based on the individual profiles customized care was shaped to improve the neurocognitive functions in order to reduce the problem behaviour. Whether these mechanisms, for instance executive functions, are improved cannot be verified, because that requires a post-intervention follow-up of these mechanisms, in addition to other factors that have been influenced. Such studies need to be conducted in the future. Second, in order to have a better understanding of the factors that might play an essential role in the effectiveness of the intervention, such as frequency and duration,

future studies should also collect these variables. Despite the limitations, the results of our study highlight the importance of identification of at-risk children and the relevance of customized care in this target group based on neurocognitive profiles. The high-risk group came from families who frequently operate off the radar of the social and health services and do not recognize or ignore their children's problem behaviour. There is a good chance that these children without the PIT intervention and without the cooperation of the schools would only come into the picture after having committed a crime. Longer term follow up studies need to show whether this intervention group is less likely to come into contact with the police when they are older.

From the literature we know that preventive interventions are important to reduce criminality. The chances of successfully influencing and redirecting young high-risk children in a prosocial direction are greater when risk factors are timely identified and their malleability is still relatively high (Loeber, 1990; Van Goozen & Fairchild, 2008). The results from the current study show that high-risk children can benefit from a preventive customized approach based on neurocognitive mechanisms.

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CHAPTER

6



Summary and General Discussion



A small group of children is at high risk of persistent antisocial behaviour, including future involvement in the criminal justice system. Targeting children at risk of persistent antisocial behaviour in an early stage to direct them to interventions may provide crucial opportunities, not only to help these children attain a more positive developmental trajectory, but also to diminish the enormous negative impact their behaviour can have on society. Although different developmental processes are supposed to underlie the course and maintenance of aggressive and antisocial behaviour, a better insight into the role of neurocognitive and neuroaffective functioning in aggressive behaviour in young children is needed. This may ultimately be helpful in the design of intervention programs that aim to redirect these children onto a more adaptive, prosocial pathway (Van Goozen & Fairchild, 2008). The main aim of the studies in this dissertation was to explore whether the assessment of neurocognitive and neuroaffective mechanisms provides the necessary information that helps to shape early intervention in children at high risk of future criminal behaviour. In four separate studies we examined several well-known relevant neurocognitive and neuroaffective mechanisms, and additionally the effectiveness of customized care, based on the individual strengths and difficulties of these mechanisms, on reducing the problem behaviour.

From a neuropsychological point of view we support the idea that problems in behaviour are associated with dysfunctions in the brain. These dysfunctions can be identified by assessing the neurocognitive and neuroaffective functions. Behaviour is the resultant of predispositions, quality of the neurocognitive functions, and interactions with the environment (see Chapter 1, Swaab, Bouma, Hendriksen, & König, 2011). The studies described in this dissertation unravel the association of several neurocognitive and neuroaffective functions with antisocial behaviour in children who are at risk of future criminal behaviour, but not yet offenders. This knowledge is important to gain more insight into individual differences in developmental trajectories and functions in these children, which may help to design or improve (preventive) customized intervention strategies targeting the reduction of problem behaviour. All studies are part of a large ongoing early identification and prevention project, the Preventive Intervention Trajectory (PIT) of the municipality of the city of Amsterdam, the Netherlands. The samples consisted of children between 8 and 13 years of age who are at high-risk of future criminal behaviour. These children have in common that they all exhibit high levels of aggression and rule-breaking behaviour, reported by their teachers. They are the underage siblings of young offenders, have

delinquent parents or fail at school because of severe absenteeism or extreme antisocial behaviour. While these children might have behavioural problems, they often have no formal diagnosis yet, nor do their families actively seek help from clinicians, which substantially increases the risk of an unfavourable social developmental trajectory (Farrington, Piquero, & Jennings, 2013; Loeber & Stouthamer-Loeber, 1998). The motivation behind the PIT project is to get this group on the radar of social and health services, to obtain insight into their socio-cognitive and emotional functioning, and to prevent antisocial development in an effort to take a generation out of crime. Below, the findings of the four studies are summarized, followed by a general discussion, clinical implications, and directions for future research, and closed with some concluding remarks.

Summary

Executive functioning

The study presented in **Chapter 2** aimed to investigate the contribution of impaired executive functions (EFs) and attention in explaining externalizing problem behaviour in children at high risk of future criminal behaviour. Executive function impairments are associated with antisocial behaviour (Riccio, Hewitt, & Blake, 2011), but the contribution of specific EF impairments in explaining severity of problem behaviour is less known. To this end, we first identified possible strengths and difficulties in EF in the high-risk group in comparison with a control group of typically developing children and a normative sample. The results demonstrated that the high-risk group had impairments in working memory, cognitive flexibility, inhibition, and sustained attention. Within the high-risk group, eight percent of the variation in externalizing problem behaviour was explained by inhibition, sustained attention, and working memory. These findings clearly indicate that EF impairments can be seen as important risk factors in the development of antisocial behaviour. Therefore, it is suggested that evaluations of high-risk children should include assessment of EFs and that preventive interventions should focus on supporting EF development in high-risk children given its protective role and the positive effect of EF on later success in life (Diamond & Lee, 2011; Waller, Hyde, Baskin-Sommers, & Olson, 2017).

Emotion recognition

In **Chapter 3** emotion recognition was studied, using stimuli presenting facial expressions and the affective tone of voices, in a group of children at high-risk of future criminal behaviour. Facial affect and affective prosody recognition are important when it comes to engaging in adequate social behaviour and are needed for normal socialization (Blair, Colledge, Murray, & Mitchell, 2001; Montagne et al., 2005). Although facial affect recognition has been studied extensively in clinical and forensic samples, little is known about affective prosody recognition in antisocial populations. The results show that the recognition of facial fear and sadness was impaired in the high-risk group compared to the control group, but the recognition of affective prosody was equally accurate, although they needed significantly more time, which constitutes a handicap in social communication that inescapably evolves under time pressure. No hostile attribution bias in facial affect recognition was found. These results strongly suggest that high-risk children exhibit deficits in facial emotion recognition, in particular concerning the distress-related emotions, and slowness in the recognition of affective prosody, that could impair their prosocial development. It are precisely these emotions, fear and sadness, that are supposed to serve as social reinforcements leading to appropriate social behaviour and evoke empathy (Marsh, Adams Jr, & Kleck, 2005; Marsh & Blair, 2008). When a child does not recognize the distress of another caused by its behaviour it is not likely that the child is motivated to adapt its behaviour (Marsh & Blair, 2008). Interventions targeting emotion recognition skills early in life could create a turning point in the development of antisocial behaviour in high-risk children (Hubble, Bowen, Moore, & van Goozen, 2015; Hunnikin & van Goozen, 2018).

