Forms and Functions of Aggression in Preschool-age children: The roles of Executive Function and Emotion Understanding

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Ehara taku toa i te toa takitahi, engari he toa takitini.

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Om Bhur Bhuvah Swaha,

Tat Savitur Varenyam,

Bhargo Devasya Dhimahi,

Dhiyo Yo Nah Prachodayat

Gratitude and praise to the powers of transformation, inner growth, and self-realisation provided by the radiant light of the divine (or whatever)

Abstract

This study adopted a multidimensional approach to investigate the relationships between children's executive function, emotion understanding and forms and functions of aggression in children from five different preschools in Christchurch, New Zealand. The study aimed to explore potential gender differences within these relationships and to see which components of executive function and emotion understanding would be most predictive of different subtypes of aggression. Potential interactions between executive function and emotion understanding were also explored as predictors of aggression. One hundred and thirty-seven preschool-age children (61 boys and 77 girls) from 2 to 5 years of age (mean age = 3.9, SD = 0.73) completed inhibitory control and cognitive flexibility tasks and expressive and receptive emotion understanding tasks. Teachers completed questionnaires on children's aggressive behaviours. Emotion understanding emerged as a significant predictor across aggression forms and functions. Distinct patterns were observed with lower receptive emotion understanding associated with reactive aggression and higher levels linked to proactive aggression. Lower receptive emotion understanding and higher inhibitory control predicted increased teacher-reported reactive relational aggression. This suggests there is a more intricate relationship between executive function, emotion understanding and aggression in preschool-age children that extends beyond a simple deficit-based explanation.

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Chapter 1: Introduction

Some expression of aggression in young children is viewed as developmentally normative, stabilising over time as children develop in their cognitive, social, and emotional functioning (Eisenberg, 2020; Tremblay, 2002; Vitaro et al., 2006). Aggression can be defined as a range of behaviours designed to hurt or harm others. Common forms of aggression observed in young children typically include physical aggression, like hitting, pushing, or snatching and relational aggression, like excluding another child from play or withdrawing friendship (Ostrov et al., 2018). These forms of aggression provide different functions, categorised as reactive or proactive, reflecting distinct motives behind the aggression (Evans et al., 2019b). Reactive aggression can be expressed physically or relationally as a spontaneous response to perceived or actual provocation or threat, whereas proactive aggression is commonly expressed as a pre-meditated response. A decrease in these aggressive behaviours overall is often considered a critical developmental milestone indicative of positive adjustment (Card & Little, 2006; Denham, 1986; Denham et al., 2002; Izard et al., 2008; Laurent et al., 2020).

Conversely, ongoing or developmentally-inappropriate aggressive behaviours in preschool-age children can lead to adverse outcomes such as problems in peer, sibling and teacher interactions (Godleski et al., 2015; Gower et al., 2014; Poulou & Bassett, 2018; Swit et al., 2023; Yue & Zhang, 2023), learning difficulties and school adjustment (Denham et al., 2014; Ostrov & Crick, 2007) and bullying perpetration and victimisation (Jamie M Ostrov et al., 2022). Some children may be more susceptible to developing persistent aggressive behaviours, particularly if their vulnerabilities and social difficulties go unnoticed (Schuberth et al., 2019; Swit et al., 2023).

Aggression in Early Childhood

Recent research challenges common perceptions of early childhood aggression and suggests that the development and presentation patterns of aggression in preschoolers are more complex than previously thought, as they can vary significantly based on other factors such as age, gender, and individual child characteristics (Austin et al., 2017; Evans et al., 2019b; Jamie M. Ostrov et al., 2022). This can make it challenging to track normative social development in preschool-age children. Continued examination of individual child characteristics of preschool-age children's aggression is needed to more effectively inform interventions and support systems (Baker et al., 2019; Swit et al., 2023).

Moreover, there are multiple risk factors for aggression in preschoolers that involve a complex interplay of environmental, individual, and developmental factors. Family dynamics and parental socialisation practices (Navarro et al., 2022; Tremblay et al., 2004) and individual factors such as temperament (Ostrov et al., 2023; Van Adrichem et al., 2020a), emotion regulation (Held, 2020; Röll et al., 2012), and cognitive abilities (Denham, 1986; O'Toole et al., 2017) have all been found to contribute to aggression during early childhood. Particular interest has been paid to executive function and emotion understanding as both drivers and mitigators of aggression in children (Arsenio & Lemerise, 2010; Denham et al., 2002; Laurent et al., 2020; Suurland et al., 2016).

Study Rationale

According to the Social Information Processing (SIP) model of aggression (Dodge & Crick, 1990) deficits in executive function, such as poor inhibitory control, can lead to impulsive or emotionally dysregulated behaviours associated with aggression during early childhood (Greenberg, 2006; Sasser et al., 2015; Séguin & Zelazo, 2005). Additionally, deficits in emotion function within the SIP model are also thought to contribute to aggression in preschool-age children (Arsenio, 2010). These include challenges in emotion

understanding (Denham et al., 2002), moral and empathic thinking (Tampke et al., 2020) as well as difficulties in recognising emotions (Acland et al., 2021)

Research on aggression has primarily targeted school-age children and adolescents, due to the importance of executive and emotion function development during these critical stages (Card & Little, 2006; Fite et al., 2008; Fraser, 1996; Granvald & Marciszko, 2016). Executive and emotion function become increasingly important for adaptive functioning for these age groups, given the rapid expansion of social contexts, ongoing development of relationships and identity, and increasing expectations related to academic or learning milestones (Ahmed et al., 2019; Choudhury et al., 2006; Latzman et al., 2010; Rapee et al., 2019). However, it is equally important for further research to prioritise the exploration of these factors in early childhood.

The foundations for lifelong development are established in this period (Fox et al., 2010; Masten & Cicchetti, 2010). Early experiences shape cognitive, social, and emotional development, profoundly impacting a child's abilities, behaviour, and well-being in later years (Blankson et al., 2013; Goldstein & Boxer, 2010; McClelland et al., 2013; Porsch et al., 2016). Therefore, research carried out on this age group holds potential for nurturing elements such as executive function or emotion function, particularly for children susceptible to maladaptive aggression (Diamond et al., 2007; Keown et al., 2020; McClelland et al., 2017).

However, both executive and emotion function are multi-dimensional constructs and few studies have examined how individual executive function and emotion processes map onto the 4 different subtypes of aggression during early childhood. For example, while evidence supports the association between inhibitory control and physical and reactive forms of aggression (Granvald & Marciszko, 2016; Noten et al., 2020), our understanding of other facets of executive function and their relationship with both forms and functions of aggression remains limited. Equally, while aspects of emotion function have been linked to

relational aggression, such as emotion understanding and empathy, (Schuberth et al., 2019; Tampke et al., 2020), little is known about how these are related to other subtypes of aggression in preschool-age children.

Further, both executive and emotion function are in emergent stages of development in early childhood (Huizinga et al., 2006; Lee et al., 2013; Pons et al., 2004) implying that children may be at different stages of progress in their development. This can lead to diverse patterns of cognitive and emotional growth (Blair et al., 2015; Smith & Hart, 2011) that, in turn, can have different, ongoing outcomes or cascade effects (Cicchetti & Masten, 2010). Therefore, understanding how these forms and functions of aggression are differentially associated with developmental constructs of executive function and emotion understanding is necessary to provide a clearer picture of social and emotional development in young children.

Thesis Overview by Chapter

This introductory chapter outlines the study background, rationale and overview of the thesis. Chapter 2 reviews the literature on childhood aggression in preschool-age children and covers the key concepts of Executive Function and Emotion Understanding within the Social Information Processing model. We present a theoretical framework and describe the current study aims, questions, and hypotheses, and planned data analysis. Chapter 3 includes the method section with information on participants, measures, and study design. Statistics and results of the statistical analysis are described in Chapter 4. Finally, Chapter 5 presents the discussion of the study's results, including practical implications as well as strengths and limitations of the study that may inform future research and interventions in the field.

Chapter 2: Literature Review

This chapter provides an overview of the literature on aggression during early childhood and describes its distinct presentations. The Social Information Processing model (SIP) steps are explained and the roles of Executive Function (EF) and Emotion Understanding (EU) within the model are described. Research pertaining to independent and interactive associations of EF and EU in relation to aggression in preschoolers is reviewed, addressing complexities and methodological challenges. The chapter also presents an integrated framework using the Social Information Processing Model (Dodge & Crick, 1990) and Developmental Cascade model (Cicchetti & Masten, 2010), which provides a foundation for the study results and discussion. The chapter concludes by presenting the study's aims, research questions and hypotheses and planned data analysis.

Aggression in Preschool-age Children

Children's aggressive behaviours have been shown to change in both form and function over the preschool years (Crick, Ostrov, & Werner, 2006). Physical aggression that is reactive, often in the presence of frustration, typically reaches a peak at age 3 and then declines as children's regulatory and prosocial behaviours increase (Ostrov et al., 2013). Although the frequency of physical aggression has been shown to decrease between the ages of 2 and 5, some children display ongoing aggression from a young age into later years, particularly physical aggression (Cummings et al., 1989). In contrast, relational aggression, such as spreading rumours or exclusion, is also thought to start in early childhood yet tends to remain relatively consistent, particularly among older girls (Crick et al., 2006; Swit & Slater, 2021). As children get older, aggression tends to evolve and can become intentional or proactive in nature, rather than solely reactive and may not always be as overtly physical as seen in the earlier years (Swit, 2019).

Prinstein and Cillessen (2003) proposed a combined, two-dimensional approach of examining aggression where forms and functions are crossed. This results in the categorisation of four subtypes of aggression: proactive physical, reactive physical, proactive relational and reactive relational. Below, the literature is examined where this two-dimensional approach aggression is taken. However, although these distinctions can provide a more precise examination of aggression that may reveal more details about why children exhibit such behaviours (Evans et al., 2019a), not all studies examine both forms and functions.

Age and Gender-based Differences in Aggression

Research on aggression among school-aged children and adolescents has shown patterns in gender-specific behaviours and shifts in aggression across different age groups. For example, physical aggression in older children aged 5 to 11 appears to decline in girls but not boys (Cummings et al., 1989). Following this, Crick and Grotpeter (1995) found that school-age boys and girls exhibit aggression differently. This appears to be driven by gender-specific social goals, such as the pursuit of physical dominance for boys, and the prioritisation of developing secure social relationships for girls. One of the theoretical explanations is the influence of societal gender roles, where girls are encouraged to mask anger and emphasise relationship-building, while boys are directed to display assertiveness (Bowie, 2007). However, evolving research queries these established patterns, particularly in the context of relational aggression (Card & Little, 2006; Ersan, 2020; Laurent et al., 2020).

Some studies indicate that, on average, both boys and girls exhibit similar levels of relational aggression (Card & Little, 2006; Ersan, 2020). Gender-atypical aggressive behaviours (i.e. boys engaging in relational aggression and girls exhibiting physical aggression), have been observed in both genders, with boys and girls engaging in physical forms of aggression, such as ruining peer belongings, and relational aggression, such as

threatening to exclude or excluding others (Swit, 2019). Furthermore, parental and teacher perceptions of forms of aggression often align with societal norms, perceiving girls as more relationally aggressive and boys as more physically aggressive (Swit, 2019). This bias may contribute to the oversight of gender-atypical forms of aggression (Evans et al., 2019b; Swit, 2019). Few studies have explored gender differences across functions of aggression. Some studies indicate higher proactivity and reactivity in adolescent boys (Little et al., 2003) while others reveal no gender differences in older boys (Fite et al., 2008).

Gender-based variations in patterns have also been reported in early childhood studies. By age three, preschoolers begin to exhibit gender-related patterns in forms of aggression with males exhibiting more physical and verbal aggression, and females leaning towards relational aggression (Bowie, 2007; Ostrov & Keating, 2004). Typical trends suggest that boys display more overt aggression, such as physical or verbal aggression while girls tend to engage more in relational aggression (also referred to as indirect aggression), aimed at influencing social dynamics or peer acceptance (Björkqvist, 2018; Ostrov & Keating, 2004). Relative to older children, younger children have been shown to be less likely to join in aggressive acts or victimisation of peers (Monks et al., 2021). Further, when young children exhibit aggressive behaviour, it is more likely to be towards children of their own gender choose (Monks et al., 2021), perhaps reflecting that young children tend to choose same gender playmates (Martin et al., 2013).

These findings point to gender differences in expressions of aggression in early childhood, which challenge conventional notions that aggression during this period adheres strictly to gender or age-specific patterns. Continued examination of gender differences across both forms and functions of aggression and between younger and older preschool-age children is warranted to dispel any oversimplified assumptions about how aggression manifests in early childhood. Moreover, while gender may play a role in a child's propensity

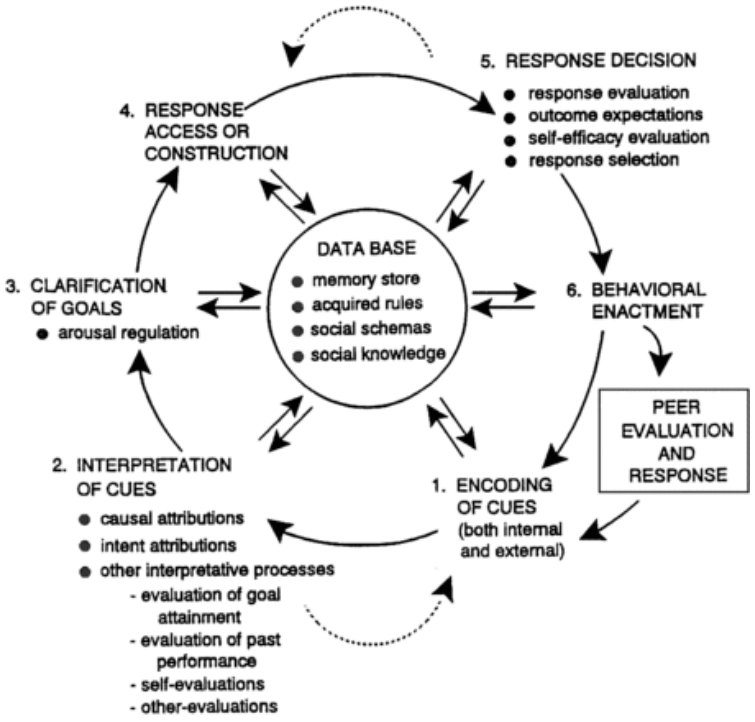
to engage in aggression, the manner in which past aggressive experiences are conceptualised by the child also impacts the likelihood of future behaviours recurring.

Social Information Processing Model of Aggression

The Social Information Processing model of aggression posits that children's aggressive behaviours can stem from individual interpretations of social cues and cognitive processes. As shown in figure 1, the model consists of six distinct steps in an information processing sequence—namely, encoding, interpretation, response generation, and response selection and behavioural enaction. (Dodge & Crick, 1990). At step one, children encode and attend to relevant social cues in their environment. This involves perceiving and interpreting the actions, expressions, and cues of others, including emotions and can lead to aggressive behaviours if children misperceive ambiguous provocations as hostile and intentionally harmful (De Castro et al., 2002). After encoding, children interpret the social cues to derive meaning. This step involves making sense of the intentions or emotional states of others using internal knowledge structures based on prior or current experience. Similarly to hostile misperceptions, children with hostile knowledge structures tend to misinterpret the intentions of others and respond aggressively (Bates et al., 2010). Thirdly, children clarify their goals in the given social situation, determining what they want to achieve in relation to the interpreted social cues and their own objectives. In the fourth step, children then generate a range of potential responses to achieve the goals set. In the fifth step, children choose a response from the pool of generated responses that they believe is most likely to achieve their goals based on their interpretation of the social cues and their objectives. The next three steps of the model require children to employ planning, problem-solving and decision-making skills in order to respond appropriately.

Figure 1

Reformulated Social Information Processing Model of Children's Social Adjustment



Note. Steps 1 to 6 of a non-linear flow of processing are shown. This figure was proposed by Crick, Nicki R.; Dodge, Kenneth A. (1994) A review and reformulation of social information-processing mechanisms in children's social adjustment. Psychological Bulletin, 1 (115), 76. http://dx.doi.org/10.1037/0033-2909.115.1.74. Copyright © 1994 by American Psychological Association

The reformulated model includes a sixth step that represents the final response or behavioural output by the child. When children experience difficulties in these areas of cognitive functioning, the aggressive behaviours that occur can be thought of as the outward, final product of the process (Crick & Dodge, 1994). Additionally, the reformulated model emphasises that the processes involved in each step may occur simultaneously and are iterative. In summary, according to the SIP model, aggressive behaviours are explained by

social schemas and ongoing cognitive processes. This suggests a uniqueness in each child's approach to understanding and reacting to their social environment.

Executive Function

Executive Function (EF) represent a complex set of neurocognitive functions, which can be categorised into three components: working memory, inhibitory control, and cognitive flexibility (Diamond, 2013). Described as goal-oriented problem solving behaviours (Zelazo, 2020), EF skills allow children to pay attention, adapt flexibly to different situations, and control responses to stimuli before acting on them (Diamond, 2013; Zelazo, 2015). As children grow and develop, their EF abilities undergo rapid changes that can influence vary aspects of their cognitive, social and emotional development (Ahmed et al., 2019; Huizinga et al., 2006; Lee et al., 2013). It follows then that EF is considered to be a critical component of the SIP model (Caporaso et al., 2021) and consequently has been found to play an important role in preschool-age children aggression (Caporaso et al., 2021; Denham et al., 2014; Granvald & Marciszko, 2016; O'Toole et al., 2017).

Working Memory

Working memory (WM) involves the ability to mentally hold, analyse and use verbal or visual information, and is required for understanding sequential events (Diamond, 2013). In the SIP model, WM is thought to be used during the process of encoding, storing, and retrieving relevant social information. It aids in holding and manipulating social information or cues, allowing children to effectively evaluate and respond to social situations (Caporaso et al., 2021). A common example of a working memory task is the digit span task in which the child is presented with a sequence of numbers (e.g., 3-7-1-9-2-4) and is asked to repeat them back in reverse order immediately after hearing the sequence (Diamond, 2013).

Inhibitory Control

Inhibitory control (IC) includes two cognitive processes: response and attentional inhibition (Tiego et al., 2018). Response inhibition involves stopping or suppressing a motor response, such as snatching a toy. Attentional inhibition refers to the ability to resist interference from distracting stimuli to maintain a goal-oriented task, also referred to as interference control (Zelazo & Müller, 2010).

In the context of Social Information Processing (SIP), IC is required in the first two steps: response evaluation and decision-making. It helps children suppress impulsive reactions and supports processing that leads to more thoughtful and socially adaptive behaviours. A common measure of IC is the Flanker test, which involves asking the child to focus on a target stimulus while ignoring surrounding (flanking) stimuli (Zelazo, Anderson, Richler, Wallner-Allen, et al., 2013).

Cognitive Flexibility

Cognitive flexibility (CF) refers to the capacity to adapt thinking and behaviour in response to changing circumstances. It involves mental flexibility, the ability to switch between different tasks or perspectives, and set-shifting, the ability to change cognitive strategies (Patwardhan et al., 2021b) such as viewing something from a different perspective or remembering different rules for different situations (Suchy, 2015; Zelazo, 2020). In the SIP model, CF has been linked to response evaluation (Caporaso et al., 2021). Further distinction is made between perseverative errors in CF, where children incorrectly continue with a previous rule, and CF distraction errors, where children struggle to uphold their current sorting rule (Blakey et al., 2016). The Dimensional Change Card Sort (DCCS) task is commonly used to assess CF in young children and involves sorting cards based on different rules, like colour or shape (Zelazo, Anderson, Richler, Wallner-Allen, et al., 2013).

Structure of Executive Function in Preschool-age Children

EF have been further differentiated into a continuum of "hot" or "cool" functioning, which accounts for the influence of emotion and social factors on EF processes (Zelazo & Carlson, 2012). "Hot" EF involves regulating emotions, considering social cues, and making decisions based on emotional states. On the other hand, "Cool" EF, focuses more on purely cognitive processes, such as logical and abstract thinking, without emotional or social influences (Zelazo & Carlson, 2012).

From a developmental perspective, EF is characterised by non-linear growth, showing individual variations in trajectories and rapid changes in early childhood particularly between the ages of 3 and 5 (Anderson & Reidy, 2012; Reilly et al., 2022; Zelazo et al., 2016). Debate surrounds whether EF in this developmental period should be seen as a single, unified construct or as separate components (Karr et al., 2018). Current evidence supports both perspectives, with some studies supporting a unidimensional model suggesting a common cognitive skill across tasks in young children (Reilly et al., 2022; Willoughby et al., 2012), while others propose a two-factor model, especially in older preschool-age children from the age of 5 (Monette et al., 2015; Nelson et al., 2016) . According to the unidimensional model, EF evolves with age, with WM and IC appearing as foundational precursors to CF (Best & Miller, 2010; Blakey et al., 2016; Carlson, 2005; Diamond, 2013). Tasks like the Dimensional Change Card Sort (DCCS) indicate the increasing developmental complexity and integration of WM and IC components as three-year-olds adhere to initial rules, while 5-year-olds exhibit flexible rule-switching (Doebel & Zelazo, 2015).