Empathy and social attention

The study in **Chapter 4** examined the role of social attention and empathy in response to different emotionally meaningful events in children at high risk of future criminal behaviour. Empathy deficits are hypothesized to underlie impairments in social interaction exhibited by those who engage in antisocial behaviour, and social attention is an essential precursor to empathy (Blair, 2005b; Klein, Shepherd, & Platt, 2009). Therefore, we examined social attention in relation to cognitive and affective empathy. The results show that the high-risk children had impaired affective empathy when viewing emotional video clips. Specifically, they showed reduced heart rate (HR) to pain and fear, and reduced skin conductance level (SCL) and skin conductance responses (SCRs) to pain compared to control children. However, importantly, the high-risk children did

not differ from controls on measures of social attention and cognitive empathy, nor in affective empathy to happiness. These results indicate that high-risk children showed adequate understanding of the emotions presented in the video clips, but had specific problems with empathizing and experiencing negative emotions of others. Elaborating on these results, when a child does not empathize with the distress caused by their aggressive behaviour, they are more likely to continue the display of harmful behaviour (Marsh & Blair, 2008). Moreover, the empathy impairments that presumably play a significant role in antisocial development are primarily related to a deficit in affective empathy which has implications for the development of interventions, that should focus specifically on enhancing emotional awareness and affective empathy (Hunnikin & van Goozen, 2018).

Effectiveness of preventive customized care

In **Chapter 5** the focus was on studying the effectiveness of the preventive customized care offered in the PIT approach in reducing externalizing problem behaviour, comparing the development of behaviour over time between the high risk (intervention) and low-risk group (no intervention). Currently, most interventions aiming to reduce antisocial behaviour adopt a “one size fits all” approach. However, there is a clear need to adopt a tailored, more customized approach in which individual differences in the nature of the problems as well as in the surrounding circumstances are taken into account when deciding upon a course of action (Hendriks, Bartels, Colins, & Finkenauer, 2018; Hunnikin & van Goozen, 2018). Such an approach was adopted by the PIT, by assessing neurocognitive and neuroaffective functions providing individual strength and difficulties profiles which formed the basis to individually customize the preventive intervention. The results showed that customized preventive care is effective in reducing externalizing problem behaviour, since the reported problem behaviour reduced significantly after six months and this decrease was stable over twelve months. Supportive of the impact of the PIT approach is the finding that the low-risk group (without PIT intervention) showed an increase in problem behaviour after six months, in particular in externalizing behaviour. Between the 70 and 80 % of the high-risk children showed less problem behaviour after six months. These findings clearly demonstrated that high-risk children benefit from a preventive customized approach. The chances of successfully influencing and redirecting children in a prosocial direction are greater when risk factors are identified when their malleability is still relatively high. This suggests to target

the children for intervention as early as possible, so they can optimally benefit from it (Loeber, 1990; Van Goozen & Fairchild, 2008).

General Discussion

The studies described in this dissertation focused on the neurocognitive and neuroaffective mechanisms in children at high risk of future criminality. In addition, the effectiveness of preventive customized care based on individual profiles of strengths and difficulties of these mechanisms was studied. Three main conclusions can be drawn pertaining to these mechanisms and the effectiveness of reducing externalizing problem behaviour.

First, children at high risk of future criminal behaviour show difficulties with experiencing, empathizing, and recognizing others' emotions, in particular distress-related emotions (Chapter 3 and 4). These findings might (partly) explain the problems these children experience with adjusting their behaviour in a social adequate manner and connecting with peers. They are less able to experience what it feels like for another person to experience a certain emotion, in particular the emotions pain and fear. Furthermore, they have problems with recognizing facial emotions of others, in particular fear and sadness, and they need more time to recognize emotions in the voice of others (affective prosody). Social interactions often involve the processing of implicit and dynamic information, frequently changing and expiring under time pressure. It are precisely those skills that are required to respond adequately in social situations that are less well developed in the children in our high-risk sample. As a result, in the classroom or at home one may observe, for example, misinterpretation of a sad facial expression, the inability to mentalize and adapt behaviour in favour of reacting in the usual way by showing aggression.

According to the Integrated Emotion System (IES) model of Blair (2005a), typically developing children learn to avoid initiating behaviours that result in the sadness or fear of others because this is aversive to them. The high-risk children do not seem to have acquired this learning history, probably because they do not necessarily recognize and empathize with distress-related cues. Consequently, distress caused by their behaviour does not serve as a cue to adapt their behaviour which makes them more likely to continue the display of harmful behaviour. On a neurophysiological level, these results also fit the Violence Inhibition Mechanism (VIM) theory (Blair, 2001) which states that

the VIM is a system that, when activated by distress cues, for example sad and fearful expression of others, reacts with increased autonomic activity, attention, and the activation of the brain stem threat response system, usually resulting in freezing. Classical conditioning ensures that the link between the activation of the system by the distress cues (pain or sadness) with a representation of the act (a person hitting someone) which caused the distress cues results in a trigger for the system. In typically developing children these situations makes the distress cues as aversive as the acts themselves. The results in these dissertation show an opposite development, reflected in a decrease in autonomic activity. In children whose response system fails to operate in this way, the system is not triggered by the distress cues. As a result there is no increase in autonomic activity, the children do not learn that these cues and the associated representation of the act that causes the distress is aversive. Being able to recognize and empathize the distress-related cues of others is a prerequisite to learn socially, to show social adequate behaviour, and to be successful in social interactions. Therefore, enhancing emotional awareness, affective empathy, and emotion recognition training would constitute important targets in intervention and prevention programs.

Second, children at high risk of future criminal behaviour have serious EF impairments which constitute important risk factors in antisocial behaviour and these factors should be the target in the intervention (Chapter 2). The high-risk children in general do have problems with inhibition, cognitive flexibility, working memory, and sustained attention which might (partly) explain the problems they experience in social interaction. EF skills are indispensable in regulating the behaviour and adapting the behaviour to the social environment. In social, often dynamically evolving, situations, timely responding is vital and this requires well-developed EF skills in order to behave appropriately. For example, a child that finds it difficult to inhibit first impulses when socially interacting, will often respond inappropriately, for instance with aggression. Or a child who has problems focusing on a task for a longer period of time, may be disruptive for other children in the classroom, keeping them from their work.

Recapitulating, EF impairments are associated with behaviours which are inadequately adapted to the social environment, such as aggression and antisocial behaviour (Riccio et al., 2011). This dissertation suggests that the EF impairments found in children with a formal diagnosis, such as conduct disorder (CD) or oppositional defiant disorder (ODD), are already present in children who are

at high-risk of future criminal behaviour and therefore do represent important risk factors. In particular, the fact that the parents of these children operate off the radar of social and health services and in general do not recognize or ignore the problem behaviour exhibited by their children may lead to an accumulation of risk. This might result in an increase in problems in social interactions and social adjustment. Early intervention may reduce these problems, since studies on the effectiveness of EF training in young children suggests that computerized or behavioural training is effective (Diamond & Lee, 2011). It is therefore argued that timely identification of at-risk children and mapping of their EF skills is important in order to provide effective interventions to minimize the possible damage to the society, their environment, and themselves. In our study, we found that 8% of the variance in the severity of externalizing problem behaviour was explained by inhibition, working memory, and sustained attention. Whilst 8% may seem a rather small contribution, this is only based on three performance-based EF skills. Hence, we think this highlights the importance of taking into account the role of cognitive factors in the development of severe problem behaviour, besides other factors such as sociocultural or emotional factors.

Third, a customized preventive approach aiming at reducing externalizing problem behaviour incorporating the information from the individual neurocognitive profiles, thus accounting for individual differences in the development and appearance of the antisocial behaviour, is effective in children at high risk of future criminal behaviour (Chapter 5). Our study suggests that between 70 to 80% of the children at high risk of future criminal behaviour benefit from the customized preventive approach offered by the PIT. In contrast with other reputable interventions such as Parent Management Training –Oregon (Thijssen, Vink, Muris, & de Ruiter, 2017) effective in 45.8% of the children and Primary Care Triple P (Spijkers, Jansen, & Reijneveld, 2013) not more effective than care as usual, these results are quite promising. The PIT professionals provided care adapted to the needs and possibilities of the child and environment. As a first step, care was sought in the existing range of interventions and at school that was suitable and according to the profile of strengths and difficulties of the individual child, but when not available, the PIT professionals go off the beaten track to provide for the care that the child needs. For instance, when a child needs extra support to make a transfer from learned social skills to use of the skills in the classroom, the PIT professionals make sure that a couple of hours a week a coach is in the class or on the playground to support the child by making the transfer. This procedure is different from usual in clinical practice, where a

‘one size fits all’ approach is still adhered to. Most interventions target global risk factors and general social skills rather than specific socio-emotional dysfunctions that have been shown to be important in antisocial behaviour within a specific child (Hunnikin & van Goozen, 2018). However, the results in this dissertation show that customization, with the focus on the underlying mechanisms of the behaviour instead of the behaviour itself, is effective in reducing externalizing problem behaviour.

In this project the cooperation of the school is very important, because this is a pedagogical and safe environment where children are a large part of the day. The children in our sample often come from multi-problem families with minimum awareness of the problems in behaviour and few opportunities to offer their children something extra in the field of affection or socio-cognitive skills. So, the first setting in which care is given is school, and when possible also at home. In the next phase of the study, it will be necessary to further explore the effectiveness of several chosen interventions to support specific developmental tracks in the child.

Clinical implications

Obviously, every child is unique and develops in his or her own way. The results in this dissertation emphasize the importance of neurocognitive and neuroaffective mechanisms playing a role in the development of criminal behaviour. Although behaviours might be the same, the underlying mechanism (origin) of the behaviour could be different. For that reason, it is advised to obtain individual profiles of strengths and difficulties providing the necessary information to set up customized care. This approach constitutes a shift from a “one size fits all” approach to individualized treatment. Such an individualized approach does also justice to the heterogeneity in appearance of antisocial behaviour. Eventually, the study in Chapter 5 provides evidence that this type of approach is effective in reducing the externalizing problem behaviour. In this study, success rate was approximately 70 to 80% versus circa 45% in other treatments studies using standard intervention programs. Additionally, these interventions rely heavily on parents’ involvement and motivation. The parents in our study often mistrust support and are less keen to cooperate, but still the effectiveness is higher. Since the PIT professionals work with parents and with teachers who support the intervention at school, the exposure to treatment is much higher than usual.

In addition, the study in Chapter 4 provides evidence that high-risk children have problems with affective empathy. Affective empathy can be assessed by using self-report questionnaires that are subjective assessments, or by measuring neurophysiological responses to specific content, such as changes in heart rate. In this study we opted for a neurophysiological measure. To date, in clinical practice, the implementation of neurobiological measures in intervention programs, let alone in daily treatment programs, is hardly, or not at all, realized (De Kogel & Alberda, 2018). Research has clearly shown that biological factors, among other factors, play a significant role in the severity and persistence of antisocial behaviour (Van Goozen & Fairchild, 2008), which suggests the importance to include neurobiological factors in the diagnostic process. To be able to include these factors in the diagnostic process, first, it should be standard procedure to collect these data in order to facilitate comparisons on a neurophysiological level and to attach substantive conclusions to the results. Insight into the neurobiological functioning on an individual level could be helpful in psychoeducation and in making interventions more effective by connecting to the individual needs.

Based on the findings in the study in Chapter 2, it seems worthwhile to consider some adjustments to the curriculum at primary schools. This study provides some evidence that besides the standard curriculum, like for example language and mathematics, it is important to consider learning and practicing other skills that help to improve the regulation of one's behaviour. For instance, EF training seems promising given the protective role and positive effect of EF on later success in life (Diamond & Lee, 2011; Waller et al., 2017). Recognition of this perspective is also illustrated in the new edition of the Wechsler Intelligence Scale for Children (WISC-V) that is based on the hierarchical Cattell – Horn - Carroll model (CHC-model; Schneider & McGrew, 2018) involving a general factor debouche into broader and more narrow cognitive skills that are comparable to EFs. From this perspective, one can conclude that well-developed EFs are needed to function properly and attention should be paid to developing these skills in the classroom.