In relation to aggression in preschool-age children, if EF is seen as a unified construct, deficits in this general cognitive ability may pose a global risk for different forms and functions of aggression. That is to say, a child with overall weaker EF might face challenges in impulse control, emotional regulation, and problem-solving, increasing the likelihood of

aggressive behaviour in various situations. Alternatively, if EF is viewed as having distinct factors, particular deficits in one factor may be linked to different forms or functions of aggression or may be influenced positively or negatively by other factors. However, as a multidimensional construct, assessing EF in young children poses challenges due to these varying conceptualisations about structure and differing definitions of components and associated behaviours.

Assessment of Executive Function in Preschool-age Children

EF measures are often multidimensional, presenting "task impurity" challenges, making it difficult to isolate individual components. For instance, according to Diamond (2013), many WM measurement span tasks include other processes such as selective attention rather than just the ability to hold information and use it. Similarly, a task that is designed to assess IC may inadvertently tap into WM, making it challenging to attribute any observed outcomes solely to IC (Noreen & MacLeod, 2015). Furthermore, measuring WM in preschool-age children using span tasks presents other difficulties, such as interference during recall, sequential processing demands, and language limitations, which can affect scores and task completion in this age group (Roman et al., 2014).

To overcome this limitation and manage the complexity that can arise when looking at multiple components of EF, a composite score can be used to provide a single numerical representation of overall performance across multiple domains. However, the use of summary scores may mask individual factors, especially in young children who may be easily distractible (Anderson & Reidy, 2012). Further, EF difficulties related to one component does not necessarily mean difficulties in others (Anderson & Reidy, 2012) and individual strengths in some areas can influence EF performance in others.

Executive Function and Aggression

Lower EF in early childhood has been connected to higher impulsive or reactive behaviours (Séguin & Zelazo, 2005), poor social adjustment (Sasser et al., 2015), disruptive or externalising behaviour (Schoemaker et al., 2013; Willoughby et al., 2011), and reduced social competence (Caporaso et al., 2021). Some studies have specified WM as the most significant factor in aggression in both preschoolers and older children (Caporaso et al., 2021; Granvald & Marciszko, 2016). Others have identified low IC as a central predictor of aggression in children aged 3 to 6 years (Baker et al., 2019; Poland et al., 2016).

Of the few studies that have explored EF across a two-dimensional model of aggression, a clear association has been established between low IC and higher reactive, physical aggression (Baker et al., 2019; O'Toole et al., 2017; Poland et al., 2016). This makes sense developmentally, as preschool-age children with emergent IC skills may resort to a "lashing out" type of aggression to achieve their goals. However, the relationship between IC and other subtypes of aggression such as relational aggression is less clear.

While there is little empirical knowledge regarding the link between CF and forms and functions of aggression, some attention has been paid to CF's role during the response evaluation and decision-making steps in the SIP process (Caporaso et al., 2021). It is suggested that CF may enable children to adapt their thinking and responses based on changing social cues. Theoretically, this would support more adaptable and context-appropriate responses, i.e. fewer aggressive responses (Patwardhan et al., 2021a).

These results have several implications. Firstly, that EF contributes to aggression differently at various ages, which explains the observed variability in the EF-aggression relationship across studies. As such, greater attention should be paid to age when considering developmentally sensitive constructs of aggression and EF. Further, findings across studies suggest that the relationship between EF and aggression is not limited to IC but likely

involves a dynamic interplay with other factors such as emotions (Baker et al., 2019; Granvald & Marciszko, 2016; Rohlf et al., 2018). From this point onward in the current study, for EF the focus will be exclusively on the examination and discussion of IC and CF.

It is also important to acknowledge that EF does not operate in isolation of other cognitive function and neural processes (Lemerise & Arsenio, 2000). Instead, emotion and cognition are thought to function in tandem (Bell & Wolfe, 2004; Storbeck & Clore, 2007). This is particularly evident in the differentiation between "hot" and "cold" EF. "Hot" EF tasks refer to the emotionality a child may experience during a task, which requires managing emotion and processing social cues in emotionally charged situations, whereas "cold" EF tasks involve more detached cognitive processes that are less influenced by emotionality (Zelazo & Carlson, 2012). Therefore, a comprehensive understanding of preschool aggression likely requires including other factors such as emotion function rather than focussing exclusively on EF.

Emotion Function

Emotion Function is another domain thought to be implicated in forms and functions of aggression in preschool-age children. It consists of various cognitive, expressive, and regulatory processes. These include a diverse range of responses to stimuli (Russell, 2003) spanning from typical emotions such as joy, fear, or anger to broader emotional states known as affect or moods. These can be thought of essentially as reflections of children's internal states and experiences (Bretherton et al., 1986).

Children's emotional states are influenced by their interactions and environment and continually evolve as children grow and develop (Blankson et al., 2013). Experiences, relationships, and surroundings shape children's emotional development and emotions, in turn, reciprocally influence children's interactions with others, places, and events (Campos, 1996). Therefore, emotion function can be described as dynamic processes that link the child

with their environment (Bell & Wolfe, 2004; Gross, 2014; Leerkes et al., 2008; von Salisch et al., 2013) and influence how children understand, navigate and express emotions in response to their evolving surroundings (Critchley & Garfinkel, 2017; Levenson, 1999; Shablack & Lindquist, 2019). Therefore, it follows that emotion function processes are strongly implicated in a child's ability to form relationships, or display empathy, and problem-solve (Bertie et al., 2021; C. Izard et al., 2008; Scherer, 1982).

Constructs Within Emotion Function

Emotion Function can be described as a super construct that represents various component processes related to the regulation, expression and cognition or recognition of emotion. Interrelated emotion function constructs such as emotion regulation (Helmsen et al., 2012; Röll et al., 2012; Roos et al., 2016) and emotion knowledge, including emotion understanding have all been linked to problems in social interactions and externalising or aggressive behaviours. (Denham et al., 2012; Garner & Waajid, 2012; Trentacosta & Fine, 2010).

Emotion Regulation

Emotion regulation refers to both conscious and unconscious strategies that are required to monitor, modify and influence emotions and emotional experiences for self and for others (Gross, 2014; McRae & Gross, 2020). It has been argued that emotion regulation is often used as a proxy for EF because both involve cognitive abilities such as IC that help children control and adjust their emotions and responses (Campbell et al., 2016).

Research has linked children's emotion regulation difficulties with aggressive behaviour, particularly reactive relational aggression (Ersan, 2020; Ostrov et al., 2013). Furthermore, gender and age differences have been found to play a role in how emotion regulation contributes to aggression. Individual studies have shown that both emotion regulation strategies and outcomes can vary amongst girls and boys (Cai et al., 2020; Röll et

al., 2012). Girls tend to exhibit better emotion regulation than boys, which appears to result in fewer externalizing behaviours (Röll et al., 2012). These findings are supported by results from a meta-analysis that found gender differences in emotional expression, where girls tend to exhibit more positive emotion and less externalising behaviour (Chaplin & Aldao, 2013)

From a deficit perspective of SIP, a systematic review carried out by Smeijers et al. (2020) examined the research to-date on the role of emotion and SIP in aggressive behaviour in children, adolescents, and adults. 8 out of the 13 studies reviewed pertained to school-aged children. After study results were delineated between emotionality, understanding and regulation, a considerable overlap was identified between SIP processes, emotion and emotion regulation processes. This lends further support to the theory that both emotion and emotion regulation influence SIP and are jointly implicated in aggressive behaviour in children.

More importantly for the context of the current study, these findings build on previous research on the relationship between EF and aggression and more especially the role of IC in behaviour regulation. They also align with studies on aggression that call attention to gender differences. However, emotion regulation involves several different processes (Weinberg & Klonsky, 2009), including emotional awareness, understanding, acceptance, and flexible regulation strategies across different contexts (Cole et al., 1994; Eisenberg & Spinrad, 2004) and has been operationalised in different ways. A more precise lens is required for the purpose of our investigation that can essentially separate out the different threads within emotion regulation.

Emotion Knowledge

Emotion knowledge has been described as children's understanding of what emotions are, why they occur, and their awareness of controlling emotion responses (Di Maggio et al., 2016). Skills related to emotion knowledge include interpreting emotions from facial

expressions and social cues or situations and are believed to develop early in life and advance in complexity throughout childhood (Campbell et al., 2016; Trentacosta & Fine, 2010).

Emotion knowledge has been found to support cognitive competence at school and social competence at home in children aged between 3 and 5 year (Garner & Waajid, 2012). Other studies carried out on children in a similar age range have shown that children with better self-regulation and emotion knowledge showed more adaptive responses and these were correlated with improved classroom behaviour and early literacy skills (Denham & Bassett, 2020).

With regard to aggression, Ornaghi et al. (2017) implemented an emotion conversation-based training program for toddlers, led by nursery schoolteachers. Aggression function was assessed through video observations of children's peer interactions. Reactive aggression was scored when a child defensively reacted to provocation or attack, and proactive aggression was scored when a child deliberately provoked, challenged, or attacked others. Results showed that children's comprehension and spontaneous use of emotion knowledge during peer play was enhanced post-training. Furthermore, children reportedly engaged in increased acts of emotion kindness and sharing behaviours. However, the training did not appear to affect the children's level of proactive or reactive aggression towards others.

We could speculate from this that some other factor is involved in children's responses to provocation which overrides children's abilities to use the emotion knowledge they have gained. Findings from prior research have proposed that younger children may hold more accepting beliefs about aggression compared to older children (Swit et al., 2016). Therefore, it is possible that the lack of findings for reduced aggression observed in this study could be attributed to the program's focus on emotion-related skills rather than directly addressing aggressive behaviour. This places further importance on understanding forms and functions of aggression so that we can target skills in education-based interventions to address these

beliefs and reduce aggression. The role of EF could also be a factor, as ongoing development in EF domains such as IC may limit children's ability to regulate aggression effectively.

Taken together, these findings show the close connection between understanding the emotions of others and effectively regulating one's own emotions in order to respond appropriately in social situations. Yet the observations reported by Ornaghi et al. (2017) also suggest that there may be a greater complexity in the underlying mechanisms that drive aggressive behaviours.

Emotion Understanding

Emotion Understanding (EU) includes skills like recognising emotions, understanding facial expressions, and knowing emotion triggers (Eggum et al., 2011). EU can be categorised into two aspects: declarative, which involves knowledge about the nature, causes, and effects related to emotion, and procedural, referring to activities such as recognizing or expressing and then controlling emotions in oneself or others (Viana et al., 2022).

In young children EU skills start with attaching labels to emotion feelings and expressions and emerge from about the age of two (Izard, 2009). They progress sequentially, stemming from basic skills such as understanding of emotional valence ("feels good" or "feels bad") and show growing proficiency in external recognition such as identifying and labelling mixed emotional expressions (Bassett et al., 2012; Pons et al., 2004; Rhoades et al., 2011). These foundational, procedural EU skills are often assessed through receptive and expressive identification of emotions. For example, the Affect Knowledge Test (AKT) measures preschoolers' understanding of emotions using cartoon-like faces displaying various expressions (Denham, 1986; Denham et al., 2020). Children label the emotions verbally (expressively) and then identify nonverbally by pointing (receptively). Ensor and Hughes (2005) demonstrated emergent EU skills in toddlers aged 2 and a half. They reported that expressive and receptive EU were linked to more positive behaviour than verbal ability.

Similar to the AKT task Denham (1986), child participants in their study were asked to identify (point) and match labels to emotions in different scenarios. Positive behaviour was measured through maternal rating and researcher observations. The results of this study illustrate the relevance of non-verbal EU skills at an early age and how this can shape behaviour.

Emotion Understanding: Related Constructs

Constructs like Theory of Mind (ToM), empathy, and callous-unemotional (CU) traits are often discussed in relation to children's EU (Eggum et al., 2011; O'Brien et al., 2011; Pons et al., 2004). ToM involves the ability to attribute mental states to others (Wang et al., 2023), empathy entails both cognitive and affective understanding of others' emotions (Spinrad & Gal, 2018) and CU traits relate to deficits in empathy and concern for others' feelings (Schuberth et al., 2019). ToM and empathy share aspects of perspective-taking, while CU traits are characterised by the absence of such abilities. This commonality between the constructs often results in their use as proxies for EU in research on children's behaviour (Ekerim-Akbulut et al., 2020; Izard, 2009).

Gender Differences in EU

Previous studies suggest that preschool girls tend to outperform boys in EU tasks (Bosacki & Moore, 2004; Denham et al., 2012; Garner & Waajid, 2008). One explanation for this is that girls may receive more emotion education than boys as a result of parental or adult socialisation practices that inadvertently reinforce gender stereotypes (Garner & Waajid, 2008). However, several studies counter this view and propose that boys' and girls' EU abilities at this age are more similar than they are different (Fidalgo et al., 2018; Tampke et al., 2020). In fact, the evidence regarding gender-related disparities in EU remains inconclusive, which adds to some of the challenge in understanding how it contributes to children's behaviour.

Emotion Understanding and Aggression

According to research, children's understanding of their own emotions and those of others is inherent to the SIP model (Lemerise & Arsenio, 2000). For example, recognition and understanding of emotion is required to interpret and navigate one's own and other's social and emotional cues at the encoding stage (Lemerise & Arsenio, 2000). Consequently, distorted perceptions, biased or erroneous interpretations of emotion cues in the SIP steps may contribute to aggression in social interactions (Chronaki et al., 2015; Denham et al., 2002; Smeijers et al., 2020; Trentacosta & Fine, 2010). Studies that have tracked behaviour and subcomponents of EU in children from the general population have found an association between a decreased ability to recognise facial expression and increased level of behaviour issues and lower levels of empathy and prosocial behaviour (Eggum et al., 2011).

A meta-analytic review found that recognition of discrete emotions (facial expression, gestures) has been connected with greater negative internalizing and externalizing symptoms across various age groups (Trentacosta & Fine, 2010). For example, Fine et al. (2003) reported that for socially disadvantaged 7-year old children, understanding facial emotions predicted their self-reported emotional problems 4 years later at age 11. Although the majority of studies included in the meta-analysis by Trentacosta and Fine (2010) included preschool-age children, smaller effects were found for younger children from the ages of 3 to 5-year-old compared to older children and adolescents (Trentacosta & Fine, 2010).

The few studies carried out in early childhood suggest that difficulties in these emergent EU skills have lasting effects such as lower social competence and aggressive behaviours later in childhood. Lower EU has been found to be responsible for higher externalising behaviours in children and adolescents (Trentacosta & Fine, 2010) and lower empathy or prosocial behaviours in young children (Eggum et al., 2011; Spinrad & Gal, 2018).

Other studies have shown the long-term implications of EU on behaviour over time. For example, Denham et al. (2002) discovered that EU deficits in 3- to 4-year-olds predicted lower social competence a year later. This finding was further supported by Schuberth et al. (2019) who found that lower EU at age 4 was linked to higher levels of aggression at age 8 in a sample of 498 Afro-American and Afro-Caribbean children. Building on these findings, Izard et al. (2008) reported the effectiveness of a twenty-week intervention aimed at improving emotion knowledge to reduce both EU deficits and aggressive behaviour in 3- to 5-year-olds.

To our knowledge only one study has attempted to differentiate between types of aggression when investigating emergent components of EU. Laurent et al. (2020) studied expressive and receptive EU, aggression and social functioning in two groups of preschool-age children with an average age of 4.7 years. They compared patterns between teacher-reported aggressive and non-aggressive groups. Aggression was measured using the MacArthur Health and Behaviour Questionnaire–Teacher Form (Armstrong & Goldstein, 2003) which assesses forms of aggression (i.e., physical and relational). Aggressive children showed lower expressive EU yet exhibited higher receptive EU compared to non-aggressive children, irrespective of gender. On examination of forms of aggression, the ability to identify emotions (receptive EU) predicted physical aggression for both genders. It would appear from these results that aggressive children may struggle to express their own emotions yet are adept at identifying emotions in others.

Together these findings tell us that early challenges in EU may lead to long-term aggressive behaviours, but interventions can address these challenges. More information is needed to understand how individual emergent EU skills such as recognising and labelling emotions are related to forms and function of aggression in young children.

The Relationship Between Emotion Understanding and Executive Function

A wide body of research shows that a child's ability to recognise and manage emotions is closely tied to cognitive abilities, such as EF. Children with better emotion control and understanding at age 3 tend to show more advanced cognitive development by age 4 (Blankson et al., 2013) . Additionally, early development of emotion regulation skills positively influences how well children understand emotions as they grow (Lucas-Molina et al., 2020). To be more exact, the ability to control impulses has been found to affect overall emotion management (Alamos et al., 2022). Cognitive flexibility or children's ability to shift their way of thinking has also been identified as a key factor in being able to understand emotions across different situations (Mărcuș et al., 2022; Martins et al., 2016). CF has been further connected with the cognitive processing of empathy and EU (Cai & Qi, 2023). However, the associations between EF and EU have not been extensively explored in the existing literature on preschool-age children's aggression and warrant further attention (Smeijers et al., 2020).

EF and EU as Predictors of Aggression Forms and Functions

Research to date provides substantial evidence that both EF and EU are independently related to aggression. Yet the extent to which these factors interdependently relate to aggression in preschool-age children remains underexplored (Izard, 2009).

Extant studies exploring the relationships between EF, EU and aggression have predominantly focused on school-age children, adolescents, or adults (Holley et al., 2017; Roos et al., 2016; Runions & Keating, 2010). However, there is a gap in investigations concerning preschool-age children, a population with distinctive characteristics in terms of EF, EU, and aggression development. Understanding these constructs in early childhood is important, as this developmental period lays the foundation for social-emotional development later in life.

Furthermore, a diverse array of constructs is used within the studies conducted in early childhood. This includes social and emotional development, such as empathy, Theory of Mind (ToM), emotion regulation, and emotion knowledge (Di Maggio et al., 2016; Garner & Waajid, 2012; O'Toole et al., 2017). These studies have established clear associations between these constructs and a broad scope of child behavioural outcomes including social functioning, adjustment, or social competence.

In a study of Italian preschool-age children aged 3 to 5, Di Maggio et al. (2016) found that higher emotion knowledge was linked to increased social competence and that this was supported by emotion regulation abilities. Another study carried out by Garner and Waajid (2012) investigated whether emotion knowledge and self-regulation in preschool-age children aged 3 to 5 years would predict cognitive, social, and behavioural outcomes. The outcome of their analysis was that emotion knowledge was linked to better cognitive and social competence, while self-regulation influenced classroom behaviour.

We can conclude from this that understanding how to handle emotional situations is necessary for children's cognitive and social competence. This provides indirect support for how EF and EU may contribute to aggression. For example, a child that can recognise and name emotions may be more likely to engage in caring or problem-solving behaviours like including a peer that looks sad or re-directing themselves to another activity if they feel frustrated or sense conflict. In line with this thinking, O'Toole et al. (2017) found that lower ToM and EF contributed to increased physical aggression in preschool-age children aged 4 to 6. Building on this, Noten et al. (2020) reported that toddlers aged 2 and half with both high levels of empathy and IC were less aggressive. These factors have either not been individually examined in relation to aggression in young children (Di Maggio et al., 2016; Helmsen et al., 2012) or they have examined aggression without consideration of forms and functions (Laurent et al., 2020; O'Toole et al., 2017).

Nevertheless, we can draw some conclusions about a relationship between EF, EU, and aggression. Several studies show that aggression in older, school-aged children is influenced by a multifaceted system where EF and EU can have both positive and negative effects. For example, Roos et al. (2016) reported that effortful control and anger moderated the influence of aggressive thoughts on aggressive behaviour towards peers in 11-year-old children. In line with these findings, Romero-López et al. (2021) observed a reduction in aggressive behaviour following a two-and-a-half-month intervention that was aimed at enhancing IC and emotion control in 5- and 6-year-old children.

The role of IC and emotion function in aggression was also reported by Alamos et al. (2022) who examined how IC might predict emotion regulation and the nature of preschool-age children's peer and teacher interactions in four-year old children. Their results confirmed that the children in their study with lower IC experienced more conflict with peers and teachers (conflict was defined as negative interactions marked by aggression). Positive interactions with peers were related to better emotion regulation. However, the general measures of aggression used in Alamos et al. (2022); Romero-López et al. (2021); Roos et al. (2016) prevented seeing which of the forms or functions were each related to individual aspects of emotion function. For instance, reactive aggression and physical aggression tend to be more overt and related to heighted emotion and "bad temper" whereas proactive aggression and relational aggression require greater emotional insight.