Lastly, in this dissertation we were not able to draw conclusions about the relevance of early identification of high-risk children, since our follow-up was limited to one year. However, we know from the literature that the chances of successfully influencing and redirecting children in a prosocial direction are greater when risk factors are identified early, i.e. when their malleability is relatively high (Loeber, 1990; Van Goozen & Fairchild, 2008). The studies in

this dissertation have shown that in particular the teachers are able to identify children at risk for future criminal behaviour. The studies also show that most parents of the high-risk children are inclined to ignore or do not recognize the problem behaviour of their child. This means that they likely will not seek help from clinicians themselves, and thus these children remain off the radar of social and health services. Schools and especially the teachers are essential as a link between these families and children and the social assistance, by identification of the risk factors and the possibility to early identify children at risk. In clinical practice, this would be facilitated by setting up an ambulant consultation hour at schools in their neighborhood, in order to early identify children at risk, redirect them to adequate interventions, provide support to teachers, and prevent these children from a drop out or even a criminal career.

Recommendations for future research

There are a number of directions for future research to be recommended. First, it is important that future research incorporates post-intervention assessment of the identified neurocognitive and neuroaffective strengths and difficulties in the study design. Based on the individual neuropsychological profiles, customized preventive care was shaped to improve the neurocognitive and affective functions in order to reduce the problem behaviour. The study in Chapter 5 showed that the customized care provided by the PIT professionals was effective in reducing externalizing problem behaviour. Since the neurocognitive and neuroaffective functions were not assessed post-intervention, we were not able to link potential changes in these functions with the change in externalizing problem behaviour.

There is preliminary evidence that, for example, empathy and compassion training result in increased affective responses and functional activity in brain areas involved in emotion processing (Klimecki, Leiberg, Ricard, & Singer, 2014). When it comes to improving empathy and recognition of emotions these results are promising for future interventions. Incorporating functional magnetic resonance imaging (fMRI) could be helpful in understanding why a particular training is, or is not, effective in children, which may help to improve the effectiveness of training.

Furthermore, it is important to incorporate environmental factors in future study designs. We know that the environment plays a significant role in how behaviour comes about. A review of previous studies show that the environmental

factors can have a protective role in the development of antisocial behaviour, for instance parental warmth, sensitivity, and prosocial parental values are important (Labella & Masten, 2018). Unfortunately, the reverse is also the case, in that unfavourable environmental factors can be a risk factor, such as parental offending or domestic and/or neighborhood violence (Margolin & Gordis, 2000; Tzoumakis et al., 2018), or, what we have seen in our study, ignorance or failure to recognize problem behaviour by parents. In general, as argued earlier, the children in the reported studies come from families who operate off the radar of health and social services, are not aware of or ignore the problem behaviour, and can be characterized as multi-problem families. It is conceivable that these family and thus environmental factors play a role in how the behaviour of these children develops. The studies in this dissertation explicitly aimed to individually evaluate the underlying mechanisms that are involved in children's antisocial development. In future research it is recommended to include environmental factors as well.

Lastly, in future research it would be interesting to investigate whether implementation of an extra curriculum, focused on the improvement of EFs and social cognition skills, does result in a positive development with more prosocial and less problem behaviour throughout elementary school.

Concluding remarks

The studies in the current dissertation demonstrated impairments in affective empathy, emotion recognition, and executive functioning in a group of children at high risk of future criminal behaviour. Furthermore, the studies in this dissertation indicate that individual strengths and difficulties profiles of these neurocognitive and neuroaffective skills in order to shape customized care to help children to adjust their behaviour is effective in reducing problem behaviour. This is not only important for the children themselves who can hopefully develop in a more optimal direction, but also for society as such. Because the PIT uses recent knowledge of brain-behaviour relationships in antisocial development in their preventive and customized approach they are a step closer in their ultimate goal, namely prevent antisocial development in an effort to take a generation out of crime.

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Summary in Dutch



Inleiding

Als kinderen moeilijk corrigeerbaar grensoverschrijdend of agressief (externaliserend) gedrag laten zien is het belangrijk dit gedrag tijdig te signaleren en (preventief) te behandelen om te voorkomen dat deze gedragspatronen zich voortzetten in de adolescentie en de volwassenheid, waardoor deze kinderen een verhoogd risico zouden lopen later in aanraking te komen met justitie. Om tijdig succesvolle ondersteuning van de ontwikkeling in te kunnen zetten, in het belang van het welzijn van het kind, maar ook in het belang van de samenleving, is het belangrijk te onderzoeken welke factoren bijdragen aan de totstandkoming van dit externaliserende grensoverschrijdende en agressieve gedrag en om te bezien welke van deze factoren via begeleiding positief beïnvloedbaar zijn.

Op basis van eerder onderzoek wordt gesuggereerd dat specifiek vormgegeven maatwerk interventies, gericht op de factoren die bij een specifiek kind bijdragen aan het in stand houden van het moeilijk beïnvloedbare externaliserende gedrag, bij zouden kunnen dragen aan het succes van interventies die tot doel hebben deze kinderen naar een meer adaptief en prosociaal ontwikkelpad te leiden (Van Goozen & Fairchild, 2008).

In het huidige proefschrift staat de vraag centraal of bij een groep kinderen met hardnekkig grensoverschrijdend en agressief gedrag neurocognitieve en neuroaffectieve mechanismen herkenbaar zijn die aan dit gedrag lijken bij te dragen. Vervolgens worden de effecten op het gedrag geëvalueerd van een preventieve interventie gericht op ondersteuning van de ontwikkeling, die mede is ingericht op basis van de individuele neurocognitieve en neuroaffectieve sterkte- en zwakteprofielen. Op basis van eerder onderzoek werd verondersteld dat de kwaliteit van de ontwikkeling van de aandachtregulatie en executieve functies, emotieherkenning, empathie en sociale aandacht van belang zijn bij het ontstaan en in stand blijven van externaliserend gedrag. De samenhang van deze neurocognitieve en neuroaffectieve functies met grensoverschrijdend en agressief gedrag wordt opeenvolgend in vier studies onderzocht.