In comparison, O'Toole et al. (2017) focused on forms and functions of aggression in their examination of EF and ToM as predictors of aggression and prosocial behaviour in preschool-age children aged 4 to 6. EF was measured according to "hot" and "cold" dimensions that included affective decision-making and delayed gratification tasks ("hot" EF) and inhibition, planning skills and WM ("cold" EF). ToM was measured by false belief tasks that evaluate a child's ability to recognise that others may hold beliefs that differ from the

actual situation presented (Carlson & Moses, 2001). Results showed a joint association between EF (lower inhibition and lower delay of gratification) and ToM as stronger predictors of physical aggression only. At the component level of EF, inhibition and WM were found to be predictors of relational aggression, independent of each other (O'Toole et al., 2017).

However, these findings are somewhat limiting when it comes to the purpose of pinpointing precise mechanisms to understand how they influence on aggression in young children. Constructs that relate to EF like emotion regulation and self-regulation are too broad as they encompass a wide range of skills and behaviours. This is also true of emotion function constructs. For example, while there is an important relationship between ToM and EU that has implications for children's social and emotional development (Eggum et al., 2011; O'Brien et al., 2011), ToM is a separate, multidimensional construct and ToM tasks do not measure the same cognitive skills as EU tasks. Taken as a whole, evidence from these studies provide valuable insights and illustrate how EF and EU may contribute to children's aggressive behaviour. They also reveal a greater complexity and go some way to explain why a gap remains in the literature regarding the interrelatedness of EF, EU and aggression in preschool-age children.

Complexities of Aggression Forms and Functions and EF, EU patterns

Research reviewed thus far suggests that the complexities in the diverse forms and functions of aggression are closely tied to equally complex patterns of EF and EU which lead to challenges within each study. O'Toole et al. (2017) provide a good example of the challenge involved in examining multiple dimensions of aggression. Their study aimed to examine both forms and function of aggression alongside EF. Despite good internal consistency, unexpected high correlations between proactive and reactive forms within each aggression type led to a decision to collapse the subscales into physical and relational categories for simplicity (O'Toole et al., 2019). As previously mentioned in relation to EF and

EU, aggregating data can increase clarity, however it also risks the loss of granularity in understanding individual EF and EU mechanisms and relationships with both forms and functions of aggression.

In direct contrast to this, the use of a more streamlined approach results in other limitations, as illustrated by the study carried out by Laurent et al. (2020). The study aimed to explore the relationship between EU and only forms of aggression without additional factors such as functions of aggression or EF. A strength of the study was in the thoroughness of the methods used to explore aggression from different angles. The study explored two perspectives: group comparison and the frequency of aggressive behaviours from teacher ratings to explore associations between all components. Contrary to researcher expectations, expressive EU and receptive EU did not predict relational aggression overall. This was unexpected given the social nature of relational aggression as children who engage in relational aggression to achieve goals tend to exhibit greater awareness of others and of social and emotional dynamics (Ostrov et al., 2013). Understanding differential associations of the functions of aggression may have provided further insights into why no effect was found for EU and relational aggression.

On the other hand, their results did reveal interesting gender differences where a positive association between higher receptive EU and relational aggression was found in girls, and the inverse (lower receptive EU related to increased relational aggression) was found in boys (Laurent et al., 2020). In sum, gender-specific strengths and difficulties in EU may contribute to distinct outcomes in relational aggression for boys and girls. Gender is an important area of analysis that the present study will include.

Dual Effects in Social Information Processing

Within the literature review of this study, the Social Information Processing (SIP) framework has been previously described from a social skills deficit-based perspective.

(Denham et al., 2014; Dodge & Crick, 1990). Conversely, an alternate view considers how strengths in social and emotion processing can equally result in maladaptive responses such as aggression. This has also been referred to as a 'double-edged sword' effect (Sutton et al., 1999; Wang et al., 2023).

On one hand, it has been argued that preschool-age children who effectively manage impulses or can effectively name and express emotion feelings may showcase superior social emotional problem-solving skills and exhibit less aggressive behaviour. In this case these strengths act as protective factors that may reduce the likelihood that a child will respond with aggression. However, it is important to recognise that in some situations these very strengths might contribute to behaviours that manifest as aggression and therefore they present as risk factors.

There is evidence to suggest that children who engage in relational aggression perhaps challenge the common perception of an aggressive child with social skills deficits. For example, Hawley (2003) carried out research on preschool-age children between 2 and 5 years of age to examine how children's moral cognition and social problem-solving behaviours are related to overt (i.e. physical aggression) and relational teacher-reported aggression. Children were categorised into groups according to the results. A group of children were identified that were categorised as bi-strategic controllers. These were children who were reported by teachers to engage in aggressive behaviour but who also demonstrated proficient social problem-solving skills and exhibited greater moral maturity. They were also preferred by their peers compared to children who were more coercive in their behaviour.

Building on this, other studies have found that relationally aggressive children demonstrate better emotional regulation (Ersan, 2020), or display EU and empathy (Ostrov et al., 2013), prosocial problem-solving behaviours (Swit, 2019), and tend to be socially dominant and successful in building relationships with teachers and peers (Murray-Close &

Ostrov, 2009; Ostrov & Crick, 2007; Swit et al., 2016). However, research evidence does not unequivocally support the double-edged view.

Substantial research evidence has demonstrated that children's empathy and ability to understand the thoughts and emotions of others function as a protective factor for aggression (Eisenberg et al., 2010). The opposing view, as previously described, is that children can use such skills to carry out aggressive acts. A meta-analysis carried out by Wang et al. (2023) sought to examine whether ToM functions more as a risk or as a buffer. Findings across and from the ages of 2 to fifteen showed a negative relationship between ToM and both forms and functions of aggression. This would suggest that children's deficits in perspective-taking and understanding of others are a risk factor for aggression, more than strengths.

Further counterevidence for the double-edged sword theory suggests not that all aggression stems from intentional use of strengths in social emotional or cognitive skills. For example, it has been shown that children who engage in proactive aggression are less motivated by social relationships than relationally aggressive children and have more self-oriented and instrumental goals such as wanting to access resources such as toys or playground equipment (Crick & Dodge, 1996; Hubbard et al., 2010). This could be described as a more emotion neutral motivation for aggression that does not draw on strengths nor is characterised by obvious deficits. Other counter arguments are that inadvertent adverse outcomes may arise from what appear to be strengths. For example, findings from a meta-analysis showed girls exhibited more positive emotion expression and less externalizing behaviour, but paradoxically displayed more internalizing behaviour. (Chaplin & Aldao, 2013). This suggests that despite showing more positive emotion and fewer disruptive behaviours, girls may internalise stress or negative emotions, inadvertently leading to increased anxiety or depression.

These mixed findings have implications for designing interventions to increase EF and EU and reduce aggression and suggest that it is not a clear-cut case of boosting skills to reduce aggression. Considering any dual or double-edged effects of cognitive and emotional processes in EF or EU can enrich our comprehension of the multiple associations and presentations of forms and functions of aggression. Additionally, this approach may help explain unexpected results by revealing how strengths in EF and EU may contribute to aggressive behaviours. There is limited research investigating the importance of EF and EU in predicting forms and functions of aggression in early childhood. This lends further support for an exploration into the roles of EF or EU in aggressive behaviours in this age group to see what the nature of their interaction might be. This study sought to contribute to this gap in the literature on preschool-age children.

Methodological Considerations

There are several theoretical and methodological challenges common to this area of research (Denham et al., 2012). EF and EU are complex multi-faceted constructs with subtypes and components that are often nested or interrelated (Campbell et al., 2016; Denham et al., 2020). Research to date therefore presents a rich but confusing kaleidoscope of findings that share the same broader aims but probe multiple different constructs which often overlap (Campbell et al., 2016; Smeijers et al., 2020) (i.e. IC and effortful control, affect and emotion, recognition or knowledge) and use different measures. While there is evidence indicating that aggression patterns emerge in very young children, it is a developmentally dynamic period of growth. Some studies have adopted a dual approach to better capture this such as using both distinct EF measures and composite scores (Camerota et al., 2020; Granvald & Marciszko, 2016) .

With respect to aggression, lack of direct measurement of the functions of aggression or motives behind the associations found in studies such as Laurent et al. (2020); O'Toole et al. (2019) limits our ability to speculate further on why differences might occur. Understanding the function of aggression, such as whether it serves as a means of obtaining a desired outcome or expressing frustration, is necessary for developing targeted interventions. This is a gap in the extant literature that this study hopes to fill.

Integrated Theoretical Framework for Preschool Aggression

The integration of the Social Information Processing model (Dodge & Crick, 1990) and Developmental Cascade model (Cicchetti & Masten, 2010) can support a more complex exploration of childhood aggression (Blandon et al., 2010; Lansford et al., 2010). By focusing on cognitive and emotion function processes, SIP provides a detailed account of how children interpret and respond to social cues, shedding light on the underlying mechanisms of aggressive behaviour.

Alongside SIP, the Developmental Cascade model provides a broader perspective to account for the interconnectedness between various developmental factors that contribute to the complexity of aggressive behaviour in preschool-age children. According to this model, cumulative outcomes of interactions within developing systems can lead to widespread positive or negative effects across different levels, domains, and generations (Masten & Cicchetti, 2010). In relation to the current study, preschool-age children are in the initial phases of developing their capacity to attend to information, regulate responses, and are still acquiring the skills to recognise, interpret, and manage emotions. The DCM framework can be used to support our understanding of the interconnected nature of ongoing experiences, that include genetics, environment, and early development (Blandon et al., 2010; Fraser, 1996). Additionally, the DCM accounts for how individual variations in EF and EU

functioning might influence how children uniquely process and respond to social and emotional situations (Blair et al., 2015; Campbell et al., 2016).

This integrated, theoretical perspective provides a foundation to understand how early individual differences in development and experience, including both strengths and deficits, can impact cognitive processes of SIP such as EF and EU and contribute to aggression in preschool-age children. The present study aimed to take this complexity into account and address and perhaps mitigate some of the challenges encountered in prior studies. We employed a measurement framework that disentangles the multifaceted components of EF and EU and the forms and functions of aggression aiming to obtain a more focussed understanding of their interplay.

Current Study

This study addresses the existing knowledge that both EF and EU are related to aggression. While some studies have explored associations with various forms and functions, what remains unclear is the degree of influence each factor has in predicting aggression. Current literature has not examined these associations in much detail. The hypothesis driving this study is that different forms and functions of aggression are related to distinct developmental constructs of EF and EU. It is hoped that by identifying these associations, research findings may increase the precision of interventions to provide parents and educators with more effective interventions for preschool aggression (Crick, Ostrov, & Werner, 2006; Evans et al., 2019b; Ostrov et al., 2023; Swit, 2019).

Research Aims

Based on the existing knowledge and identified gaps in the literature, we sought to: (1) Explore the extent to which relationships between EF, EU and different forms and functions of aggression in preschool-age children vary according to child gender and (2) Investigate which components of EF (IC, CF) and EU (expressive and receptive) would be

most predictive of the forms and functions of aggression in this age group and (3) examine whether there is an interaction between EF and EU that contributes to the forms and functions of aggression.

Hypotheses for Gender Differences

We drew on theories that girls are socialised to better manage emotions (Bowie, 2007; Denham et al., 2010) and gender stereotypes about expectations on girls' aggressive behaviour (Evans et al., 2019b) to hypothesise that gender differences would emerge. We predicted that girls would exhibit higher levels of EU and lower levels of aggression compared to boys. We also predicted that girls would exhibit stronger associations between receptive and expressive EU and relational aggression, reflecting the socially influenced nature of relational aggression in girls. We anticipated higher levels of physical aggression in boys and lower levels of expressive EU. We did not specify any predictions regarding gender differences in EF.

Hypotheses for Components of EF and EU and Aggression Forms and Functions

In line with other studies, we predicted that lower IC would be a stronger predictor of reactive physical aggression compared to other forms/functions of aggression. Hypotheses for EF components and proactive and relational aggression were considered exploratory. We predicted that higher levels of both components of EU would be related to lower levels of reactive physical aggression. We also predicted that higher levels of expressive and receptive EU would be related to higher levels of proactive and relational aggression.

Hypotheses for Interactions Between EF and EU

We hypothesised that a significant interaction might exist, where children with strong EF and high EU skills would display the lowest levels aggression, suggesting a protective effect.

Chapter 3: Methods

Participants

All preschool-age children, their parents/primary caregivers and teachers enrolled in the five participating KidsFirst Kindergartens were invited to participate in the THRIVE study. Children and their parents who were not enrolled at the Kindergarten at Time 1 were given the opportunity to participate in the study at Time 2. All children and parents who participated in Time 1 could choose to withdraw their participation at Time 2. However, with their consent, their data from Time 1 was used in analyses.

We obtained child consent to participate from the parents/primary caregivers and teacher consent prior to the commencement of interviews or assessments. We observed divergent retention rates among children and parents throughout the study. For instance, some child participants left the kindergarten setting to transition to school during the course of the study.

A total of 138 children and 18 teachers across 5 kindergartens participated in the study as informants of child aggressive behaviour. Teacher informants reported nine to thirty years (M = 23.3 years, SD = 7.40) experience working in kindergartens. Among the child participants, 44.2% were male. The ages ranged from 2 to 5 to years, (M = 3.9, SD = 0.73).

The most prevalent ethnic group was New Zealand European, which accounted for 63.2% of the representation, while 20% fell into the 'Other' category. This included Indian, Fijian Indian, and mixed ethnicities like African-NZ European or Chilean-NZ European. Māori, Pasifika, and Chinese accounted for 6.4%, 4%, and 5.6%, respectively.

In New Zealand schools, decile ratings are indicators of socio-economic distributions that reflect the economic profile of communities across the country. Decile ratings rely on Census data pertaining to households with school-aged children within the catchment area of each school. This data is comprised of various household indicators, including income,

parents receiving benefits, occupation, education levels, and household crowding. In the present study, the sample contained 5 out of 10 possible decile ratings (Ministry of Education, 2023).

Measures

Aggressive behaviour: The Preschool Proactive and Reactive Aggression – Teacher Report (PPRA-TR)

The PPRA-TR Ostrov and Crick (2007) is a questionnaire that includes 12 items pertaining to both form and function of aggression. Item content aligns with typical behaviours associated with aggression in early childhood. There are three items for each type of aggression. Using a 5-point Likert-type scale (0 = never or almost never true; 4 = always or almost always true), teachers rated the frequency of children's aggressive behaviours on four subscales: reactive-relational aggression (e.g., "If other children hurt this child, s/he often keeps them from being in their group of friends"), proactive-relational aggression (e.g., "This child often says "you can't come to my birthday party" to other children to get what s/he wants"), reactive physical aggression (e.g., "If other children make this child mad, s/he will often physically hurt them"), and proactive-physical aggression (e.g., "This child often hits, kicks, or punches to get what s/he wants"). Higher scores are indicative of greater use of form and function of aggressive behaviour. Reliability for all subscales was excellent, with Cronbach's α equal to 0.84, 0.57, 0.89, and 0.91 respectively.

Executive Function: Child Executive Functioning and Attention (NIH Toolbox)

The National Institutes of Health Toolbox (Zelazo, Anderson, Richler, Wallner-Allen, et al., 2013) includes a battery of EF measures for Age 3-7 that includes the Flanker Inhibitory Control and Attention Test and the Dimensional Change Card Sort, DCCS.
The DCCS is a measure of Cognitive Flexibility administered by the researcher or research assistant through use of an iPad. The child is presented with two target pictures that vary according to shape and colour. Children were asked to match a series of bivalent test pictures (e.g., yellow balls and blue trucks) to the target pictures, first according to one dimension (e.g., colour) and then, after several trials, according to the other dimension (e.g., shape).“Switch” trials are also employed, in which the participant must change the dimension being matched. For example, after four straight trials matching on shape, the participant may be asked to match on colour on the next trial and then go back to shape, thus requiring the cognitive flexibility to quickly choose the correct stimulus. Scoring is based on a combination of accuracy and reaction time. Researchers were trained to administer the test in a neutral, non-corrective and non-evaluative manner and were trained how to respond when children were hesitant or resistant in their responses.

Executive Function: Flanker Inhibitory Control and Attention Test

The Flanker test (Zelazo, Anderson, Richler, Wallner-Allen, et al., 2013) requires the child to focus on a given stimulus while inhibiting attention to stimuli. For children aged 3- 7 a fish is used for the stimulus. The test takes approximately three minutes to administer and consists of a practice block, a fish block, and an arrows block. The practice block administers fish stimuli. Children are instructed to press one of two laterally presented arrow “buttons” on the touch screen, each corresponding to the direction a middle fish is pointing. To remind children to attend to the middle stimulus, the word “middle” is presented aurally on each trial. Sometimes the middle stimulus points in the same direction as the "flankers" (congruent) and

in the opposite direction (incongruent). Four trials are offered (2 congruent and 2 incongruent) that require correct responses on at least 3 out of the 4 to advance to the test blocks. Two additional practice trials are offered if this criterion is not met. For ages 3-7, if a participant score ≥ 90% on the fish stimuli, 20 additional trials with arrows are offered.

Emotional Understanding: The Affect Knowledge Test (AKT),

AKT (Denham, 1986) is a measure of two components of preschool-age children's' EU, expressive and receptive emotion recognition, using prototypical drawings of four target emotions: happy, sad, mad, and scared (Denham, 1986). The task is divided into two parts. Firstly, for the expressive task the four faces are laid out so that they are facing the child in one straight row. The researcher points to each one and asks the child, "How does he/she feel?". This is repeated for all four faces. Children receive two points for correctly naming the target emotion; one point for incorrect feelings that were of the same valence as the target emotion (e.g., identifying a mad expression as sad) and zero points for incorrect answers.

For the second task, the researcher shuffles the faces and lays them down again in one straight row. Then the child is asked to "Point to the (fill in emotion) face" or "Show me the (fill in emotion) face." This is repeated for all four emotions. The same drawings are presented again in random order to assess children's receptive abilities. Children received two points for pointing to the correct face, one point for selecting an incorrect emotion of the same valence, and zero points for faces of the opposite valence.

Design

We used a cross-sectional design for the study and focussed on data at one time point. The study was part of a larger, longitudinal research project "THRIVE" that uses a developmental cascade model. The project was led by principal investigator, Dr Cara Swit (School of Health Sciences, University of Canterbury). The first aim of "THRIVE" has been to examine how early social and emotional factors (e.g., child prosocial behaviour and

aggression) influence and are influenced by separate, but perhaps related teacher, parent, and child processes.

Procedure

Ethics approval from the Educational Research Human Ethics Committee at University of Canterbury was obtained for this study (2020/04/ERHEC). Using data from the THRIVE study, the current study analysed teacher data with aggression as the dependent variable and child data related to EF and EU as the independent variables.

Data collection for the wider study occurred at two-time points, approximately 6-months apart. Analyses for this study relied on data from the first time point only. Data collection at the first time point began 3 months after the school year to allow child participants to be established in routines and relationships with teacher informants. A week was given prior to collection to allow researchers and research assistants to establish positive rapport with child participants prior to administering measures.

Once consent was obtained from the child's parent and assent was given by the child, the EF and EU tasks were administered in a quiet, enclosed room to ensure that children were less likely to be distracted.

The current study examined two components of EF separately (IC and CF). This was in in consideration of evidence that children's strengths and weaknesses in different EF components can vary significantly, and of the non-uniform nature of EF development during early childhood, This approach enables tracking of distinct components and assessment of variations and how they relate to forms and functions of aggression (Best & Miller, 2010; Caporaso et al., 2021; Lee et al., 2013). Although WM was measured in the wider study, data was incomplete due to typical methodological challenges measuring this construct and therefore not included in the present study.

Executive Function tasks were scheduled at the start of the day before children got too tired. Tasks were administered by researchers after completing task training. Child responses in the AKT task were also audio and video recorded. to allow for coding.

The Preschool Proactive and Reactive Aggression Teacher Report (PPRA-TR) (Ostrov & Crick, 2007) was completed by teachers 2 weeks before the end of data collection for each respective time point. . Written informed consent was obtained from the teachers before they completed the behavioural reports. The reports were distributed two weeks before the data collection was completed and were filled out by teachers who had known the child for at least 8 weeks.

Data Analysis

All data for the study were imported from Qualtrics and analysed using SPSS, version 28. Firstly, missing data were addressed; 8% (n = 11) of data was missing on variables related to teacher reports of children's forms and functions of aggression. After inspecting the distribution of the data, the data for children's aggression was determined to be slightly skewed.