De studies in dit proefschrift maken deel uit van een groot innovatief project gericht op vroegtijdige signalering van externaliserend probleemgedrag bij kinderen en preventie van het risico op ontwikkeling van crimineel gedrag, uitgevoerd door het Preventief Interventie Team (PIT) van de gemeente Amsterdam. Participanten in de studies zijn kinderen tussen de acht en dertien

jaar. Zij zijn de minderjarige broers en zussen van jonge delinquenten, hebben ouders met delinquent gedrag of vallen uit op school vanwege ernstig verzuim of extreme agressie of moeilijk corrigeerbaar gedrag. De kinderen die participeren in de studie hebben allen een hoge mate van agressief en grensoverschrijdend gedrag, zoals geobserveerd door hun leerkrachten. Hoewel deze kinderen serieuze gedragsproblemen laten zien, zoeken hun families meestal niet actief de hulp van klinici en hebben de kinderen vaak (nog) geen formele diagnose. Deze situatie wordt verondersteld het risico op een ongunstige sociale ontwikkeling aanzienlijk te verhogen (Farrington, Piquero, & Jennings, 2013; Loeber & Stouthamer-Loeber, 1998). De motivatie achter het PIT project is om deze kinderen tijdig op de radar te krijgen van de hulpverlening om de ontwikkeling positief te ondersteunen en om inzicht te krijgen in de sociaal-cognitieve en emotionele factoren om hulp op maat te bieden zodat een antisociale ontwikkeling kan worden voorkomen en daarmee het risico op criminaliteit. Hieronder worden de bevindingen van de vier studies samengevat, gevolgd door een algemene discussie en afgesloten met enkele slotopmerkingen.

Samenvatting

Executief functioneren

In **hoofdstuk 2** wordt gerapporteerd in hoeverre minder goed ontwikkelde executieve functies en aandacht bijdragen aan het verklaren van probleemgedrag bij kinderen die hardnekkig externaliserend gedrag laten zien en daarom worden beschouwd als behorend bij een hoog-risicogroep met een kwetsbaarheid voor het ontwikkelen van crimineel gedrag. Beperkingen in de executieve functies zijn geassocieerd met antisociaal gedrag (Riccio, Hewitt, & Blake, 2011), maar in hoeverre deze beperkingen het probleemgedrag helpen verklaren is minder bekend. In vergelijking met een controlegroep en een normatieve steekproef bleken de kinderen uit de hoog-risicogroep significant zwakker te presteren als een beroep werd gedaan op het werkgeheugen, de cognitieve flexibiliteit, de inhibitie en de volgehouden aandacht. Binnen de hoog-risicogroep werd acht procent van de variantie in externaliserend probleemgedrag verklaard door inhibitie, volgehouden aandacht en werkgeheugen. Deze bevindingen laten zien dat beperkingen in de executieve functies kunnen worden beschouwd als relevante risicofactoren in het risico op het ontwikkelen van antisociaal gedrag. Daarom wordt aanbevolen om bij kinderen met een verhoogd risico de executieve functies te onderzoeken en preventieve interventies mede te richten op het ondersteunen van de ontwikkeling van executieve functies. Deze aanbeveling

wordt ondersteund door studies die de beschermende rol en het positieve effect van executieve functies op later succes in het leven laten zien (Diamond & Lee, 2011; Waller, Hyde, Baskin-Sommers, & Olson, 2017).

Emotieherkenning

In **hoofdstuk 3** wordt onderzoek naar emotieherkenning beschreven waarbij gekeken is naar het vermogen gezichtsexpressies te herkennen en op basis van prosodie emotie in de stem te identificeren. Emotieherkenning in gezichten en in de stem is belangrijk bij het ontwikkelen en laten zien van adequaat sociaal gedrag en is nodig voor normale socialisatie (Blair, Colledge, Murray, & Mitchell, 2001; Montagne et al., 2005). Hoewel bekend is dat herkennen van gelaatsexpressies vaak problematisch is in klinische en forensische populaties, is er weinig bekend over de relatie tussen affectieve prosodie herkenning en het risico op antisociaal gedrag. De resultaten toonden aan dat de hoog-risicogroep minder goed in staat is om de emoties ‘bang’ en ‘verdrietig’ te herkennen bij het zien van gezichten dan de controlegroep. Daarentegen was de herkenning van affectieve prosodie net zo accuraat, hoewel de hoog-risicogroep hiervoor wel meer tijd nodig had. Dit vormt een handicap in sociale communicatie die onvermijdelijk plaatsvindt onder tijdsdruk. Hoewel verwacht, werd er geen vijandige attributiebias gevonden bij het herkennen van gelaatsexpressies. De hoog-risicogroep laat dus met name problemen zien bij het herkennen van de negatieve emoties en het zijn juist deze negatieve emoties (‘bang’ en ‘verdrietig’) die geacht worden te dienen als sociale bekrachtiging die leidt tot passend sociaal gedrag en het oproepen van empathie (Marsh, Adams Jr, & Kleck, 2005; Marsh & Blair, 2008). Wanneer een kind minder goed in staat is zich in te leven en het verdriet van de ander niet herkent, hoewel dit het gevolg is van het eigen gedrag, is het zeer waarschijnlijk dat het kind ook minder goed in staat is om het gedrag aan te passen (Marsh & Blair, 2008). Het aanbieden van interventies gericht op het herkennen van emoties zou kunnen bijdragen aan het voorkomen van de ontwikkeling van antisociaal gedrag bij kinderen met een hoog risico (Hubble, Bowen, Moore, & van Goozen, 2015; Hunnikin & van Goozen, 2018).

Empathie en sociale aandacht

De studie in **hoofdstuk 4** onderzocht de rol van sociale aandacht en empathie in reactie op emotioneel beladen situaties bij de hoog-risicogroep in vergelijking met een controlegroep. Verondersteld wordt dat tekorten in de empathie, die gezien worden bij personen die antisociaal gedrag vertonen, mede ten grondslag kunnen liggen aan beperkingen in de sociale interactie. Sociale aandacht wordt beschouwd

als een essentiële voorwaarde van empathie (Blair, 2005; Klein, Shepherd, & Platt, 2009). De resultaten laten zien dat de hoog-risicogroep een verminderde affectieve empathie (gedefinieerd als een emotionele respons op het zien van emotie bij anderen) toont bij het bekijken van emotioneel geladen videoclips, zoals blijkt uit een verlaagde hartslag (HR) bij het waarnemen van 'pijn' en 'angst' en uit een verlaagd huidgeleidingsniveau (SCL) en minder huidgeleidingsreacties (SCRs) bij het waarnemen van 'pijn' in vergelijking met de controlekinderen. Belangrijk is dat de kinderen met een hoog risico niet verschillen van controles op de maten van sociale aandacht en cognitieve empathie (het kunnen duiden van de emotionele respons van de ander en hier spontaan de aandacht op richten), noch in affectieve empathie bij 'blijdschap'. Deze resultaten lieten zien dat kinderen met een hoog risico voldoende in staat zijn om de emoties in de video clips te herkennen en te begrijpen, maar specifiek problemen hebben met het emotioneel inleven in de (negatieve) emoties van anderen. Dit verklaart mogelijk voor een deel het externaliserende probleemgedrag. Wanneer een kind zich niet kan inleven in het leed dat wordt veroorzaakt door het eigen agressieve gedrag, is de kans groter dat het kind dit gedrag blijft vertonen (Marsh & Blair, 2008). Met name tekorten in de affectieve empathie spelen vermoedelijk een belangrijke rol bij het risico op een antisociale ontwikkeling. Bij het ontwikkelen van interventies zou men zich specifiek moeten richten op het verbeteren van het emotioneel bewustzijn en de affectieve empathie.