Missing values were imputed with the median value; using the median value rather than the mean is preferred when the distribution is skewed because the median value is less sensitive to outliers. This allowed for the retention of the full sample, ensuring that no data points were lost due to missing values. The full sample size was 138. Skewness statistics ranged from -1.9 to 2.56 and kurtosis statistics ranged from -1.05 to 5.76. Although skewness and kurtosis were elevated for proactive physical aggression, they were still within the acceptable range of <3 and <10 respectively (Kline, 2011).

Given the context of our sample, which comprises preschool-age children attending kindergarten rather than a clinical population, some degree of skewness might be expected

likely reflecting the developmentally expected low level of aggressive behaviour observed in this age group and setting.

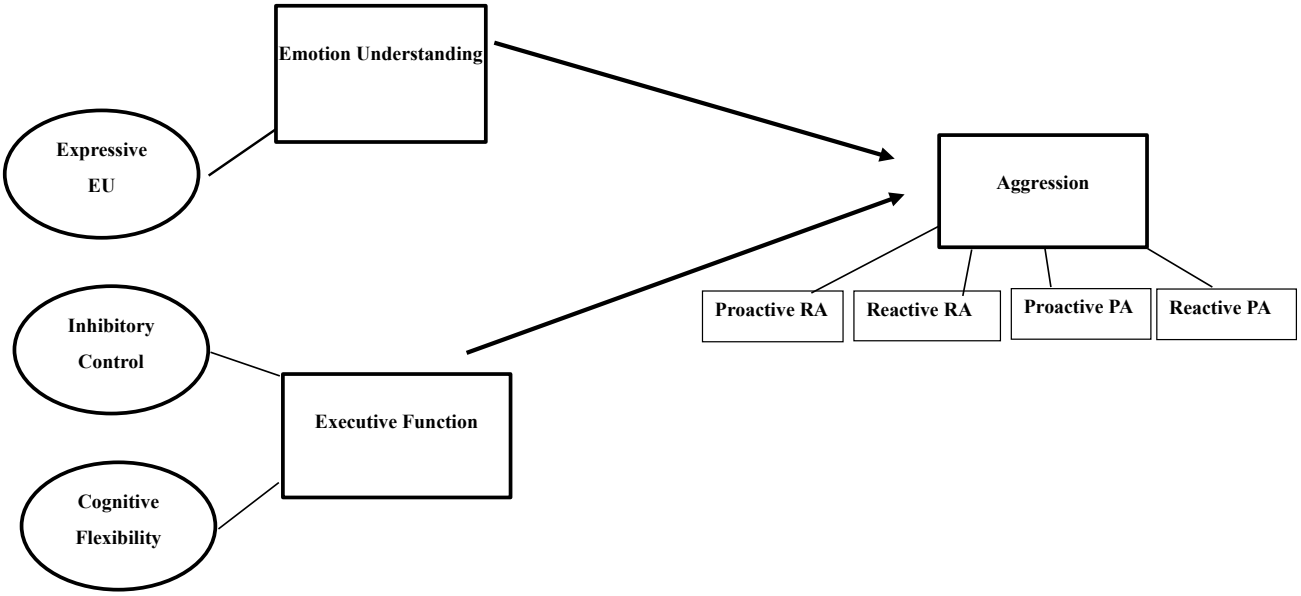
Descriptive statistics (means, standard deviation and total scores) were calculated for each of the study subscales. This was followed by an independent t-test to examine the differences between boys and girls on all study variables. Cohen's d was used to analyse mean differences between gender. To interpret values we followed Cohen's conventions of 0.2, 0.5 and 0.8 represent small, medium and large effect sizes respectively (Cohen, 1992). Next, bivariate correlations were computed between all study variables. These were computed separately for boys and girls because there was evidence of gender differences in teacher's reports of children's aggression.

We used hierarchical linear regression to explore the unique contribution of dimensions of EF and EU to the prediction of forms and functions of aggression (see figure 2 below). In these analyses, respective forms and functions of aggression were the dependent variables and child gender and EF and EU were the independent variables. For ease of interpretation, the predictors were mean centred before running the regression analysis. Two-way interactions between EF and EU dimensions, and three-way interactions between EF, EU and child gender were examined.

Possible gender differences in the relationship between EF and EU were examined by including all interactions involving the predictors with gender. The significance of each interaction between EF and EU and gender was examined before and after deleting non-significant interactions.

Figure 2

Conceptual Diagram of the Relationship Between EF, EU and Aggression



Note. RA = relational aggression, PA = physical aggression

Due to the exploratory nature of some of our hypotheses, all predictors were entered into the model simultaneously with EU dimensions entered first, followed by EF dimensions, after controlling for the other forms and functions of aggression.

Chapter 4: Results

Descriptive Statistics

Table 1 shows the means, standard deviations, and independent samples t-test t, *p*-values and effect sizes comparing mean scores for boys and girls across all study variables. Teachers reported higher use of both reactive and proactive relational aggression in girls compared to boys, as evidenced by girls' higher mean scores compared to boys. Although suggestive of trends, t-test results did not reach conventional levels of statistical significance (i.e. $p = .05$) for all variables. The effect size for the difference between boys and girls was calculated using Cohen's d. For reactive relational aggression this resulted in a value of 0.32, which is considered a small effect. A small effect size was also found for proactive relational aggression with a value of 0.31. Teachers reported higher use of physical aggression, both reactive and proactive functions, in boys compared to girls, with boys' having higher mean scores compared to girls. Although the t-test result showed a statistically significant difference between boys and girls for reactive physical aggression, $t(136) = 2.89$, $p = .006$, a value of 0.49 was found suggesting a small to medium effect size. The result for proactive physical aggression suggested a trend toward significance, $t(136) = 1.97$, $p = .064$, however only a small effect size was found.

Overall, results showed teachers reported reactive relational aggression as the most frequently used form and function of aggression in this sample of preschool-age boys and girls. Group comparisons between boys and girls showed that boys in this sample had higher mean scores for expressive emotion and receptive emotion tasks compared to girls (see Table 1), however, these differences were not statistically significant (expressive EU, $p = 0.122$; receptive EU, $p = 0.169$). There was minimal variability in children's EU abilities regardless of gender, as evidenced by the small standard deviations in both EU tasks.

Conversely, girls had higher mean scores on both IC and CF tasks compared to boys. There was considerable variability in both the IC and CF tasks, regardless of gender, as shown by the large standard deviations for both boys and girls. The absence of statistical significance for the IC and CF tasks suggests that boys and girls performed similarly on tests measuring their ability to control impulses ($p = 0.38$) and switch between tasks ($p = 0.49$).

Table 1

Gender Differences for all Variables and Independent Samples T-test

Variable	Boys (61)		Girls (77)		t	p	Cohen's *d*
	M	SD	M	SD			
Reactive relational aggression	1.03	0.98	1.37	1.00	1.962	.052	0.34
Proactive relational aggression	0.56	0.77	0.83	0.95	1.840	.061	0.31
Reactive physical aggression	0.80	0.86	0.44	0.60	2.896	.006	0.49
Proactive physical aggression	0.25	0.50	0.11	0.31	1.970	.064	0.34
Expressive EU	5.82	1.85	5.31	1.99	1.554	0.27	0.27
Receptive EU	7.31	1.41	6.95	1.65	1.357	0.23	0.23
Inhibitory Control	15.11	9.65	16.69	10.99	-.881	0.15	0.15
		11.69	16.24	14.23			
Cognitive Flexibility	14.69				-.685	0.12	0.12

Note. EU = emotion understanding

Associations Between Study Variables

Bivariate correlations were computed between all study variables. These were computed separately for boys and girls given the evidence of the gender difference in

teachers' reports of children's reactive physical aggression. Table 2 displays the correlations between forms and functions of aggression and each of the EF and EU dimensions.

Correlations Between Aggression Forms and Functions by Gender

We found a statistically significant positive correlation across all forms and functions of aggression. Strong and statistically significant correlations were found between both functions of relational aggression (i.e. reactive and proactive). A strong, positive correlation was also found between both forms of reactive aggression (i.e. physical and relational). More frequent reactive tendencies in physical aggression were related to more frequent reactive relational aggression, signifying a general inclination towards reactive behaviours. This association was found to be moderate yet significant for both genders and may be reflective of common aggressive behaviour during this developmental period. Additionally, a strong and significant correlation was established between increased reactive physical aggression and proactive physical aggression for both genders. Reactive physical aggression was the only behaviour that was positively associated with all other forms and functions.

The data analysis revealed some minor differences between gender in the associations between forms and functions of aggression. For example, a small association was found between reactive relational aggression and proactive physical aggression, which was statistically significant among girls but not among boys, despite the strength of the relationship being the same for both genders. A small to moderate but significant positive association was observed between reactive physical aggression and proactive relational aggression for both boys and girls, with greater significance for girls.

Table 2

Correlation Matrix of all Measures for Boys (Above Diagonal) and Girls (Below Diagonal)

Variable	1	2	3	4	5	6	7	8
1. Reactive Relational Aggression	-	.845**	.405**	.239	.006	-.059	.125	.002
2. Proactive Relational Aggression	.805**	-	.314*	.212	.007	.023	.076	.035
3. Reactive Physical Aggression	.351**	.347**	-	.749**	-.173	-.253*	-.149	-.156
4. Proactive Physical Aggression	.239*	.167	.728**	-	-.225	-.123	-.186	-.157
5. Expressive EU	.233*	.211	.076	.187	-	.558**	.281*	.153
6. Receptive EU	.082	.240*	.015	.145	.583**	-	.200	.321*
7. Inhibitory Control	.108	.026	-.178	-.195	.235*	.191	-	.376**
8. Cognitive Flexibility	.124	.143	-.023	-.033	.307**	.245*	.611**	-

Note. EU = Emotion Understanding

*$p < .05$

**$p < .001$

Correlations Between EF Components and Aggression Forms/Functions

Hypothesis 2 was to examine to what extent individual EF components, IC and CF were related to children's aggressive behaviours. Our results did not yield any statistically

significant findings. Some minor gender nuances were observed as well as inverse relationships, however the strength of relationships ranged from negligible or very small to small, and none reached the threshold of statistical significance.

Correlations Between EU Components and Aggression Forms and Functions

A statistically significant and strong positive correlation was observed between expressive EU and receptive EU for both boys and girls. This suggests that a child's proficiency in one aspect of emotional understanding corresponds with proficiency in the other.

A small but significant positive association was found between expressive EU and reactive relational aggression in girls, suggesting that girls who can better recognise and name emotions engage in more reactive relational aggression. No statistically significant association was found between receptive EU and reactive relational aggression for boys.

For proactive relational aggression and receptive EU, a small, positive, and statistically significant association was observed for girls (r = .240) but not boys. This suggests that in girls a greater ability to discern others' emotion cues is related to greater frequency of proactive relational aggression, such as pre-planning to exclude others from social activities or friendships.

In contrast, a statistically significant, inverse relationship emerged between receptive EU and reactive physical aggression for boys but not for girls. This indicates that lower proficiency among boys in identifying emotions through verbal or nonverbal cues correlates with more frequent occurrences of reactive physical aggression. The findings highlight that both strengths and deficits in EU can contribute to aggression, with contrasting patterns of inverse and positive correlations observed between boys and girls.

Correlations Between EF and EU

Regarding the relationship between EF and EU, a weak but significant, positive association was found between expressive EU and IC for both genders, indicating that greater ability in children's emotional expression skills such as recognising and then naming emotions were related to increased impulse control. Moreover, a small positive association was observed between expressive EU and CF, suggesting that children's ability to switch perspectives or thinking across tasks is linked to their ability to accurately label emotions. This association was more significant in girls. A moderate and significant positive relationship was found between CF and receptive EU for both genders, suggesting that CF such as perspective switching or task switching may assist children in picking up on verbal or nonverbal emotion cues. No significant association was found between receptive EU and IC.

Some gender patterns were observed in the correlation analysis between all the study variables. The findings indicated that both relative strengths and weaknesses in EF and EU are differentially related to forms and functions of aggression.

It is important to note that multicollinearity was not a concern. Multicollinearity occurs when independent variables are highly correlated, potentially rendering them redundant and limiting the information gained from them. Previous research often collapses various dimensions, such as receptive and expressive EU, into single constructs due to their high correlation. Concerns arise when multicollinearity is present, particularly if variables exhibit correlations close to or exceeding 0.9 (Kim, 2019). In this study, one argument has been the necessity to explore different dimensions of EF and EU to assess their unique associations with various forms and functions of aggression.

Fortunately, this was not a concern in this analysis. For instance, the correlation between expressive and receptive EU scores was 0.56. Similarly, correlations between other variables, such as IC and CF, were also below 0.9. This allowed for a thorough exploration of

the associations between each of the EF and EU dimensions, and forms and functions of aggression among both boys and girls.

Regression Analyses

Four hierarchical linear regressions were conducted to examine the relationship between forms and functions of aggression, EF, and EU. No interactions were significant for reactive relational aggression (all *p*s >.10), proactive relational aggression (all *p*s >.20), and reactive physical aggression (all *p*s > .08). However, a significant three-way interaction emerged between expressive EU, IC and gender for proactive physical aggression ($p = .04$).

As illustrated in Table 3 below, alternative forms and functions of aggression were entered at the first step of the regression model, which contributed to a strong significance to the model F (3,137) = 97.13, p <.001 and accounted for 68% of the variance in teacher reports of children's reactive relational aggression. The two EU predictors were added at step two and accounted for an additional 2% of the variance in teacher reports of children's reactive relational aggression and resulted in a significant R^2 change F (2,132) = 4.75, p = .01. In step three, the two EF predictors were added and accounted for an additional 1% of the variance in teacher reports of children's reactive relational aggression and this R^2 change was not significant F (2,132) = 2.90, p = .06.

When all of the independent variables were examined in the full regression model, teacher reports of children's proactive relational aggression, receptive EU, and IC were significant predictors of teacher reports of children's reactive relational aggression. This result suggests that higher use of proactive relational aggression, lower levels of receptive EU, and higher performance on IC predicted higher frequency of reactive relational aggression. With an adjusted R^2 of .70, these predictors explain two-thirds of variance in reactive relational aggression in this sample of preschool-age children.

Table 3

Regression Analysis of Reactive Relational Aggression, EF and EU

		Reactive Relational Aggression		
	Intercept	β	t	p
Step 1: control variables	Proactive Relational Agg	.81	16.30	<.001***
	Reactive Physical Agg	.06	.85	.40
	Proactive Physical Agg	.06	.81	.42
		Adjusted R^2 = .68		
Step 2: EU predictor variables	Expressive EU	.11	1.85	.07
	Receptive EU	-.18	-3.05	.00***
		Adjusted R^2 = .70		
Step 3: EF predictor variables	Inhibitory Control	.13	2.37	.02*
	Cognitive Flexibility	-.04	-.78	.44
		Adjusted R^2 = .70		
	Model fit	R = .85; F (7, 137) = 47.45, p < .001		

Note. EF = executive function, EU = emotion understanding

Following the same analysis procedure described for reactive relational aggression, Table 4 below shows that alternative forms and functions of aggression accounted for 67% of the variance in teacher reports of proactive relational aggression, and this model was significant F (3,134) = 93.14, p <.001. Child EU accounted for an additional 3% of variance in teacher reports of children's proactive relational aggression and this R^2 change was significant F (2,132) = 5.99, p = .00. Child EF did not add any additional variance to the model F (2,130) = 1.66, p = .19.

Table 4

Regression Analysis of Proactive Relational Aggression, EF and EU

		Proactive Relational Aggression		
	Intercept	β	t	p
Step 1: control variables	Reactive Relational Agg	.83	16.30	<.001***
	Reactive Physical Agg	.08	1.04	.30
	Proactive Physical Agg	-.09	-1.29	.20
		Adjusted R^2 = .67		
Step 2: EU predictor variables	Expressive EU	-.09	-1.48	.14
	Receptive EU	.20	3.33	.00***
		Adjusted R^2 = .69		
Step 3: EF predictor variables	Inhibitory Control	-.10	-1.80	.08
	Cognitive Flexibility	.06	1.14	.26
		Adjusted R^2 = .70		
	Model fit	R = .84; F (7, 137) = 45.52, p < .001		

Note. EF = executive function, EU = emotion understanding

As Table 4 shows when all of the predictors were examined in the final model, teacher reports of children's reactive relational aggression and children's receptive EU significantly predicted proactive relational aggression, indicating that higher levels of reactive relational aggression and receptive EU predicted a higher frequency of proactive relational Aggression. The adjusted R^2 of .70 indicates that these predictors explain two-thirds of variance in teacher reports of proactive relational aggression. Table 5 below shows that alternative forms and functions of aggression accounted for 58% of the variance in teacher reports of children's reactive physical aggression and this model was significant F (3,134) = 64.70, p <.001. Child EU accounted for an additional 1% variance and child EF did not add any additional variance

to teacher reports of children's reactive physical aggression. The R^2 change for both EF and EU were not significant F (2,132) = 2.39, p = .10, and F (2,130) = 0.23, p = .79.

When all of the predictors were examined in the full model, children's proactive physical aggression and receptive EU significantly predicted reactive physical aggression. Higher levels of proactive physical aggression and lower levels of receptive EU predicted higher frequency of reactive physical aggression. With an adjusted R^2 of .59, these predictors explain over half of variance in reactive physical aggression in this sample of preschool-age children.

Table 5

Regression Analysis of Reactive Physical Aggression, EF and EU

		Reactive Physical Aggression		
	Intercept	β	t	p
Step 1: control variables	Reactive Relational Agg	.09	.85	.40
	Proactive Relational Agg	.11	1.04	.30
	Proactive Physical Agg	.71	12.32	<.00**
		Adjusted R^2 = .58		
Step 2: EU Predictor variables	Expressive EU	.06	.89	.38
	Receptive EU	-.14	-2.00	.05*
		Adjusted R^2 = .59		
Step 3: EF Predictor variables	Inhibitory Control	-.04	-.59	.55
	Cognitive Flexibility	.00	-.01	.99
		Adjusted R^2 = .59		
	Model fit	R = .78; F (7, 137) = 28.71, p < .001		

Note. EF = executive function, EU = emotion understanding

As can be seen in Table 6 below, alternative forms and functions of aggression accounted for 55% of the variance in teacher reports of children's proactive relational aggression and this model was significant F (3,134) = 57.80, p <.001. The addition of child EU variables contributed an additional 1% of variance, and child EF and the three-way interaction between expressive EU, CF, and child gender did not add any additional variance to teacher reports of children's proactive physical aggression. The R^2 change for Step 2, Step 3, and Step 4 were not significant (ps >.12).

Table 6

Regression Analysis of Reactive Physical Aggression, EF, EU and Gender

		Proactive Physical Aggression		
	Intercept	*β*	t	p
Step 1: control variables	Reactive Relational Agg	.09	.81	.42
	Proactive Relational Agg	-.14	-1.36	.18
	Reactive Physical Agg	.74	11.97	<.00***
		Adjusted R^2 = .55		
Step 2: EU predictor variables	Expressive EU	-.08	-1.08	.28
	Receptive EU	.15	1.98	.05*
		Adjusted R^2 = .56		
Step 3: EF Predictor Variables	Inhibitory Control	-.06	-.80	.42
	Cognitive Flexibility	.00	.02	.98
		Adjusted R^2 = .56		
Step 3: interaction terms	Expressive EU*IC*Gender	-.07	-1.16	.25
		Adjusted R^2 = .56		
	Model fit	R = .77, F (7, 137) = 25.99, p < .001		

Note. IC = Inhibitory Control

When all of the predictors were examined in the full model, children's reactive physical aggression and receptive EU significantly predicted proactive physical aggression. Higher levels of reactive physical aggression and receptive EU predicted higher frequency of proactive physical aggression. These predictors explain over half of variance in proactive relational aggression, as indicated by an adjusted R^2 of .56.

The overarching finding of this analysis highlights the significance of receptive EU as a predictor across all forms and functions of aggression examined after controlling for other forms and functions of aggression. A pattern emerged where lower levels of receptive EU are predictive of reactive aggression, while higher levels are related to proactive aggression.

Chapter 5: Discussion

This study adopted a multidimensional approach to investigate the relationships between children's EF, EU and forms and functions of aggression in preschool-age children. In line with our hypotheses, we explored potential gender differences and identified predictors of aggression. We hypothesized that girls would show higher EU and higher aggression, particularly in relational aggression. The hypotheses regarding gender differences in children's EF was exploratory. We expected each of the dimensions of EF (IC and CF) and EU (receptive, expressive) to be differentially associated with children's forms and functions of aggression, as reported by teachers. We predicted lower IC to be correlated to higher reactive physical aggression, and reactive aggression more generally. We hypothesised that higher EU would correlate with lower reactive physical aggression but higher proactive aggression and relational aggression. We also hypothesised interactions between EF and EU, suggesting a protective effect against aggression for children with strong EF and high EU skills.

Gender Differences

Our first hypothesis predicted gender differences in aggression, EF and EU. The findings partially supported our hypotheses. A significant difference emerged in aggression patterns where boys exhibited higher levels of reactive physical aggression compared to girls. This is in alignment with previous and earlier studies that have emphasised boys' overall tendency towards physical aggression (Ostrov & Keating, 2004). For example, Card and Little (2006) and Granvald and Marciszko (2016) reported higher reactive aggression in boys, although the results from both these studies were specific to adolescent boys and 9-year old boys respectively. For proactive physical aggression, boys in the sample demonstrated a tendency towards higher levels compared to girls. This difference approached but did not reach conventional levels of statistical significance. We also failed to find statistically

significant gender disparities in relational aggression for either reactive or proactive functions. According to teacher reports, girls displayed higher mean scores for relational aggression than boys, however, this discrepancy fell short of statistical significance. This finding aligns with previous research in early childhood that has shown small gender differences in relational aggression (Ersan, 2020; Laurent et al., 2020). A possible explanation for the contrasting results could be in the characteristics of the sample. Teachers reported a high prevalence of reactive relational aggression overall. Furthermore, the mean age of the children in this study was 3.9 years. Prior research indicates that as children get older and develop language and social cognitive skills, physical aggression tends to be replaced by relational aggression (Crick, Ostrov, Burr, et al., 2006; Murray-Close & Ostrov, 2009). Our findings indicate that teachers reported that relational aggression is most frequently used in this sample of preschool-age boys and girls and that boys in this sample still exhibit more physical, reactive aggression. Given that on average children in this study were almost 4 years old, this is not surprising and may reflect the developmental point at which children are experimenting with different forms of aggression. These findings highlight the importance of exploring gender and age differences in both forms and functions of aggression among young children and call for longitudinal studies to confirm and better understand these associations.

We did not find any statistically significant gender differences in relation to EF. This would suggest that boys and girls performed similarly in IC and CF tasks. These results are follow those of prior studies that found no gender differences in EF between boys and girls (Carlson & Wang, 2007; Wiebe et al., 2011). The result was similar for EU. Girls had higher mean scores for EU tasks but these differences were not statistically significant. These findings are supported by results from prior research by Fidalgo et al. (2018) that reported no gender differences between boys and girls aged from 3 to 8 years. Future studies could

examine these relationships in older children and adolescents to see if gender differences are apparent.

EF and Aggression Forms and Functions

We wanted to explore the relationships between individual components of EF (IC and CF) and teacher reports of children's aggressive behaviours. We predicted that lower IC would be correlated to higher reactive aggression, following extant research. Results from the bivariate analysis did not yield any statistically significant findings. We also hypothesised that lower IC would be a stronger predictor of reactive physical aggression compared to other forms and functions of aggression. Surprisingly, our findings did not confirm this hypothesis and therefore they differ from multiple previous studies reported a relationship between low IC such as difficulties with impulse control and reactive aggressive behaviours (Granvald & Marciszko, 2016; Poland et al., 2016; Raaijmakers et al., 2008; Runions & Keating, 2010; van Adrichem et al., 2020b).

Poland et al. (2016) found that 'cool EF' (IC) negatively predicted proactive relational, reactive relational, and reactive physical aggression but not proactive physical aggression. According to their findings, children with lower IC would be more likely to exhibit all forms and functions of aggression except proactive physical aggression. In other words, higher IC may be required to carry out premeditated physical acts of aggression. Our study's findings contrast with these results in that higher IC was associated particularly with more frequent reactive relational aggression but not with any other forms or functions of aggression. We might conclude from this that IC may have differential effects on various forms and functions of aggression.

The discrepancy in findings between our results and those reported by Poland and colleagues could be attributed to several factors, including the use of different measures to capture EF abilities or differences in participant age range and developmental stage of EF. For

example, Poland and colleagues used the Go/No Go task to measure IC. While this measure is not dissimilar to the Flanker measure that we used, the actual demands of the tasks differ. In the Go/No Go task (Simpson & Riggs, 2006) involves response inhibition, requiring children to suppress their response to press a button on the screen whereas the Flanker measures attentional inhibition and requires children to ignore distractors that interfere with the goal of the task (Howard & Melhuish, 2017; Simpson & Carroll, 2019; Zelazo, Anderson, Richler, Wallner-Allen, et al., 2013). The results reported by Poland and colleagues may indicate that children's ability to inhibit responses are needed more than the ability to ignore interference in order to not react aggressively. Conversely, in order to carry out premeditated acts of aggression associated with proactive aggression it is more likely that children need to be able to suppress distractors in order to carry out their goal.

Another explanation for the differences in results is that our study may represent a younger age group where EF is still developing and therefore its association with aggression may not yet be fully apparent. The mean age of the children in our study was 3.9 years, whereas in the Poland study, the mean age was reported as 5.1 years in a range from 3 to 6. It is well-documented that EF undergoes rapid development during early childhood. It is therefore possible that children's EF abilities have increased even with this short period of development from age 4 to 5. This is supported by results reported by Granvald and Marciszko (2016) that showed associations between EF and forms and functions in older children (aged 8). Furthermore, there is wide variability in EF skills in our sample of preschool-age children. This may obscure any relationship between EF and forms/functions of aggression. This aligns with research on EF and early childhood that typically posits a unidimensional structure of EF, acknowledging that EF skills may still be in the process of maturation during the preschool years. Including a composite score of EF in our analysis as

well as examining EF multidimensionally may have added to our findings, although Poland et al. (2016) did not include a composite score and still found an association.

EU and Aggression Forms and Functions

Our hypotheses for EU had a dual focus. Firstly, we hypothesised that higher abilities in EU would emerge as protective factors. We predicted that higher levels of both expressive and receptive EU would be correlated to lower levels of reactive physical aggression, indicating that children with better EU can recognise their own and others' emotions, leading to less impulsive, physical aggression. In line with SIP, our reasoning was that if children with better EU skills can recognise and name their own and others' emotions, this may offer them a wider variety of response options and therefore reduce the likelihood of responding with impulsive, physical aggression. (This can also be described inversely from a deficit-perspective where low EU skills lead to more frequent aggression).

Secondly, we also anticipated a risk effect. This was based on prior research that strengths in social skills do not only protect against aggression but can also influence socially driven aggressive behaviours. We predicted that higher expressive and receptive EU would be correlated to higher levels of proactive relational aggression. Although our results supported both the risk and protective factor hypotheses, they did not align entirely with our predictions regarding which components of EU would map onto which form of aggression as a risk or a buffer.

Results from the bivariate analysis initially revealed a pattern of significant associations. Higher expressive EU was positively related to reactive relational aggression and higher receptive EU was positively related to proactive relational aggression, indicating that higher EU abilities may present as risk factors for increased frequency of both functions of relational aggression. These correlations were only significant for girls. Conversely, a significant negative association was found between receptive EU and reactive physical

aggression that was unique to boys. However, the gender-specific patterns observed in the correlation analysis were not supported by the subsequent regression analysis once the other variables were included in the model.

Results from the regression analysis partially supported our hypothesis that children who had a lower receptive EU ability (i.e. labelling emotions) were more likely to have higher teacher reports of reactive physical aggression. This finding is in line with results from other studies. Acland et al. (2021) found that low ability to recognise negative emotions in others was related to more overt aggression towards others a year later (i.e., damaging others' belongings or hitting others) in both younger children (aged 4) and older children (aged 8), although the function of aggression was not specified in their study and the analysis did not go beyond correlational observations.

Contrary to our prediction that lower EU would be primarily related to reactive physical aggression, our regression analyses showed that lower receptive EU was also related to reactive relational aggression. This suggests that when children find it difficult to identify emotion cues in others, they are more likely to react aggressively in the moment by using both physical acts such as hitting or throwing toys as well as relational acts such as excluding a playmate or withdrawing friendship.

One explanation for the association between lower receptive EU and reactive physical and relational aggression is that children lacking the ability to recognise others' emotions may not experience a sense of concern or obligation to regulate their own negative emotion responses when conflict arises. This has been referred to as "empathy-related responding" (Eisenberg et al., 2010) and has been well documented in prior research on children's socialisation development, including the development of morality (Arsenio & Lemerise, 2010; Hawley, 2003), prosocial behaviours, and theory of mind (Eggum et al., 2011; Ensor & Hughes, 2005).

Evidence of an empathy link between EU and aggressive behaviours is supported by O'Brien et al. (2011) who found that children's ability to accurately recognise and label emotions at age 3 predicted their ability in visual perspective-taking (i.e. being able to recognise that another person cannot always see the same things that they can see) at age 4. They propose that EU skills overall are precursory to the development of empathy and perspective-taking. Schuberth et al. (2019) findings further support this idea. They found that children's ability to label emotions and identify feelings in others was not only related to higher levels of aggression over time but was indirectly related to callous-unemotional traits. In other words, this suggests that children with low receptive EU may be unhindered by others' emotions and therefore more likely to express frustration, or anger. It is important to note that we cannot validate the role of receptive EU in this context since we did not include measures of empathy or ToM. Nonetheless, taken together with findings from these studies, our results do illustrate how receptive EU could function as a protective factor for reactive forms of aggression.

In further contrast to our hypothesis, we found no significant association for expressive EU as a predictor of reactive forms of aggression beyond our initial correlation analysis. Our regression results showed that expressive EU only trended towards significance as a predictor of reactive relational aggression. Laurent et al. (2020) observed similar differences between expressive and receptive EU when analysing associations between EU, forms of aggression and social functioning. They found that aggressive children showed lower expressive EU during the AKT task (Denham, 1986) when compared to non-aggressive children in their study. To be more precise, they showed deficits in the ability to name emotions displayed by puppets compared to the non-aggressive group. However, a different result was found when associations between EU and aggression were analysed at the dimensional level. They also found that higher abilities in receptive EU contributed

exclusively to higher physical aggression. Higher expressive EU was related to higher social functioning but was not particularly related to either form of aggression. This suggests that receptive EU skills may play a critical role in regulating aggressive behaviours, whereas expressive EU may contribute more to social competence (Denham & Grout, 1993; Miller et al., 2006; Trentacosta & Fine, 2010).

We predicted that higher expressive and receptive EU would be associated with higher levels of proactive relational aggression. In line with our predictions, our study found that higher levels of EU did not function as strengths that mitigate children's aggressive behaviours but as skills that contribute to aggression. However, our prediction only partially accounted for the results in the regression model. What is interesting from our findings is that we appear to have underestimated the role of receptive EU, which emerged as the main predictor of both proactive physical and proactive relational aggression after controlling for the alternative forms and functions of aggression. Our results suggest that children who can understand what hurt or upset look like in others appear to be able to leverage this knowledge of emotions. In other words, they carry out premeditated or strategic acts of harm to achieve what they want or express their needs. Our findings indicate that they do this both physically, such as planning to damage someone's toy, as well as relationally such as planning to not invite a peer to a group activity or event.

Several prior studies support our results. Hawley (2003) described how relationally aggressive children in their study understood that acts of aggression are wrong and were able to offer emotion-related reasoning that included considering the feelings of others. Similarly, Murray-Close et al. (2006) found that aggressive children were more likely to be aware of the harmful impacts of their aggressive behaviour than non-aggressive children. Building on this, Swit and Harty (2023) propose that empathy and attitudes toward aggression may be evolving concurrently in preschool-age children. Their findings indicate that children's beliefs about

the acceptability of aggression correlate with their level of empathy. More exactly, it means, higher empathy is linked to reduced physical aggression but also to increased reactive and proactive relational aggression. This suggests that although children may be empathic, their developing understanding of social dynamics may supersede their empathic reactions, leading to engagement in relational aggression.

Taken together, these findings suggest that relationally aggressive children demonstrate an understanding of the impact of their actions and possess emotion-related reasoning abilities. However, it is possible that socially related goals and beliefs about the acceptability of behaviours may override empathic responses, leading to relational aggression. While children's EU abilities were not measured in these studies, the role of receptive EU skills can be inferred in relation to a child's ability to understand someone's feelings or to recognise what causing in harm in others may look like. This lends further support to the relevance of our findings and is in keeping with findings from Laurent and colleagues regarding the role of social competence.

EF, EU and Aggression Forms and Functions

We hypothesised that a significant interaction might exist between EF and EU and the forms and functions of aggression. We predicted a protective effect whereby high EF and high EU skills would display the lowest levels aggression.

We started our exploratory analysis with examining correlations. Our data revealed a weak but significant positive association between expressive EU and IC for both genders. This suggests that children who exhibit greater proficiency in recognising and naming emotions also demonstrate improved impulse control. This result is supported by previous studies that found IC was positively correlated with EU in preschool-age children (Blankson et al., 2013; Denham et al., 2012). Moreover, a significant positive relationship was observed between expressive EU and CF, particularly in girls. This is aligned with prior research that

has found that children's ability to switch perspectives or thinking across tasks is related to their ability to accurately label emotions (Mărcuș et al., 2022; Martins et al., 2016) . CF also showed a moderate and significant positive relationship with receptive EU in both boys and girls. This further lends support to the theory that CF is integral to children's understanding of emotions and may help regulate aggressive behaviour.

From a theoretical standpoint, these findings align with previous research suggesting integrated cognitive and emotion function regulation (Bell & Wolfe, 2004; Gross, 2015; Lemerise & Arsenio, 2000) where EF and EU are intertwined and jointly influence emotional and behavioural outcomes in children. In regard to SIP, Lemerise and Arsenio (2000) suggest that mood, emotions and physiological emotion arousal can affect children's encoding and interpretation of cues. Gross (2015) elaborated on this further with the process model of emotion regulation. The model illustrates how emotion and cognition are closely related through a series of stages where children employ cognitive processes, such as reappraisal or suppression (i.e. IC) to regulate their emotional responses. In this model, cognitive strategies influence how emotions are experienced and expressed, and emotions influence how cognitive strategies are deployed. This is supported by other studies such as von Salisch et al. (2013) who found empirical evidence that in children aged between 4 and 6, cognitive abilities such as receptive language skills and non-verbal cognitive ability such as WM, "cool" EF and self-regulation, play a significant role in EU. However, we did not find evidence of a significant EF link to aggression, other than lower receptive EU and higher IC in reactive relational aggression.

On examination of all variables in our full regression model, lower levels of receptive EU and a higher performance in IC tasks predicted a higher frequency of teacher reported reactive relational aggression. This means that children who have difficulty understanding and interpreting the emotions of others (lower receptive EU) but are good at controlling their

impulses and regulating their behaviour (higher IC) are more likely to engage in reactive relational aggression. If higher IC is typically associated with fewer externalising behaviours or adverse outcomes (Ahmed et al., 2019) then this result is particularly interesting.

Firstly, it is reasonable to infer from these results that receptive EU plays a more significant role in reactive relational aggression than we might have previously thought. We can interpret these findings to mean that children can inhibit their immediate reactions and think before acting (higher IC) yet they struggle to understand the emotions and perspectives of others (lower receptive EU). From this we could suggest that despite children's impulse control, their limited understanding of others' emotions still leads them to respond aggressively when faced with social challenges or conflicts such as by excluding others or spreading rumours. This may be as a way to assert control or retaliate against perceived threats. It is possible that our results reflect the developmental age of this sample where empathy-responding behaviours have not yet fully come online. This would provide further support to the idea that receptive EU may be the building blocks to empathy.

We could further speculate that IC may be helping children to make deliberate choices about their actions, such as choosing to refrain from physical aggression and instead use relational aggression as a means of asserting themselves or achieving their goals within social interactions. As previously discussed from prior research, children tend to exhibit increased use of relational aggression at this age and physical aggression tends to decline. At the same time, IC is thought to undergo rapid changes and strengthen over time in this age group (Best & Miller, 2010; Simpson & Carroll, 2019). With the development of IC, children may increasingly choose relational forms of aggression, as these are often perceived as more socially acceptable and may appear to carry fewer consequences than physical aggression (Swit et al., 2016). This explanation is supported by findings reported by Utendale and Hastings (2011) on toddlers and preschool-age children that showed children with lower IC

exhibited more maternally-reported externalising behaviour problems that decreased over the course of a year as IC increased. Furthermore, developmental changes in EF in preschool-age children may also account for the absence of significant findings in our study for EF and other forms and functions of aggression. For example, some studies suggest that CF skills develop after IC (Diamond, 2013; Karr et al., 2018). This suggests that the manifestation of EF abilities and their impact on behaviour may vary depending on the child's developmental stage and environmental influences.

In interpreting our study results overall, receptive EU was found to be a determinant of all forms and functions of aggression irrespective of gender differences. Furthermore, clear differential patterns emerged where both deficits and strengths in receptive EU contribute to different aggressive behaviours across function of aggression. Lower receptive EU appears to predict reactive forms of aggression and higher receptive EU appears to predict proactive forms of aggression. Higher IC with lower receptive EU emerged as a significant predictor of reactive relational aggression. This is a particularly interesting finding as it reveals how differential combinations of interactions between EF and EU can be related to different forms and functions of children’s aggression. Moreover, our results suggest that emotional and social cognition, may be more strongly linked to certain forms of aggression in young children, rather than cognitive EF skills. This aligns with previous studies on empathy or Theory (ToM) and aggression.

Strengths and Limitations

This study is one of few that uses a multidimensional approach to examine the relationship between cognitive and emotion function and both forms and functions of aggression in a New Zealand sample of preschool-age children. Our sample was diverse and reflected a range of socio-economic backgrounds across the kindergartens. By adopting a multidimensional approach, our study has revealed differences in how preschool-age

children's EF and EU is related to different types of aggressive behaviours that may not have become apparent with a narrower focus or by using composite scores of these constructs, which is typically the approach used in previous research. Other strengths of our study lie in the measures used for capturing children's EF and EU abilities. These were obtained directly through child activities rather than only using observation or teacher/parent reports. Moreover, our research benefits from the insights of experienced teachers involved in the study reporting on children's aggression, recognising that teachers are known for their accuracy in reporting children's behaviour (Hay et al., 2021).

Our results build on extant research that has identified the importance of EF and EU in reducing aggressive behaviours during early childhood. Findings contribute towards developing a more detailed picture of how young children's abilities to recognise and identify emotions may play both a mitigating and contributing role in their aggressive behaviours. A further strength is that our study focuses on early childhood when children's cognitive and social emotional abilities are developing rapidly. This presents an early opportunity to intervene and nurture essential EF and EU skills, which are foundational for healthy socioemotional development and behaviour throughout life.

One of the key findings of our study is the importance of EU. Our analysis shows that the predictive value of receptive EU as a determinant of aggressive behaviour remains consistent among preschool-age children, irrespective of gender differences.

Our findings need to be interpreted in light of several limitations. Reliance on cross-sectional data limits our ability to establish causality and assess changes over time. Therefore, the extent to which our results are reflective of developmental characteristics in our sample is not clear. For example, contrary to previous studies, we failed to find significant associations between EF and forms and functions of aggression. This may be due to the fact that we measured IC and CF and did not include data for WM. Research suggests that CF develops

later in childhood and is therefore not likely to be captured in this age group. Longitudinal studies with a middle time point could examine how individual EF functions and components of EU develop and interact with aggression over time. Although we provided a developmental theoretical framework for our study, the potential oversimplification of complex interactions within this age group and the variation in children's individual abilities mean that results should be interpreted with caution. Preschool-age children may not fully exhibit the cognitive and emotional processing capabilities outlined in these models.

Additionally, our lack of findings for expressive EU may be related to the characteristics of our sample that included children from diverse backgrounds. As we did not include a measure of language ability, we cannot exclude that this influenced our results. Laurent et al. (2020) found expressive EU was linked to aggression after controlling for language skills. This is important as EU skills have been shown to improve as a function of language skills (Pons et al., 2004). A further consideration is that the preschool-age children in our sample exhibited higher levels of teacher-reported relational aggression overall. If receptive EU is more strongly associated with relational aggression than expressive EU, it is conceivable that associations with expressive EU might be less apparent in this context.

Our analyses were not able to account for individual child experiences and or factors that might explain why a child has engaged in certain aggressive acts. Including opportunities for more detailed observations may add more to our understanding. For example, studies that include child voice, where child participants explain their thinking or choices through vignettes such as the Challenging Situation Task (Denham et al., 2014) or Normative Beliefs about Physical and Relational Aggression task (Swit et al., 2016) go some way to providing this, although responses are forced. More recently, Swit et al. (2024) used video observation and video stimulated recall in their study on preschool-age children's aggression. They reported that by seeking children's interpretations and explanations about their aggressive

behaviour resulted in uncovering more child-centered understandings about what drives the different forms and functions of aggression in this age group.