Effectiviteit van preventieve maatwerkzorg

In **hoofdstuk 5** wordt gerapporteerd over een studie waarbij de focus lag op het bestuderen van de effectiviteit van de preventieve maatwerkzorg, aangeboden in de PIT aanpak, gericht op het verminderen van externaliserend probleemgedrag. De ontwikkeling van het gedrag in de hoog-risicogroep (interventie) en de laag-risicogroep (geen interventie) is met elkaar vergeleken over de tijd. Het protocollair interveniëren bij agressief en grensoverschrijdend gedrag wordt in de regel gekenmerkt door een aanpak die gericht is op de gedragskenmerken, maar die veelal niet is afgestemd op de onderliggende neurocognitieve tekorten die hiermee samenhangen, waardoor de effectiviteit beperkt is. Vanuit de kennis over de relatie tussen neurocognitieve tekorten die samenhangen met externaliserend gedrag is een maatwerkaanpak ontwikkeld waarbij het individuele sterkte- en zwakteprofiel op verschillende domeinen van neurocognitieve functies ondersteunend was bij het ontwikkelen van de maatwerkaanpak, waarbij ook omgevingsfactoren werden meegewogen. De hierop gebaseerde PIT methode bleek effectief te zijn in het verminderen van externaliserend gedrag zoals bleek

uit de afname van het probleemgedrag na zes maanden en het doorzetten van deze afname na twaalf maanden. Tussen de 70% en 80% van de kinderen met een hoog risico vertoonden aanzienlijk minder probleemgedrag na zes maanden. Ondersteunend voor de impact van de PIT aanpak is de bevinding dat de groep met een relatief laag risico (zonder PIT interventie) na zes maanden een toename in het externaliserende gedrag liet zien. Deze resultaten tonen aan dat kinderen met een hoog risico profiteren van een preventieve, op maat gemaakte aanpak. De kans om kinderen met succes naar een prosociale richting te begeleiden en hen positief te beïnvloeden, is groter wanneer risicofactoren tijdig worden geïdentificeerd. Dit bevestigt de veronderstelling op basis van eerder onderzoek (Loeber, 1990; Van Goozen & Fairchild, 2008) dat vroege onderkenning van hoog risico en het aanbieden van een preventieve interventie zinvol lijkt te zijn bij het voorkomen van een toename in externaliserend gedrag.

Discussie

De studies beschreven in dit proefschrift waren gericht op het onderzoeken van de neurocognitieve en neuroaffectieve mechanismen bij kinderen met grensoverschrijdend en agressief gedrag die een hoog risico hebben op het op het ontwikkelen van ernstig probleemgedrag in de puberteit en de volwassenheid. Daarnaast is de effectiviteit van preventieve zorg op maat, mede op basis van individuele sterkte- en zwakteprofielen van neurocognitieve mechanismen bestudeerd. Er kunnen drie hoofdconclusies worden getrokken.

Ten eerste, de kinderen die we onderzochten hebben moeite met het ervaren van, inleven in en herkennen van de emoties van anderen, in het bijzonder van de negatieve emoties (Hoofdstukken 3 en 4). Deze bevindingen kunnen (gedeeltelijk) de problemen verklaren die deze kinderen ervaren met het aanpassen van hun gedrag en het aansluiten bij leeftijdsgenoten. Ze zijn minder goed in staat om te ervaren hoe het voelt voor een ander om een bepaalde emotie te ervaren, in het bijzonder de negatieve emoties 'pijn' en 'angst'. Bovendien hebben ze problemen met het herkennen van emotionele gezichtsexpressies van anderen, met name de negatieve emoties 'bang' en 'verdrietig' en hebben ze meer tijd nodig om emoties te herkennen in de stem van anderen (affectieve prosodie). Sociaal gedrag wordt in hoge mate gestuurd door de perceptie van emoties bij anderen en door het begrip daarvoor en het meevoelen met deze emoties. Sociale interacties vragen om verwerking van impliciete en dynamische informatie onder tijdsdruk. Deze vaardigheden, die nodig zijn om adequaat te kunnen reageren in sociale situaties,

blijken minder goed ontwikkeld te zijn bij de kinderen in de hoog-risicogroep. Het resultaat wordt zichtbaar in de klas of thuis wanneer bijvoorbeeld een misinterpretatie van een verdrietige gezichtsuitdrukking leidt tot een ongepaste reactie, zoals agressie, waardoor negatieve interacties mede tot stand kunnen komen en in stand worden gehouden.

Volgens het *Integrated Emotion System* (IES) model van Blair (2005a) leren kinderen gedrag te vermijden dat resulteert in verdriet of angst voor anderen, omdat dit bij hen aversie opwekt vanwege hun sociale leergeschiedenis. Kinderen met externaliserend gedrag worden verondersteld deze leergeschiedenis niet optimaal doorgemaakt te hebben, mogelijk mede omdat ze de noodzakelijke emotionele signalen niet herkennen en zich hierin onvoldoende in kunnen leven. Als gevolg dient een negatieve emotie bij de ander, ook als het door hun gedrag wordt veroorzaakt, niet als *trigger* om hun gedrag aan te passen, omdat er geen motivatie tot aanpassing (correctie) van hun gedrag ontstaat vanuit een gevoel van aversie. Op neurofysiologisch niveau passen deze resultaten ook in de *Violence Inhibition Mechanism* (VIM) theorie (Blair, 2001). Deze theorie stelt dat de VIM een systeem is dat, wanneer geactiveerd door nood, reageert met een toename van activiteit in het autonoom zenuwstelsel, toename in aandacht en de activering van het bedreigingsstelsel in de hersenstam, wat meestal leidt tot *freeze*. Trieste of angstige uitdrukkingen van anderen zijn hierbij voorbeelden van noodsignalen. Klassieke conditionering zorgt ervoor dat de link tussen de activering van het systeem door de nood (pijn of verdriet) in combinatie met de representatie van wat de nood veroorzaakt (bijvoorbeeld een persoon die iemand slaat) resulteert in een *trigger* voor het VIM systeem. In normaal ontwikkelende kinderen heeft dit tot gevolg dat zowel de nood als de gebeurtenis die de nood veroorzaakt even aversief voor hen wordt. De resultaten in dit proefschrift laten een afwijkende ontwikkeling van het VIM systeem zien bij de hoog-risicogroep, weerspiegeld in een afname van activiteit in het autonoom zenuwstelsel bij het waarnemen van negatieve emotie bij de ander. Bij kinderen van wie het VIM systeem niet werkt zoals beschreven, wordt het systeem niet getriggerd door de nood of de gebeurtenis die de nood veroorzaakt. Als gevolg neemt de activiteit in het autonoom zenuwstelsel niet toe en leren de kinderen niet dat de aan de negatieve emotie gerelateerde signalen en de bijbehorende gebeurtenis aversief zijn. De negatieve emoties van anderen kunnen herkennen en het voelen van empathie is een voorwaarde om sociaal te leren, sociaal adequaat gedrag te kunnen laten zien in een specifieke situatie en succesvol te zijn in sociale interacties. Daarom zijn het verbeteren van de emotionele bewustwording, de