Finally, our hypotheses were based on the SIP model of aggression that predominantly outlines how weaknesses in children's social processing can result in aggressive behaviours. Future research may benefit from moving away from a social skills deficit perspective and draw from person-centered research that allows for a more complex and dynamic view of aggression during early childhood (Doebel, 2020). This may offer further insights into how individual EF and EU strengths and deficits combine to create multiple pathways to aggression (Perone et al., 2021).

Implications

Despite these theoretical and methodological limitations, findings from this study have the potential to challenge perceptions of how aggression manifests in early childhood. Our results have revealed patterns that could increase parent/caregiver and educator awareness of the importance of EU to reduce aggressive behaviours in preschool-age children. Providing parents and early childhood educators with detailed information about the complexity of aggression may help them to look beyond generalised expectations of how preschool-age children express and engage in aggression. For example, parents and educators can be supported to recognise relational aggression in preschool-age children, including the ways in which children communicate and interact with peers that may not always appear as overtly aggressive. This would allow "in the moment" social-emotional coaching that can help children learn better problem-solving skills.

Furthermore, it is important for parents and teachers to understand that EF and EU skills can both reduce or facilitate aggressive behaviours, depending on children's individual strengths and challenges. Parents and teachers can explicitly draw on or scaffold children's skills to show them how to respond in less aggressive ways. Finally, parents and educators

can be encouraged to incorporate naturally occurring teachable moments in their interactions with children to explicitly teach children about different forms and functions of aggression, emphasising that relational aggression is just as harmful as physical aggression. These actions may increase their ability to address aggressive behaviours more effectively and provide more individualised support for positive social and emotion development, thus maximising on this stage of children's development.

Our results provide interesting avenues for further empirical research on early childhood intervention. The small effects sizes found for the differences in means between boys and girls indicates that differentiating EU interventions according to gender is not likely to have a significant impact. On the other hand, our results support a rationale for designing interventions or learning programmes that go beyond teaching children how to recognise and identify emotion cues in order to reduce aggression. For example, the potential for conversation-based emotion knowledge training has been demonstrated by Ornaghi et al. (2017). However, their lack of reported findings for improvements in proactive and reactive aggression together with our findings suggest that future intervention research may consider testing detailed training programmes. These might explicitly teach children about the different forms and functions of aggression. Combined with EU skills training, this could potentially further reduce aggressive behaviours at this age.

One of the most important discoveries to emerge from our studies are that there are distinct directions in receptive EU for reactive and proactive functions of aggression. Children with low receptive EU skills appear to be more at risk of engaging in reactive forms of aggression, yet children exhibiting high receptive EU skills are equally susceptible and are more at risk of engaging in proactive forms of aggression. Prior research suggests that different mechanisms are involved. Future researchers should be aware of this and continue to probe to what extent low receptive EU works as a deficit, related to empathy or ToM skills

and to what extent high receptive EU either fails to compensate for children's socially driven aggression or contributes to it. One potential avenue to explore is how receptive EU, ToM and forms and functions of aggression interact over time with children's beliefs about the acceptability of aggression.

Conclusion

Findings from our study build on prior research that has identified the importance of EF and EU, especially receptive EU, for supporting the social and emotional development of preschool-age children and reducing aggression (Denham & Bassett, 2020; Laurent et al., 2020; O'Toole et al., 2017; Schuberth et al., 2019). Our results also provide further evidence of the complexity of aggression during early childhood. Using a multidimensional approach has allowed us to uncover unique distinctions in how deficits and strengths in EF and EU contribute to forms and functions of preschool-age children's aggression. Furthermore, our study findings join with those of previous studies and reinforce the rationale to continue research on early childhood aggression and social and emotional development (Baker et al., 2019; Evans et al., 2019b; Ostrov et al., 2023).

Our findings also align with other studies that call for early childhood research and intervention design to go beyond a one-size fits all approach (Di Maggio et al., 2016; Swit et al., 2024; Tampke et al., 2020). For the purpose of informing more effective early education interventions, this might mean exploring the effectiveness of more holistic or integrated approaches (Di Maggio et al., 2016; Ornaghi et al., 2017). This might include programmes that target preschool-age children's declarative and procedural EU skills (combining the how and why of EU) as well as increasing children's understanding about the different forms and functions of aggression.

We hope the findings of this study will support and inform approaches to intervention and prevention for aggression in preschool-age children.

References

Acland, E. L., Jambon, M., & Malti, T. (2021). Children's emotion recognition and aggression: A multi-cohort longitudinal study. *Aggressive behavior*, *47*(6), 646-658. https://doi.org/10.1002/ab.21989

Ahmed, S. F., Tang, S., Waters, N. E., & Davis-Kean, P. (2019). Executive Function and Academic Achievement: Longitudinal Relations From Early Childhood to Adolescence. *Journal of educational psychology*, *111*(3), 446-458. https://doi.org/10.1037/edu0000296

Alamos, P., Williford, A. P., Downer, J. T., & Turnbull, K. L. P. (2022). How does inhibitory control predict emotion regulation in preschool? The role of individual children's interactions with teachers and peers. *Developmental psychology*, *58*(11), 2049-2063. https://doi.org/10.1037/dev0001415

Anderson, P. J., & Reidy, N. (2012). Assessing Executive Function in Preschoolers. *Neuropsychology review*, *22*(4), 345-360. https://doi.org/10.1007/s11065-012-9220-3

Armstrong, J., & Goldstein, L. (2003). Manual for the MacArthur health and behavior questionnaire (HBQ 1.0). *MacArthur Foundation Research Network on Psychopathology and Development, University of Pittsburgh*.

Arsenio, W. F. (2010). Social Information Processing, Emotions, and Aggression: Conceptual and Methodological Contributions of the Special Section Articles. *Journal of abnormal child psychology*, *38*(5), 627-632. https://doi.org/10.1007/s10802-010-9408-z

Arsenio, W. F., & Lemerise, E. A. (2010). *Emotions, aggression, and morality in children: bridging development and psychopathology* (1st ed.). American Psychological Association. https://doi.org/10.1037/12129-000

Austin, G., Bondü, R., & Elsner, B. (2017). Longitudinal relations between children's cognitive and affective theory of mind with reactive and proactive aggression. *Aggressive behavior*, *43*(5), 440-449. https://doi.org/10.1002/ab.21702

Baker, E. R., Jensen, C. J., & Tisak, M. S. (2019). A closer examination of aggressive subtypes in early childhood: contributions of executive function and single-parent status. *Early Child Development and Care*, *189*(5), 733-746. https://doi.org/10.1080/03004430.2017.1342079

Bassett, H. H., Denham, S., Mincic, M., & Graling, K. (2012). The Structure of Preschoolers' Emotion Knowledge: Model Equivalence and Validity Using a Structural Equation Modeling Approach. *Early Education and Development*, *23*(3), 259-279. https://doi.org/10.1080/10409289.2012.630825

Bates, J. E., Dodge, K. A., Lansford, J. E., Malone, P. S., & Pettit, G. S. (2010). Developmental cascades of peer rejection, social information processing biases, and aggression during middle childhood. *Development and psychopathology*, *22*(3), 593-602. https://doi.org/10.1017/S0954579410000301

Bell, M. A., & Wolfe, C. D. (2004). Emotion and Cognition: An Intricately Bound Developmental Process. *Child Development*, *75*(2), 366-370. https://doi.org/10.1111/j.1467-8624.2004.00679.x

Bertie, L.-A., Johnston, K., & Lill, S. (2021). Parental emotion socialisation of young children and the mediating role of emotion regulation. *Australian Journal of Psychology*, *73*(3), 293-305. https://doi.org/10.1080/00049530.2021.1884001

Best, J. R., & Miller, P. H. (2010). A Developmental Perspective on Executive Function. *Child Development*, *81*(6), 1641-1660. https://doi.org/10.1111/j.1467-8624.2010.01499.x

Björkqvist, K. (2018). Gender differences in aggression. *Current Opinion in Psychology*, *19*, 39-42. https://doi.org/https://doi.org/10.1016/j.copsyc.2017.03.030

Blair, B. L., Perry, N. B., O'Brien, M., Calkins, S. D., Keane, S. P., & Shanahan, L. (2015). Identifying developmental cascades among differentiated dimensions of social competence and emotion regulation. *Developmental psychology*, *51*(8), 1062.

Blakey, E., Visser, I., & Carroll, D. J. (2016). Different Executive Functions Support Different Kinds of Cognitive Flexibility: Evidence From 2-, 3-, and 4-Year-Olds. *Child Development*, *87*(2), 513-526. https://doi.org/10.1111/cdev.12468

Blandon, A. Y., Calkins, S. D., Grimm, K. J., Keane, S. P., & O'Brien, M. (2010). Testing a developmental cascade model of emotional and social competence and early peer acceptance. *Development and psychopathology*, *22*(4), 737-748. https://doi.org/10.1017/S0954579410000428

Blankson, A. N., O'Brien, M., Leerkes, E. M., Marcovitch, S., Calkins, S. D., & Weaver, J. M. (2013). Developmental Dynamics of Emotion and Cognition Processes in Preschoolers. *Child Development*, *84*(1), 346-360. https://doi.org/10.1111/j.1467-8624.2012.01841.x

Bosacki, S. L., & Moore, C. (2004). Preschoolers' understanding of simple and complex emotions: Links with gender and language. *Sex roles*, *50*, 659-675.

Bowie, B. H. (2007). Relational aggression, gender, and the developmental process. *Journal of child and adolescent psychiatric nursing*, *20*(2), 107-115.

Bretherton, I., Fritz, J., Zahn-Waxler, C., & Ridgeway, D. (1986). Learning to Talk about Emotions: A Functionalist Perspective. *Child Development*, *57*(3), 529-548. https://doi.org/10.2307/1130334

Cai, Z., & Qi, B. (2023). Cognitive flexibility as a protective factor for empathy. *Frontiers in Psychology*, *13*, 1064494.

Camerota, M., Willoughby, M. T., & Blair, C. B. (2020). Measurement Models for Studying Child Executive Functioning: Questioning the Status Quo. *Developmental psychology*, *56*(12), 2236-2245. https://doi.org/10.1037/dev0001127

Campbell, S. B., Denham, S. A., Howarth, G. Z., Jones, S. M., Whittaker, J. V., Williford, A. P., Willoughby, M. T., Yudron, M., & Darling-Churchill, K. (2016). Commentary on the review of measures of early childhood social and emotional development: Conceptualization, critique, and recommendations. *Journal of Applied Developmental Psychology*, *45*, 19-41. https://doi.org/https://doi.org/10.1016/j.appdev.2016.01.008

Campos, J. J. (1996). The functionalist approach to emotion: Implications for emotional development. *Infant behavior & development*, *19*, 154-154. https://doi.org/10.1016/S0163-6383(96)90209-X

Campos, J. J., Mumme, D. L., Kermoian, R., & Campos, R. G. (1994). A FUNCTIONALIST PERSPECTIVE ON THE NATURE OF EMOTION. *Monographs of the society for research in child development*, *59*(2-3), 284-303. https://doi.org/10.1111/j.1540-5834.1994.tb01289.x

Caporaso, J. S., Marcovitch, S., & Boseovski, J. J. (2021). Executive function and the development of social information processing during the preschool years. *Cognitive development*, *58*, 101018. https://doi.org/https://doi.org/10.1016/j.cogdev.2021.101018

Card, N. A., & Little, T. D. (2006). Proactive and reactive aggression in childhood and adolescence: A meta-analysis of differential relations with psychosocial adjustment. *International Journal of Behavioral Development*, *30*(5), 466-480. https://doi.org/10.1177/0165025406071904

Carlson, S. M. (2005). Developmentally Sensitive Measures of Executive Function in Preschool Children. *Developmental Neuropsychology*, *28*(2), 595-616. https://doi.org/10.1207/s15326942dn2802_3

Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, *72*(4), 1032-1053.

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive development*, *22*(4), 489-510. https://doi.org/10.1016/j.cogdev.2007.08.002

Chaplin, T. M., & Aldao, A. (2013). Gender Differences in Emotion Expression in Children: A Meta-Analytic Review. *Psychological bulletin*, *139*(4), 735-765. https://doi.org/10.1037/a0030737

Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience*, *1*(3), 165-174. https://doi.org/10.1093/scan/nsl024

Chronaki, G., Garner, M., Hadwin, J. A., Thompson, M. J. J., Chin, C. Y., & Sonuga-Barke, E. J. S. (2015). Emotion-recognition abilities and behavior problem dimensions in preschoolers: Evidence for a specific role for childhood hyperactivity. *Child Neuropsychology*, *21*(1), 25-40. https://doi.org/10.1080/09297049.2013.863273

Cicchetti, D., & Masten, A. S. (2010). Developmental cascades. *Development and psychopathology*, *22*(3), 491-495. https://doi.org/10.1017/S0954579410000222

Cohen, J. (1992). Statistical power analysis. *Current directions in psychological science*, *1*(3), 98-101.

Cole, P. M., Michel, M. K., & Teti, L. O. D. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the society for research in child development*, 73-100.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. In A. r. s. i.-p. m. o. c. s. s. adjustment (Ed.), *Psychological bulletin* (Vol. 115, pp. 74-101): American Psychological Association.

Crick, N. R., & Dodge, K. A. (1996). Social Information-Processing Mechanisms in Reactive and Proactive Aggression. *Child Development*, *67*(3), 993-1002. https://doi.org/10.2307/1131875

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-psychological adjustment. *Child Development*, *66*(3), 710-722. https://doi.org/10.1111/j.1467-8624.1995.tb00900.x

Crick, N. R., Ostrov, J. M., Burr, J. E., Cullerton-Sen, C., Jansen-Yeh, E., & Ralston, P. (2006). A longitudinal study of relational and physical aggression in preschool. *Journal of Applied Developmental Psychology*, *27*(3), 254-268. https://doi.org/https://doi.org/10.1016/j.appdev.2006.02.006

Crick, N. R., Ostrov, J. M., & Werner, N. E. (2006). A Longitudinal Study of Relational Aggression, Physical Aggression, and Children's Social–Psychological Adjustment. *Journal of abnormal child psychology*, *34*(2), 127-138. https://doi.org/10.1007/s10802-005-9009-4

Critchley, H. D., & Garfinkel, S. N. (2017). Interoception and emotion. *Current Opinion in Psychology*, *17*, 7-14. https://doi.org/10.1016/j.copsyc.2017.04.020

Cummings, E. M., Iannotti, R. J., & Zahn-Waxler, C. (1989). Aggression between Peers in Early Childhood: Individual Continuity and Developmental Change. *Child Development*, *60*(4), 887-895. https://doi.org/10.2307/1131030

De Castro, B. O., Veerman, J. W., Koops, W., Bosch, J. D., & Monshouwer, H. J. (2002). Hostile attribution of intent and aggressive behavior: A meta-analysis. *Child Development*, *73*(3), 916-934.

Denham, S. A. (1986). Social cognition, prosocial behavior, and emotion in preschoolers: contextual validation. *Child Development*, *57*(1), 194-201. https://doi.org/10.2307/1130651

Denham, S. A., & Bassett, H. H. (2020). 'You hit me! That's not nice and it makes me sad!!': relations of young children's social information processing and early school success. *Early Child Development and Care*, *190*(6), 791-805. https://doi.org/10.1080/03004430.2018.1491562

Denham, S. A., Bassett, H. H., Way, E., Kalb, S., Warren-Khot, H., & Zinsser, K. (2014). "How Would You Feel? What Would You Do?" Development and Underpinnings of Preschoolers' Social Information Processing. *Journal of research in childhood education*, *28*(2), 182-202. https://doi.org/10.1080/02568543.2014.883558

Denham, S. A., Bassett, H. H., Way, E., Mincic, M., Zinsser, K., & Graling, K. (2012). Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success. *Cognition and emotion*, *26*(4), 667-679. https://doi.org/10.1080/02699931.2011.602049

Denham, S. A., Bassett, H. H., & Wyatt, T. M. (2010). Gender differences in the socialization of preschoolers' emotional competence. *New directions for child and adolescent development*, *2010*(128), 29-49. https://doi.org/10.1002/cd.267

Denham, S. A., Bassett, H. H., Zinsser, K. M., Bradburn, I. S., Bailey, C. S., Shewark, E. A., Ferrier, D. E., Liverette, K. H., Steed, J., Karalus, S. P., & Kianpour, S. (2020). Computerized social-emotional assessment measures for early childhood settings. *Early Childhood Research Quarterly*, *51*, 55-66. https://doi.org/https://doi.org/10.1016/j.ecresq.2019.07.002

Denham, S. A., Caverly, S., Schmidt, M., Blair, K., DeMulder, E., Caal, S., Hamada, H., & Mason, T. (2002). Preschool understanding of emotions: contributions to classroom anger and aggression. *Journal of Child Psychology and Psychiatry*, *43*(7), 901-916. https://doi.org/10.1111/1469-7610.00139

Denham, S. A., & Grout, L. (1993). Socialization of emotion: Pathway to preschoolers' emotional and social competence. *Journal of Nonverbal Behavior*, *17*, 205-227.

Di Maggio, R., Zappulla, C., & Pace, U. (2016). The Relationship Between Emotion Knowledge, Emotion Regulation and Adjustment in Preschoolers: A Mediation Model. *Journal of Child and Family Studies*, *25*(8), 2626-2635. https://doi.org/10.1007/s10826-016-0409-6

Diamond, A. (2013). Executive functions. *Annu Rev Psychol*, *64*, 135-168. https://doi.org/10.1146/annurev-psych-113011-143750

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). The early years: Preschool program improves cognitive control. *Science*, *318*(5855), 1387-1388. https://doi.org/10.1126/science.1151148

Dodge, K. A., & Crick, N. R. (1990). Social information-processing bases of aggressive behavior in children. *Personality and social psychology bulletin*, *16*(1), 8-22.

Doebel, S. (2020). Rethinking executive function and its development. *Perspectives on Psychological Science*, *15*(4), 942-956.

Doebel, S., & Zelazo, P. D. (2015). A meta-analysis of the Dimensional Change Card Sort: Implications for developmental theories and the measurement of executive function in children. *Developmental Review*, *38*, 241-268. https://doi.org/https://doi.org/10.1016/j.dr.2015.09.001

Eggum, N. D., Eisenberg, N., Kao, K., Spinrad, T. L., Bolnick, R., Hofer, C., Kupfer, A. S., & Fabricius, W. V. (2011). Emotion understanding, theory of mind, and prosocial orientation: Relations over time in early childhood. *The Journal of Positive Psychology*, *6*(1), 4-16. https://doi.org/10.1080/17439760.2010.536776

Eisenberg, N. (2020). Findings, Issues, and New Directions for Research on Emotion Socialization. *Developmental psychology*, *56*(3), 664-670. https://doi.org/10.1037/dev0000906

Eisenberg, N., Eggum, N. D., & Di Giunta, L. (2010). Empathy-related responding: Associations with prosocial behavior, aggression, and intergroup relations. *Social issues and policy review*, *4*(1), 143-180.

Eisenberg, N., & Spinrad, T. L. (2004). Emotion-Related Regulation: Sharpening the Definition. *Child Development*, *75*(2), 334-339. https://doi.org/10.1111/j.1467-8624.2004.00674.x

Ekerim-Akbulut, M., Şen, H. H., Beşiroğlu, B., & Selçuk, B. (2020). The Role of Theory of Mind, Emotion Knowledge and Empathy in Preschoolers' Disruptive Behavior. *Journal of Child and Family Studies*, *29*(1), 128-143. https://doi.org/10.1007/s10826-019-01556-9

Ensor, R., & Hughes, C. (2005). More than talk: Relations between emotion understanding and positive behaviour in toddlers. *British journal of developmental psychology*, *23*(3), 343-363. https://doi.org/10.1348/026151005X26291

Ersan, C. (2020). Physical aggression, relational aggression and anger in preschool children: The mediating role of emotion regulation. *The Journal of general psychology*, *147*(1), 18-42. https://doi.org/10.1080/00221309.2019.1609897

Evans, S. C., Frazer, A. L., Blossom, J. B., & Fite, P. J. (2019a). Forms and Functions of Aggression in Early Childhood. *Journal of clinical child and adolescent psychology*, *48*(5), 790-798. https://doi.org/10.1080/15374416.2018.1485104

Evans, S. C., Frazer, A. L., Blossom, J. B., & Fite, P. J. (2019b). Forms and Functions of Aggression in Early Childhood. *Journal of Clinical Child & Adolescent Psychology*, *48*(5), 790-798. https://doi.org/10.1080/15374416.2018.1485104

Fidalgo, A. M., Tenenbaum, H. R., & Aznar, A. (2018). Are There Gender Differences in Emotion Comprehension? Analysis of the Test of Emotion Comprehension. *Journal of Child & Family Studies*, *27*(4), 1065-1074. https://doi.org/10.1007/s10826-017-0956-5

Fine, S. E., Izard, C. E., Mostow, A. J., Trentacosta, C. J., & Ackerman, B. P. (2003). First grade emotion knowledge as a predictor of fifth grade self-reported internalizing behaviors in children from economically disadvantaged families. *Development and psychopathology*, *15*(2), 331-342.