affectieve empathie en emotieherkenning belangrijke doelen in interventie- en preventieprogramma's.

Ten tweede, kinderen met hardnekkig externaliserend gedrag hebben ernstige tekorten in executieve functies die een belangrijke risicofactor vormen bij het reguleren van gedrag en deze factoren zouden mede focus moeten zijn van interventie (Hoofdstuk 2). De kinderen met hardnekkig grensoverschrijdend en agressief gedrag hebben problemen met de inhibitie, cognitieve flexibiliteit, het werkgeheugen en de volgehouden aandacht. Executieve functies zijn onmisbaar bij het reguleren van het eigen gedrag en het kunnen aanpassen van het gedrag aan de sociale omgeving. In sociale, vaak dynamische situaties, is tijdig reageren essentieel en dit vereist goed ontwikkelde executieve vaardigheden. Een kind dat het moeilijk vindt om de eerste impuls te inhiberen, zal vaak ongepast reageren, geleid door een primaire emotionele respons. Of een kind dat problemen heeft om zich gedurende een langere periode achtereen te richten op een taak, kan andere kinderen in de klas storen en hen van hun werk afhouden, en daarmee irritatie oproepen, zeker wanneer het begrip voor sociale informatie (zoals emotionele gezichtsexpressies) onvoldoende is, zodat de gevoeligheid voor corrigerende feedback onvoldoende is.

Beperkingen in de executieve functies worden geassocieerd met gedrag dat onvoldoende aangepast is aan de sociale omgeving, zoals agressie en antisociaal gedrag (Riccio et al., 2011). De bevindingen in dit proefschrift suggereren dat de beperkingen in de executieve functies die worden gevonden bij kinderen met een formele diagnose, zoals een gedragsstoornis (CD) of oppositionele opstandige stoornis (ODD), aanwezig zijn bij kinderen die, veelal zonder diagnose, externaliserend gedrag laten zien en daardoor een hoog risico lopen op de ontwikkeling van ernstiger probleemgedrag zoals crimineel gedrag. Omgevingsfactoren die ertoe hebben geleid dat er tot dan toe nog geen reguliere hulpverlening is ingezet, veelal doordat de ouders het probleemgedrag van hun kinderen niet onderkennen, kan leiden tot accumulatie van risico's. Dit kan weer leiden tot een toename van problemen in sociale interacties en sociale aanpassing. Tijdige signalering en interventie kunnen deze risico's verminderen, waarbij het hoopvol is dat studies naar de effectiviteit van training van executieve functies bij jonge kinderen suggereren dat zowel cognitieve- als gedragstraining effectief is (Diamond & Lee, 2011). Daarom wordt betoogd dat tijdige signalering van probleemgedrag bij kinderen met een hoog risico en het in kaart brengen van hun executieve functies belangrijk is, zodat effectieve interventies kunnen worden

ingezet om de mogelijke gevolgen voor hun ontwikkeling, hun omgeving en de samenleving te minimaliseren. In onze studie vonden we dat 8% van de variantie in externaliserend probleemgedrag werd verklaard door problemen in de inhibitie, werkgeheugen en de volgehouden aandacht. Hoewel 8% een vrij kleine bijdrage lijkt, is dit in onze studie alleen gebaseerd op drie prestatie-gebaseerde executieve functies. Daarom stellen we dat het belangrijk is rekening te houden met cognitieve factoren bij de ontwikkeling van ernstig probleemgedrag, naast andere factoren zoals sociaal-culturele of emotionele factoren.

Ten derde, een op maat gemaakte preventieve aanpak gericht op het verminderen van externaliserend probleemgedrag, waarbij de informatie uit de individuele neurocognitieve sterkte- en zwakteprofielen wordt meegenomen en waarbij rekening wordt gehouden met individuele verschillen in de neurocognitieve mechanismen die onderliggend zijn aan de ontwikkeling van het externaliserend gedrag, blijkt effectief bij kinderen met een hoog risico op toekomstig crimineel gedrag (Hoofdstuk 5). Onze studie laat zien dat tussen de 70% en 80% van de kinderen met een hoog risico profiteert van de individueel op maat gemaakte, preventieve aanpak van het PIT. In vergelijking met andere gerenommeerde interventies zoals Parent Management Training Oregon (Thijssen, Vink, Muris, & de Ruiter, 2017), effectief in 45,8% van de kinderen, en Primary Care Triple P (Spijkers, Jansen, & Reijneveld, 2013), welke niet effectiever is dan gebruikelijke zorg, zijn onze resultaten zeer veelbelovend. De PIT professionals leveren zorg die is aangepast aan de behoeften en mogelijkheden van het kind en de omgeving en die gericht is op de ondersteuning van de sociale ontwikkeling. Als eerste stap wordt in het bestaande aanbod van interventies en op school naar mogelijkheden gezocht, passend bij het individuele sterkte- en zwakteprofiel. Wanneer niets geschikt voorhanden is, gaan de PIT professionals buiten de gebaande paden om te voorzien in de zorg die het kind nodig heeft. Wanneer een kind bijvoorbeeld extra ondersteuning nodig heeft om een *transfer* te maken van getrainde sociale vaardigheden naar het gebruik van die vaardigheden in de klas, zorgen de PIT professionals ervoor dat een paar uur per week een coach in de klas en op het schoolplein is om te helpen bij het maken van de *transfer*. Deze multimethodische aanpak procedure is anders dan gebruikelijke protocollaire modules die veelal ingezet worden in de klinische praktijk, waar het gedrag leidend is voor de interventie in plaats van de verklarende onderliggende mechanismen. Het succes van de maatwerkaanpak ondersteunt de suggestie op basis van eerder onderzoek dat het belangrijk is om specifieke sociaal-emotionele disfuncties van een specifiek kind te gebruiken als leidraad voor de interventie,

waarbij het van belang is die neurocognitieve mechanismen in beeld te brengen waarvan is aangetoond dat ze belangrijk zijn bij het risico op de ontwikkeling van antisociaal gedrag (Hunnikin & van Goozen, 2018).