Fite, P. J., Colder, C. R., Lochman, J. E., & Wells, K. C. (2008). Developmental Trajectories of Proactive and Reactive Aggression from Fifth to Ninth Grade. *Journal of Clinical Child & Adolescent Psychology*, *37*(2), 412-421. https://doi.org/10.1080/15374410801955920

Fox, S. E., Levitt, P., & Nelson Iii, C. A. (2010). How the Timing and Quality of Early Experiences Influence the Development of Brain Architecture. *Child Development*, *81*(1), 28-40. https://doi.org/10.1111/j.1467-8624.2009.01380.x

Fraser, M. W. (1996). Aggressive Behavior in Childhood and Early Adolescence: An Ecological-Developmental Perspective on Youth Violence. *Social Work*, *41*(4), 347-361. https://doi.org/10.1093/sw/41.4.347

Garner, P. W., & Waajid, B. (2008). The associations of emotion knowledge and teacher–child relationships to preschool children's school-related developmental competence. *Journal of Applied Developmental Psychology*, *29*(2), 89-100.

Garner, P. W., & Waajid, B. (2012). Emotion Knowledge and Self-Regulation as Predictors of Preschoolers' Cognitive Ability, Classroom Behavior, and Social Competence. *Journal of Psychoeducational Assessment*, *30*(4), 330-343. https://doi.org/10.1177/0734282912449441

Godleski, S. A., Kamper, K. E., Ostrov, J. M., Hart, E. J., & Blakely-McClure, S. J. (2015). Peer Victimization and Peer Rejection During Early Childhood. *Journal of clinical child and adolescent psychology*, *44*(3), 380-392. https://doi.org/10.1080/15374416.2014.940622

Goldstein, S. E., & Boxer, P. (2010). Parenting Practices and the Early Socialisation of Relational Aggression among Preschoolers. *Early Child Development and Care*, *183*(11), 1559-1575.

Gower, A. L., Lingras, K. A., Mathieson, L. C., Kawabata, Y., & Crick, N. R. (2014). The Role of Preschool Relational and Physical Aggression in the Transition to Kindergarten: Links With Social-Psychological Adjustment. *Early Education and Development*, *25*(5), 619-640. https://doi.org/10.1080/10409289.2014.844058

Granvald, V., & Marciszko, C. (2016). Relations between key executive functions and aggression in childhood. *Child Neuropsychology*, *22*(5), 537-555. https://doi.org/10.1080/09297049.2015.1018152

Greenberg, M. T. (2006). Promoting Resilience in Children and Youth: Preventive Interventions and Their Interface with Neuroscience. *Annals of the New York Academy of Sciences*, *1094*(1), 139-150. https://doi.org/10.1196/annals.1376.013

Gross, J. J. (2015). Emotion Regulation: Current Status and Future Prospects. *Psychological Inquiry*, *26*(1), 1-26. https://doi.org/10.1080/1047840X.2014.940781

Gross, J. J. P. D. (2014). *Handbook of emotion regulation* (Second ed.). The Guilford Press. https://go.exlibris.link/80S2KWC1

Hawley, P. H. (2003). Strategies of control, aggression, and morality in preschoolers: An evolutionary perspective: Evolutionary developmental psychology. *Journal of Experimental Child Psychology*, *85*(3), 213-235. https://go.exlibris.link/nKVNXdJR

Hay, D. F., Paine, A. L., Perra, O., Cook, K. V., Hashmi, S., Robinson, C., Kairis, V., & Slade, R. (2021). Prosocial and aggressive behavior: A longitudinal study. *Monographs of the society for research in child development*, *86*(2), 7-103.

Held, J. (2020). *Does Inhibitory Control and Emotion Regulation Alter the Degree to which Aggressogenic Thought Is Expressed?* (Publication Number Dissertation/Thesis) ProQuest Dissertations Publishing]. https://go.exlibris.link/nVHF022Q

Helmsen, J., Koglin, U., & Petermann, F. (2012). Emotion Regulation and Aggressive Behavior in Preschoolers: The Mediating Role of Social Information Processing. *Child Psychiatry & Human Development*, *43*(1), 87-101. https://doi.org/10.1007/s10578-011-0252-3

Holley, S. R., Ewing, S. T., Stiver, J. T., & Bloch, L. (2017). The Relationship Between Emotion Regulation, Executive Functioning, and Aggressive Behaviors. *Journal of interpersonal violence*, *32*(11), 1692-1707. https://doi.org/10.1177/0886260515592619

Howard, S. J., & Melhuish, E. (2017). An Early Years Toolbox for Assessing Early Executive Function, Language, Self-Regulation, and Social Development: Validity, Reliability, and Preliminary Norms. *Journal of Psychoeducational Assessment*, *35*(3), 255-275. https://doi.org/10.1177/0734282916633009

Hubbard, J. A., McAuliffe, M. D., Morrow, M. T., & Romano, L. J. (2010). Reactive and proactive aggression in childhood and adolescence: Precursors, outcomes, processes, experiences, and measurement. *Journal of Personality*, *78*(1), 95-118. https://doi.org/10.1111/j.1467-6494.2009.00610.x

Huizinga, M., Dolan, C. V., & van der Molen, M. W. (2006). Age-related change in executive function: developmental trends and a latent variable analysis. *Neuropsychologia*, *44*(11), 2017-2036. https://doi.org/10.1016/j.neuropsychologia.2006.01.010

Izard, King, K. A., Trentacosta, C. J., Morgan, J. K., Laurenceau, J.-P., Krauthamer-Ewing, E. S., & Finlon, K. J. (2008). Accelerating the development of emotion competence in Head Start children: Effects on adaptive and maladaptive behavior. *Development and psychopathology*, *20*(1), 369-397. https://doi.org/10.1017/S0954579408000175

Izard, C., Stark, K., Trentacosta, C., & Schultz, D. (2008). Beyond Emotion Regulation: Emotion Utilization and Adaptive Functioning. *Child development perspectives*, *2*(3), 156-163. https://doi.org/10.1111/j.1750-8606.2008.00058.x

Izard, C. E. (2009). Emotion theory and research: highlights, unanswered questions, and emerging issues. *Annu Rev Psychol*, *60*, 1-25. https://doi.org/10.1146/annurev.psych.60.110707.163539

Karr, J. E., Areshenkoff, C. N., Rast, P., Hofer, S. M., Iverson, G. L., & Garcia-Barrera, M. A. (2018). The Unity and Diversity of Executive Functions: A Systematic Review and Re-Analysis of Latent Variable Studies. *Psychological bulletin*, *144*(11), 1147-1185. https://doi.org/10.1037/bul0000160

Keltner, D., & Gross, J. J. (1999). Functional Accounts of Emotions. *Cognition and emotion*, *13*(5), 467-480. https://doi.org/10.1080/026999399379140

Keown, L. J., Franke, N., & Triggs, C. M. (2020). An Evaluation of a Classroom-Based Intervention to Improve Executive Functions in 4-Year Old Children in New Zealand. *Early Childhood Education Journal*. https://doi.org/10.1007/s10643-020-01023-x

Kim, J. H. (2019). Multicollinearity and misleading statistical results. *kja*, *72*(6), 558-569. https://doi.org/10.4097/kja.19087

Kline, R. B. (2011). Principles and practice of structural equation modeling.

Lansford, J. E., Malone, P. S., Dodge, K. A., Pettit, G. S., & Bates, J. E. (2010). Developmental cascades of peer rejection, social information processing biases, and aggression during middle childhood. *Development and psychopathology*, *22*(3), 593-602.

Latzman, R. D., Elkovitch, N., Young, J., & Clark, L. A. (2010). The contribution of executive functioning to academic achievement among male adolescents. *Journal of clinical and experimental neuropsychology*, *32*(5), 455-462. https://doi.org/10.1080/13803390903164363

Laurent, G., Hecht, H. K., Ensink, K., & Borelli, J. L. (2020). Emotional Understanding, Aggression, and Social Functioning Among Preschoolers. *American journal of orthopsychiatry*, *90*(1), 9-21. https://doi.org/10.1037/ort0000377

Lee, K., Bull, R., & Ringo, M. H. H. (2013). Developmental Changes in Executive Functioning. *Child Development*, *84*(6), 1933-1953. https://doi.org/10.1111/cdev.12096

Leerkes, E. M., Paradise, M., O'Brien, M., Calkins, S. D., & Lange, G. (2008). Emotion and Cognition Processes in Preschool Children. *Merrill-Palmer Quarterly*, *54*(1), 102-124. https://doi.org/10.1353/mpq.2008.0009

Lemerise, E. A., & Arsenio, W. F. (2000). An Integrated Model of Emotion Processes and Cognition in Social Information Processing. *Child Development*, *71*(1), 107-118. https://doi.org/10.1111/1467-8624.00124

Levenson, R. W. (1999). The Intrapersonal Functions of Emotion. *Cognition and emotion*, *13*(5), 481-504. https://doi.org/10.1080/026999399379159

Little, T., Henrich, C., Jones, S., & Hawley, P. (2003). Disentangling the" whys" from the" whats" of aggressive behaviour. *International Journal of Behavioral Development*, *27*(2), 122-133.

Lucas-Molina, B., Quintanilla, L., Sarmento-Henrique, R., Martín Babarro, J., & Giménez-Dasí, M. (2020). The Relationship between Emotion Regulation and Emotion Knowledge in Preschoolers: A Longitudinal Study. *International journal of environmental research and public health*, *17*(16), 5726. https://www.mdpi.com/1660-4601/17/16/5726

Mărcuş, O., Martins, E. C., Sassu, R., & Visu-Petra, L. (2022). On the importance of being flexible: early interrelations between affective flexibility, executive functions and anxiety symptoms in preschoolers. *Early Child Development and Care*, *192*(6), 914-931. https://doi.org/10.1080/03004430.2020.1816995

Martin, C. L., Kornienko, O., Schaefer, D. R., Hanish, L. D., Fabes, R. A., & Goble, P. (2013). The role of sex of peers and gender-typed activities in young children's peer affiliative networks: a longitudinal analysis of selection and influence. *Child Dev*, *84*(3), 921-937. https://doi.org/10.1111/cdev.12032

Martins, E. C., Osório, A., Veríssimo, M., & Martins, C. (2016). Emotion understanding in preschool children: The role of executive functions. *International Journal of Behavioral Development*, *40*(1), 1-10. https://doi.org/10.1177/0165025414556096

Masten, A. S., & Cicchetti, D. (2010). Developmental cascades. *Development and psychopathology*, *22*(3), 491-495. https://doi.org/10.1017/S0954579410000222

McClelland, M. M., Acock, A. C., Piccinin, A., Rhea, S. A., & Stallings, M. C. (2013). Relations between preschool attention span-persistence and age 25 educational outcomes. *Early Childhood Research Quarterly*, *28*(2), 314-324. https://doi.org/https://doi.org/10.1016/j.ecresq.2012.07.008

McClelland, M. M., Tominey, S. L., Schmitt, S. A., & Duncan, R. (2017). SEL Interventions in Early Childhood. *The Future of Children*, *27*(1), 33-47. https://doi.org/10.1353/foc.2017.0002

McRae, K., & Gross, J. J. (2020). Emotion regulation. *Emotion*, *20*(1), 1.

Miller, A. L., Fine, S. E., Kiely Gouley, K., Seifer, R., Dickstein, S., & Shields, A. (2006). Showing and telling about emotions: Interrelations between facets of emotional competence and associations with classroom adjustment in Head Start preschoolers. *Cognition and emotion*, *20*(8), 1170-1192. https://doi.org/10.1080/02699930500405691

Ministry of Education, n. d. (2023). *Ministry Funding Deciles*

Monette, S., Bigras, M., & Lafrenière, M.-A. (2015). Structure of executive functions in typically developing kindergarteners. *Journal of Experimental Child Psychology*, *140*, 120-139. https://doi.org/https://doi.org/10.1016/j.jecp.2015.07.005

Monks, C. P., Smith, P. K., & Kucaba, K. (2021). Peer Victimisation in Early Childhood; Observations of Participant Roles and Sex Differences. *Int J Environ Res Public Health*, *18*(2). https://doi.org/10.3390/ijerph18020415

Murray-Close, D., & Ostrov, J. M. (2009). A Longitudinal Study of Forms and Functions of Aggressive Behavior in Early Childhood: Forms and Functions of Aggression. *Child Development*, *80*(3), 828-842. https://doi.org/10.1111/j.1467-8624.2009.01300.x

Murray-Close, D., Crick, N. R., & Galotti, K. M. (2006). Children's moral reasoning regarding physical and relational aggression. *Social development*, *15*(3), 345-372.

Navarro, R., Larrañaga, E., Yubero, S., & Víllora, B. (2022). Families, Parenting and Aggressive Preschoolers: A Scoping Review of Studies Examining Family Variables Related to Preschool Aggression. *Int J Environ Res Public Health*, *19*(23). https://doi.org/10.3390/ijerph192315556

Nelson, J. M., James, T. D., Chevalier, N., Clark, C. A. C., & Espy, K. A. (2016). Structure, measurement, and development of preschool executive function. In J. A. Griffin, L. S. Freund, & P. McCardle (Eds.), *Executive function in preschool-age children: Integrating measurement, neurodevelopment, and translational research* (pp. 65-89). American Psychological Association. https://doi.org/10.1037/14797-004

Noreen, S., & MacLeod, M. D. (2015). What do we really know about cognitive inhibition? Task demands and inhibitory effects across a range of memory and behavioural tasks. *PloS one*, *10*(8), e0134951.

Noten, M. M. P. G., Heijden, K. B. v. d., Huijbregts, S. C. J., Goozen, S. H. M. v., & Swaab, H. (2020). Associations between empathy, inhibitory control, and physical aggression in toddlerhood. *Developmental psychobiology*, *62*(6), 871-881. https://go.exlibris.link/N2XbsYBv

O'Brien, M., Miner Weaver, J., Nelson, J. A., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2011). Longitudinal associations between children's understanding of emotions and theory of mind. *Cognition and emotion*, *25*(6), 1074-1086. https://doi.org/10.1080/02699931.2010.518417

O'Toole, S. E., Monks, C. P., & Tsermentseli, S. (2017). Executive function and theory of mind as predictors of aggressive and prosocial behavior and peer acceptance in early

childhood. *Social development (Oxford, England)*, *26*(4), 907-920. https://doi.org/10.1111/sode.12231

O'Toole, S. E., Tsermentseli, S., Humayun, S., & Monks, C. P. (2019). Cool and hot executive functions at 5 years old as predictors of physical and relational aggression between 5 and 6 years old. *International Journal of Behavioral Development*, *43*(2), 157-165. https://doi.org/10.1177/0165025418798498

Ornaghi, V., Brazzelli, E., Grazzani, I., Agliati, A., & Lucarelli, M. (2017). Does Training Toddlers in Emotion Knowledge Lead to Changes in Their Prosocial and Aggressive Behavior Toward Peers at Nursery? *Early Education and Development*, *28*(4), 396-414. https://doi.org/10.1080/10409289.2016.1238674

Ostrov, J. M., Blakely-McClure, S. J., Perry, K. J., & Kamper-DeMarco, K. E. (2018). Definitions—The form and function of relational aggression.

Ostrov, J. M., & Crick, N. R. (2007). Forms and Functions of Aggression During Early Childhood: A Short-Term Longitudinal Study. *School psychology review*, *36*(1), 22-43. https://doi.org/10.1080/02796015.2007.12087950

Ostrov, J. M., & Keating, C. F. (2004). Gender differences in preschool aggression during free play and structured interactions: An observational study. *Social development*, *13*(2), 255-277.

Ostrov, J. M., Murray-Close, D., Godleski, S. A., & Hart, E. J. (2013). Prospective associations between forms and functions of aggression and social and affective processes during early childhood. *Journal of Experimental Child Psychology*, *116*(1), 19-36. https://doi.org/10.1016/j.jecp.2012.12.009

Ostrov, J. M., Murray-Close, D., Perry, K. J., Blakely-McClure, S. J., Perhamus, G. R., Mutignani, L. M., Kesselring, S., Memba, G. V., & Probst, S. (2022). The development of forms and functions of aggression during early childhood: A

temperament-based approach. *Development and psychopathology*, 1-17. https://doi.org/10.1017/S0954579422000177

Ostrov, J. M., Murray-Close, D., Perry, K. J., Blakely-McClure, S. J., Perhamus, G. R., Mutignani, L. M., Kesselring, S., Memba, G. V., & Probst, S. (2023). The development of forms and functions of aggression during early childhood: A temperament-based approach. *Development and psychopathology*, *35*(2), 941-957. https://doi.org/10.1017/S0954579422000177

Ostrov, J. M., Perry, K. J., Eiden, R. D., Nickerson, A. B., Schuetze, P., Godleski, S. A., & Shisler, S. (2022). Development of bullying and victimization: An examination of risk and protective factors in a high-risk sample. *Journal of interpersonal violence*, *37*(9-10), 5958-5984.

Patwardhan, I., Nelson, T. D., McClelland, M. M., & Mason, W. A. (2021a). Childhood cognitive flexibility and externalizing and internalizing behavior problems: Examination of prospective bidirectional associations. *Research on child and adolescent psychopathology*, *49*, 413-427.

Patwardhan, I., Nelson, T. D., McClelland, M. M., & Mason, W. A. (2021b). Childhood Cognitive Flexibility and Externalizing and Internalizing Behavior Problems: Examination of Prospective Bidirectional Associations. *Journal of abnormal child psychology*, *49*(4), 413-427. https://doi.org/10.1007/s10802-020-00757-x

Perone, S., Simmering, V. R., & Buss, A. T. (2021). A Dynamical Reconceptualization of Executive-Function Development. *Perspectives on Psychological Science*, *16*(6), 1198-1208. https://doi.org/10.1177/1745691620966792

Poland, S. E., Monks, C. P., & Tsermentseli, S. (2016). Cool and hot executive function as predictors of aggression in early childhood: Differentiating between the function and

form of aggression. *British journal of developmental psychology*, *34*(2), 181-197. https://doi.org/10.1111/bjdp.12122

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European journal of developmental psychology*, *1*(2), 127-152. https://doi.org/10.1080/17405620344000022

Porsch, R. M., Middeldorp, C. M., Cherny, S. S., Krapohl, E., van Beijsterveldt, C. E. M., Loukola, A., Korhonen, T., Pulkkinen, L., Corley, R., Rhee, S., Kaprio, J., Rose, R. R., Hewitt, J. K., Sham, P., Plomin, R., Boomsma, D. I., & Bartels, M. (2016). Longitudinal heritability of childhood aggression. *American journal of medical genetics. Part B, Neuropsychiatric genetics*, *171*(5), 697-707. https://doi.org/10.1002/ajmg.b.32420

Poulou, M. S., & Bassett, H. H. (2018). Children's emotional and behavioral responses to peer provocation and early school adjustment. *Pastoral care in education*, *36*(3), 205-222. https://doi.org/10.1080/02643944.2018.1479351

Prinstein, M. J., & Cillessen, A. H. N. (2003). Forms and Functions of Adolescent Peer Aggression Associated With High Levels of Peer Status. *Merrill-Palmer Quarterly*, *49*(3), 310-342. http://www.jstor.org/stable/23096058

Raaijmakers, M., Smidts, D. P., Sergeant, J. A., Maassen, G. H., Posthumus, J. A., van Engeland, H., & Matthys, W. (2008). Executive functions in preschool children with aggressive behavior: impairments in inhibitory control. *Journal of abnormal child psychology*, *36*(7), 1097-1107. https://doi.org/10.1007/s10802-008-9235-7

Rapee, R. M., Oar, E. L., Johnco, C. J., Forbes, M. K., Fardouly, J., Magson, N. R., & Richardson, C. E. (2019). Adolescent development and risk for the onset of social-

emotional disorders: A review and conceptual model. *Behaviour research and therapy*, *123*, 103501. https://doi.org/https://doi.org/10.1016/j.brat.2019.103501

Reilly, S. E., Downer, J. T., & Grimm, K. J. (2022). Developmental trajectories of executive functions from preschool to kindergarten. *Developmental Science*, *25*(5), e13236.