De resultaten in dit proefschrift tonen aan dat individueel maatwerk, met de nadruk op de onderliggende neurocognitieve mechanismen van het gedrag, effectief is in het verminderen van externaliserend probleemgedrag. Hierbij dient opgemerkt te worden dat in de PIT aanpak, de samenwerking met school centraal staat. Niet alleen zijn professionals op school goed in staat om probleemgedrag te signaleren, maar de schoolomgeving is ook een belangrijke sociale leeromgeving met professionele opvoeders waar kinderen een groot deel van de dag van kunnen profiteren. Het is aan te bevelen om in een volgende fase van het onderzoek te evalueren welke interventieonderdelen effectief zijn voor de ontwikkeling van specifieke neurocognitieve functies.

Slotopmerkingen

De studies in het huidige proefschrift tonen beperkingen aan in de affectieve empathie, de emotieherkenning en het executief functioneren in een groep kinderen met hardnekkig externaliserend gedrag en een hoog risico op de ontwikkeling van ernstig probleemgedrag zoals crimineel gedrag. Bovendien geven de studies in dit proefschrift aan dat individuele sterkte- en zwakteprofielen van de neurocognitieve en neuroaffectieve vaardigheden zorg op maat effectief kunnen ondersteunen. Dit is niet alleen belangrijk voor de ontwikkeling van de kinderen maar ook voor hun gezinnen en mogelijk voor de samenleving. Het is daarom zinvol om in toekomstig onderzoek de specifieke werkzame bestanddelen van de PIT aanpak verder in beeld te brengen.

Curriculum Vitae



Curriculum Vitae



Lisette van Zonneveld werd op 11 januari 1986 geboren te Sassenheim. In respectievelijk 2003 en 2005 heeft zij haar havo en vwo diploma behaald aan het Rijnlands Lyceum te Sassenheim. Hierna is zij in 2005 begonnen aan de bachelor Pedagogische Wetenschappen aan de Universiteit Leiden waarna zij aansluitend de tweejarige Research Master ‘Developmental Psychopathology in Education and Child Studies’ (track: Clinical Practice and Research) afrondde bij de afdeling Orthopedagogiek in 2011. Tijdens deze Research Master heeft Lisette een klinische stage van tien maanden afgerond aan het Ambulatorium, onderdeel van het Leids Universitair Behandel-

en Expertise Centrum en verbonden aan de Universiteit Leiden, waar zij haar Basisaantekening Diagnostiek heeft behaald. Na het behalen van haar master graad en registratie als NVO basis orthopedagoog is Lisette in november 2011 gestart als onderzoeksassistent aan de Universiteit Leiden bij de Programmagroep Neuropedagogiek en Ontwikkelingsstoornissen. In deze functie was zij betrokken bij de opzet en uitvoering van de screening op sociale leerbaarheid in samenwerking met het Preventief Interventie Team van de Gemeente Amsterdam. In 2015 werd Lisette aangesteld als promovendus en begon zij met haar promotieonderzoek. Onder begeleiding van prof. dr. Hanna Swaab, prof. dr. Stephanie van Goozen en dr.ir. Leo de Sonnevile heeft zij onderzoek gedaan naar de neurocognitieve en neuroaffectieve mechanismen onderliggend aan antisociaal gedrag bij kinderen met een hoog risico op een criminele toekomst. Met als doel om deze kinderen, in een vroeg stadium, maatwerk interventies te bieden. De resultaten van dit onderzoek staan beschreven in dit proefschrift. Momenteel werkt Lisette bij de Waag, onderdeel van De Forensische Zorgspecialisten. Bij de zorglijn Jeugd houdt zij zich bezig met diagnostiek en behandeling van jeugdigen.

List of Publications



List of Publications

Journals

Van Zonneveld, L., Platje, E., De Sonnevile, L., Van Goozen, S., & Swaab, H. (2017). Affective empathy, cognitive empathy and social attention in children at high risk of criminal behaviour. *Journal of Child Psychology and Psychiatry*, 58 (8), 913-921.

Van Zonneveld, L., De Sonnevile, L., Van Goozen, S., & Swaab, H. (2018). Recognition of facial emotion and affective prosody in children at high risk of criminal behavior. *Journal of the International Neuropsychological Society*, 25 (1), 57-64.

Van Zonneveld, L., Van Goozen, S., De Sonnevile, L., & Swaab, H. (under review). Executive function impairments contribute to externalizing problem behaviour in children at high risk of future criminal behaviour.

Van Zonneveld, L., Swaab, H., De Sonnevile, L., & Van Goozen, S. (submitted). Customized preventive interventions reduce externalizing behaviour in at-risk children.

Abstracts

Van Zonneveld, E.M., Van Rijn, S., Van Goozen, S.H.M., & Swaab, H. (July 10-13, 2013). *Eye-tracking and the role of social attention regulation in aggressive children*, as part of the symposium: Regulatory mechanisms and their neural substrates in aggression and antisocial behavior. International Neuropsychological Society mid-term meeting (INS), Amsterdam, the Netherlands.

Van Zonneveld, L., Platje, E., De Sonnevile, L., Van Goozen, S., & Swaab, H. (June 20-22, 2018). *Affective empathy, cognitive empathy and social attention in children at high risk of criminal behaviour*. The European Association for Forensic Child & Adolescent Psychiatry, Psychology & other involved professions (EFCAP), Venice, Italy.

Van Zonneveld, L., De Sonnevile, L., Van Goozen, S., & Swaab, H. (June 20-22, 2018). *Recognition of facial emotion and affective prosody in children at high risk of criminal behaviour*, as part of the symposium: Understanding of

and intervening in emotion problems in children with antisocial behaviour. The European Association for Forensic Child & Adolescent Psychiatry, Psychology & other involved professions (EFCAP), Venice, Italy.

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