Rhoades, B. L., Warren, H. K., Domitrovich, C. E., & Greenberg, M. T. (2011). Examining the link between preschool social–emotional competence and first grade academic achievement: The role of attention skills. *Early Childhood Research Quarterly*, *26*(2), 182-191. https://doi.org/10.1016/j.ecresq.2010.07.003

Rohlf, H. L., Holl, A. K., Kirsch, F., Krahé, B., & Elsner, B. (2018). Longitudinal Links between Executive Function, Anger, and Aggression in Middle Childhood. *Frontiers in behavioral neuroscience*, *12*, 27-27. https://doi.org/10.3389/fnbeh.2018.00027

Röll, J., Koglin, U., & Petermann, F. (2012). Emotion Regulation and Childhood Aggression: Longitudinal Associations. *Child psychiatry and human development*, *43*(6), 909-923. https://doi.org/10.1007/s10578-012-0303-4

Roman, A. S., Pisoni, D. B., & Kronenberger, W. G. (2014). Assessment of Working Memory Capacity in Preschool Children Using the Missing Scan Task. *Infant Child Dev*, *23*(6), 575-587. https://doi.org/10.1002/icd.1849

Romero-López, M., Pichardo, M. C., Justicia-Arráez, A., & Bembibre-Serrano, J. (2021). Reducing Aggression by Developing Emotional and Inhibitory Control. *International journal of environmental research and public health*, *18*(10), 5263. https://www.mdpi.com/1660-4601/18/10/5263

Roos, S., Hodges, E. V. E., Peets, K., & Salmivalli, C. (2016). Anger and effortful control moderate aggressogenic thought-behaviour associations. *Cognition and emotion*, *30*(5), 1008-1016. https://doi.org/10.1080/02699931.2015.1037721

Runions, K. C., & Keating, D. P. (2010). Anger and inhibitory control as moderators of children's hostile attributions and aggression. *Journal of Applied Developmental Psychology*, *31*(5), 370-378. https://doi.org/10.1016/j.appdev.2010.05.006

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*(1), 145.

Sasser, T. R., Bierman, K. L., & Heinrichs, B. (2015). Executive functioning and school adjustment: The mediational role of pre-kindergarten learning-related behaviors. *Early Childhood Research Quarterly*, *30*(Pt A), 70-79. https://doi.org/10.1016/j.ecresq.2014.09.001

Scherer, K. R. (1982). Emotion as a process: Function, origin and regulation. *Social Science Information*, *21*(4-5), 555-570. https://doi.org/10.1177/053901882021004004

Schoemaker, K., Mulder, H., Deković, M., & Matthys, W. (2013). Executive Functions in Preschool Children with Externalizing Behavior Problems: A Meta-Analysis. *Journal of abnormal child psychology*, *41*(3), 457-471. https://doi.org/10.1007/s10802-012-9684-x

Schuberth, D. A., Zheng, Y., Pasalich, D. S., McMahon, R. J., Kamboukos, D., Dawson-McClure, S., & Brotman, L. M. (2019). The Role of Emotion Understanding in the Development of Aggression and Callous-Unemotional Features across Early Childhood. *Journal of abnormal child psychology*, *47*(4), 619-631. https://doi.org/10.1007/s10802-018-0468-9

Séguin, J. R., & Zelazo, P. D. (2005). Executive function in early physical aggression.

Shablack, H., & Lindquist, K. A. (2019). The Role of Language in Emotional Development. In V. LoBue, K. Pérez-Edgar, & K. A. Buss (Eds.), *Handbook of Emotional Development* (pp. 451-478). Springer International Publishing. https://doi.org/10.1007/978-3-030-17332-6_18

Simpson, A., & Carroll, D. J. (2019). Understanding early inhibitory development: Distinguishing two ways that children use inhibitory control. *Child Development*, *90*(5), 1459-1473.

Simpson, A., & Riggs, K. J. (2006). Conditions under which children experience inhibitory difficulty with a "button-press" go/no-go task. *Journal of Experimental Child Psychology*, *94*(1), 18-26. https://doi.org/https://doi.org/10.1016/j.jecp.2005.10.003

Smeijers, D., Benbouriche, M., & Garofalo, C. (2020). The Association Between Emotion, Social Information Processing, and Aggressive Behavior: A Systematic Review. *European psychologist*, *25*(2), 81-91. https://doi.org/10.1027/1016-9040/a000395

Smith, P. K., & Hart, C. H. (2011). *The Wiley-Blackwell handbook of childhood social development* (2nd;2nd; ed.). Wiley-Blackwell. https://doi.org/10.1002/9781444390933

Spinrad, T. L., & Gal, D. E. (2018). Fostering prosocial behavior and empathy in young children. *Current Opinion in Psychology*, *20*, 40-44.

Storbeck, J., & Clore, G. L. (2007). On the interdependence of cognition and emotion. *Cognition and emotion*, *21*(6), 1212-1237.

Suchy, Y. (2015). *Executive Functioning : A Comprehensive Guide for Clinical Practice*. Oxford University Press, Incorporated. http://ebookcentral.proquest.com/lib/canterbury/detail.action?docID=4706155

Sutton, J., Smith, P. K., & Swettenham, J. (1999). Social cognition and bullying: Social inadequacy or skilled manipulation? *British journal of developmental psychology*, *17*(3), 435-450.

Suurland, J., van der Heijden, K. B., Huijbregts, S. C. J., Smaling, H. J. A., de Sonneville, L. M. J., Van Goozen, S. H. M., & Swaab, H. (2016). Parental Perceptions of Aggressive Behavior in Preschoolers: Inhibitory Control Moderates the Association With

Negative Emotionality. *Child Development*, *87*(1), 256-269. https://doi.org/10.1111/cdev.12455

Swit, C. S. (2019). Understanding the Distinctive Differences between Relationally and Physically Aggressive Behaviours Used in Early Childhood Contexts. *Early Education and Development*, *30*(7), 927-946. https://doi.org/10.1080/10409289.2019.1603579

Swit, C. S., & Harty, S. C. (2023). Normative Beliefs and Aggression: The Mediating Roles of Empathy and Anger. *Child Psychiatry & Human Development*. https://doi.org/10.1007/s10578-023-01558-1

Swit, C. S., Harty, S. C., & Pascoe, S. (2023). Relational and physical aggression in preschool-age children: Associations with teacher, parent, sibling, and peer relationship quality. *Aggressive behavior*. https://doi.org/10.1002/ab.22115

Swit, C. S., McMaugh, A., & Warburton, W. A. (2016). Preschool Children's Beliefs About the Acceptability of Relational and Physical Aggression. *International journal of early childhood*, *48*(1), 111-127. https://doi.org/10.1007/s13158-016-0155-3

Swit, C. S., McMaugh, A. L., & Warburton, W. A. (2024). Investigating Preschoolers' Perspectives on Aggression Through Observation and Video-Stimulated Recall. *Journal of research in childhood education*, 1-17.

Tampke, E. C., Fite, P. J., & Cooley, J. L. (2020). Bidirectional associations between affective empathy and proactive and reactive aggression. *Aggressive behavior*, *46*(4), 317-326. https://doi.org/10.1002/ab.21891

Tiego, J., Testa, R., Bellgrove, M. A., Pantelis, C., & Whittle, S. (2018). A Hierarchical Model of Inhibitory Control. *Frontiers in Psychology*, *9*, 1339-1339. https://doi.org/10.3389/fpsyg.2018.01339

Tremblay, R. E. (2002). Prevention of injury by early socialization of aggressive behavior. *Injury Prevention*, *8*(suppl 4), iv17-iv21. https://doi.org/10.1136/ip.8.suppl_4.iv17

Tremblay, R. E., Nagin, D. S., Seguin, J. R., Zoccolillo, M., Zelazo, P. D., Boivin, M., Perusse, D., & Japel, C. (2004). Physical aggression during early childhood: Trajectories and predictors. *Pediatrics*, *114*(1), e43-e50.

Trentacosta, C. J., & Fine, S. E. (2010). Emotion Knowledge, Social Competence, and Behavior Problems in Childhood and Adolescence: A Meta-analytic Review. *Social development (Oxford, England)*, *19*(1), 1-29. https://doi.org/10.1111/j.1467-9507.2009.00543.x

Utendale, W. T., & Hastings, P. D. (2011). Developmental changes in the relations between inhibitory control and externalizing problems during early childhood. *Infant and Child Development*, *20*(2), 181-193.

Van Adrichem, D. S., Huijbregts, S. C. J., Van Der Heijden, K. B., Van Goozen, S. H. M., & Swaab, H. (2020a). Aggressive behavior during toddlerhood: Interrelated effects of prenatal risk factors, negative affect, and cognition. *Child Neuropsychology*, *26*(7), 982-1004. https://doi.org/10.1080/09297049.2020.1769582

van Adrichem, D. S., Huijbregts, S. C. J., van der Heijden, K. B., van Goozen, S. H. M., & Swaab, H. (2020b). The Role of Inhibitory Control, Attention and Vocabulary in Physical Aggression Trajectories From Infancy to Toddlerhood. *Frontiers in Psychology*, *11*, 1079-1079. https://doi.org/10.3389/fpsyg.2020.01079

Viana, K. M. P., Lucena, J., Zambrana, I. M., Harris, P. L., & Pons, F. (2022). Children's Emotion Understanding and Cooperative Problem-Solving in Educational Settings. In D. Dukes, A. C. Samson, & E. A. Walle (Eds.), *The Oxford Handbook of Emotional Development* (pp. 567). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198855903.013.41

Vitaro, F., Brendgen, M., & Barker, E. D. (2006). Subtypes of aggressive behaviors: A developmental perspective. *International Journal of Behavioral Development*, *30*(1), 12-19. https://doi.org/10.1177/0165025406059968

von Salisch, M., Haenel, M., & Freund, P. A. (2013). Emotion understanding and cognitive abilities in young children. *Learning and individual differences*, *26*, 15-19. https://doi.org/10.1016/j.lindif.2013.04.001

Wang, Y., Shang, S., Xie, W., Hong, S., Liu, Z., & Su, Y. (2023). The relation between aggression and theory of mind in children: A meta-analysis. *Developmental Science*, *26*(2), e13310-n/a. https://doi.org/10.1111/desc.13310

Weinberg, A., & Klonsky, E. D. (2009). Measurement of Emotion Dysregulation in Adolescents. *Psychological assessment*, *21*(4), 616-621. https://doi.org/10.1037/a0016669

Wiebe, S. A., Sheffield, T., Nelson, J. M., Clark, C. A. C., Chevalier, N., & Espy, K. A. (2011). The structure of executive function in 3-year-olds. *Journal of Experimental Child Psychology*, *108*(3), 436-452. https://doi.org/https://doi.org/10.1016/j.jecp.2010.08.008

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

Willoughby, M. T., Wirth, R. J., Blair, C. B., & Family Life Project, I. (2012). Executive Function in Early Childhood: Longitudinal Measurement Invariance and Developmental Change. *Psychological assessment*, *24*(2), 418-431. https://doi.org/10.1037/a0025779

Yue, X., & Zhang, Q. (2023). The association between peer rejection and aggression types: A meta-analysis. *Child abuse & neglect*, *135*, 105974. https://doi.org/https://doi.org/10.1016/j.chiabu.2022.105974

Zelazo, P. D. (2015). Executive function: Reflection, iterative reprocessing, complexity, and the developing brain. *Developmental Review*, *38*, 55-68.

Zelazo, P. D. (2020). Executive function and psychopathology: A neurodevelopmental perspective. *Annual review of clinical psychology*, *16*, 431-454.

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., & Weintraub, S. (2013). II. NIH TOOLBOX COGNITION BATTERY (CB): MEASURING EXECUTIVE FUNCTION AND ATTENTION. *Monographs of the society for research in child development*, *78*(4), 16-33. https://doi.org/https://doi.org/10.1111/mono.12032

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., & Weintraub, S. (2013). II. NIH Toolbox Cognition Battery (CB): Measuring executive function and attention. *Monographs of the society for research in child development*, *78*(4), 16-33.

Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). Executive Function: Implications for Education. NCER 2017-2000. *National Center for Education Research*.

Zelazo, P. D., & Carlson, S. M. (2012). Hot and Cool Executive Function in Childhood and Adolescence: Development and Plasticity. *Child development perspectives*, *6*(4), 354-360. https://doi.org/10.1111/j.1750-8606.2012.00246.x

Zelazo, P. D., & Müller, U. (2010). Executive Function in Typical and Atypical Development. In U. Goswami (Ed.), *The Wiley-Blackwell Handbook of Childhood Cognitive Development* (pp. 574-603). Wiley-Blackwell. https://doi.org/10.1002/9781444325485.ch22

Appendix A

Preschool Proactive and Reactive Aggression Teacher Report

Please rate this child against each of these behaviours.

		Never or Almost Never True (0)	Not Often (1)	Sometimes (2)	Often (3)	Always or Almost Always True (4)
1	When this child is hurt by someone, s/he will often physically fight back	1	2	3	4	5
2	If other children hurt this child, s/he often keeps them from being in their group of friends	1	2	3	4	5
3	If other children make this child mad, s/he will often physically hurt them	1	2	3	4	5
4	This child will often share with others, to get what s/he wants	1	2	3	4	5
5	This child often starts physical fights to get what s/he wants	1	2	3	4	5
6	This child often threatens others physically to get what s/he wants	1	2	3	4	5
7	This child will often include others, after they have cooperated with her/him	1	2	3	4	5
8	If other children anger this child, s/he will often hit, kick, or punch them	1	2	3	4	5
9	When s/he is angry at others, this child will often tell them that s/he won't be their friend anymore	1	2	3	4	5
10	When s/he is upset with others, this child will often ignore or stop talking to them	1	2	3	4	5
11	To get what this child wants, s/he often tells others that s/he won't be their friend anymore	1	2	3	4	5
12	This child often hits, kicks, or punches to get what s/he wants	1	2	3	4	5
13	This child often says "you can't come to my birthday party" to other children to get what s/he	1	2	3	4	5

	wants					
14	To get what this child wants, s/he often will ignore or stop talking to others	1	2	3	4	5

Appendix B

Participant Information

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School of Health Sciences

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1 March 2023

Children's Social Behaviour and Teacher and Parent Health and Wellness Information Sheet for Parents/Primary Caregivers

You are invited to participate in a study exploring children's (2- to 5-years old) social and emotional behaviours and how these may influence teachers' and parents' (or primary caregivers') health and wellness over a school year. The purpose of the study is to 1) to explore the prevalence and nature of children's use of social and non- social behaviours, as reported by teachers and parents/caregiver; 2) to explore the prevalence and nature of teachers' and parents' health and wellness, through self-reports; and 3) to examine children's perceptions of friendship, kindness, and princesses and superheroes that are portrayed in common television series and movies. Children will also be invited to play some simple activities on an iPad to assess their attention and memory.

This study is being conducted by Dr Cara Swit (principal investigator), Senior Lecturer in the School of Health Sciences, Dr Porsha London, Researcher at Te Rūnanga o Ngāi Tahu, Dr Seth Harty, Senior Lecturer in the School of Psychology, Speech and Hearing, Dr Valerie Sotardi, Senior Lecturer in School of Educational Studies and Leadership, University of Canterbury, Dr Anne McMaugh, Senior Lecturer in the School of Education, Macquarie University.

You have been approached to take part in this study because KidsFirst Professional Leaders are interested in gathering data on ways in which we can improve the social and emotional development of young children and the health and wellness of teachers and parents. We will be collecting data from teachers, parents, and children over several years, until your child goes to school.

If you choose to take part in this study, you will be asked to complete the following questionnaires (independently or as an interview with one of the researchers or research assistants) twice per year (Time 1: March/April; Time 2: October/December):

Demographic Survey

You will be asked questions about your age, gender, ethnicity, family structure, and the highest level of education you have obtained. You will also be asked to report any past exposure to natural disasters. If the child participating in this study has siblings, you will be asked to list their age and gender. You will be asked this information so that we can identify as many potential factors that might impact on your health and wellbeing.

Parent-Child and Parent-Teacher Relationships

You will be asked about your relationship and daily interactions with your child and their teachers in the early childhood setting.

Parenting Practices and Health and Wellness

You will be asked about your everyday parenting practices, technology use, parenting stress, and your general happiness.

Completion of these questionnaires is expected to take approximately 60 minutes and they will be completed in a quiet room at the Kindergarten.

We are also interested in understanding more about what happens in your daily life and how you feel. So, once a day for one week in June and August we would like you to answer questions about the activities you completed during the day and how they made you feel. The research team will provide you details with how to download the app and complete the questions.

What will be expected of your child and their teachers involved in the study?

Teachers will complete the same questionnaires as parents, however, the questions will be adapted for teachers and the early childhood education social context.

Child Interviews

Your child will participate in short, interactive interviews that explore their friendships, understanding of kindness, and their favourite princesses and superheroes. The friendship interview will involve your child and other children participating in this study to identify children they like to play with and don't like to play with. This information will help the researchers understand the reciprocal friendships that your child has with other children. I will also use Duplo toy figurines (i.e. Lego), pictures, and short animations to tell children three scenarios about different social situations. The children will then be asked some questions about what they think about the behaviour and how they'd respond to the situation. An example of a scenario may be: a child is shown two Duplo children and told that the girl snatched the ball from the other girl. The child is then asked about whether it was okay to snatch and what might happen next. Children will also be invited to play some simple activities on an iPad to assess their attention and memory. It is expected that these activities will take approximately 30 minutes to complete with each child. These activities are designed to be fun and interactive, however, children will be given breaks or from the activities whenever they wish.

The interviews with the children will take place at a time when other children, teachers and parents are outside. This will ensure that the participating child's responses aren't influenced by the presence of others and that their responses are confidential.

With your permission and permission from the children and their teachers, the child interviews will be video and audio recorded. These recordings will only be used to analyse the information collected. If you, the child's teacher or the children do not wish to be recorded, they do not have to. During each of the activities, the researcher will also take notes to ensure they have recorded the child's responses accurately.

What will happen if your child doesn't want to do the activities or appears upset?

I will do all I can to ensure that this is a fun experience for your child. If you consent to your child participating, I will talk to them about the study and the type of activities I would like them to do. Participation in this study is entirely voluntary: your child is not obliged to participate even if you decide to participate. If your child chooses not to participate in this study, or requests to withdraw from the tasks, they will be free to return to their regular activities without having to give a reason and without consequence.

What do you need to do?

It would be great for you to talk to your child about the research study. If you are happy for you and your child to participate please complete the consent form below. The questionnaires are included in this research pack. It would be very helpful if you could complete these and return these with the consent form. Please use the enclosed envelope to post them back to me or drop them in the locked box kept at the centre. Centre staff will not have access to your consent form and completed questionnaires. If you would prefer to complete the questionnaires face to face with a researcher (this could be via Skype or telephone or in person), we would be more than happy to do this with you. Please contact Cara Swit (see contact details below) to arrange a time that is most suitable for you to participate in completing the questionnaires. You are more than welcome to bring a support person with you.

What will you receive for your participation?

Your participation is valuable to us, so we will offer you a $30 grocery voucher for each time point you complete and return your questionnaires (a total of $60 if you complete the questionnaires two times throughout the year) as a small koha of our appreciation.

In the performance of the tasks and application of the procedures, there are risks of emotional or psychological distress as you recall previous exposure to natural disasters. Some of the questionnaire items may also bring up memories of your own negative social interactions or victimization. At any time you experience discomfort or distress in disclosing this information, you are free to take a break and come back to the questionnaires at a later time, withdraw your participation or choose not to complete these questions. You are also welcome to contact the principal investigator, Cara Swit, to discuss your responses to these questions. There are confidential and anonymous external support and resources that can be offered to you. Any responses that indicate illegal activity where the life or health of any person may be at risk are required to be reported to the appropriate authority (e.g., Oranga Tamariki). In

these cases, anonymity will be breached. It is also important for you to know that everyone in the Centre will know who is participating in the study.

Participation is voluntary and you have the right to withdraw your participation or your child's participation at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once the analysis of raw data starts on 1 April 2021, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. Any information or personal details gathered in the course of the study are confidential. The results of this project will be presented in the form of journal articles and/or at conferences. No individual will be identified in any publication of the results. Toensure confidentiality, a participant code will be allocated to each participant. Only I, the research team (listed above), and University of Canterbury Master's Research students will have access to the data. All data will be transferred and securely stored on a password-protected external hard drive and will be securely stored in a locked filing cabinet in the researcher's office for a period of ten years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of the results of the project. A copy of your individual results and your child's results will be made available to you, at your request.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and the questionnaires provided in this research pack, and place these in the envelope provided and deposit your responses safely in the locked box at the centre.