The emergence of procrastination in early childhood: Relations with executive control and future-oriented cognition

Taissa S. S. Fuke, Ege Kamber, Melissa Alunni, & Caitlin E. V. Mahy

Brock University

Corresponding Author:

Taissa Fuke

Department of Psychology

Brock University

1812 Sir Isaac Brock Way

St Catharines, ON L2S 2A1

tf20qt@brocku.ca

Acknowledgements

Preparation of this manuscript was partially supported by an NSERC Discovery Grant and an Early Researcher Award from the Ontario Ministry of Research, Innovation, and Science to CEVM. TF was supported by a Social Sciences and Humanities Research Council of Canada Joseph Armand Bombardier Canada Graduate Scholarship.

Author's Note

We report how our sample size was determined (an a priori power analysis), describe our reasons for data exclusion, all manipulations, and measures in the study (following JARS; Kazak, 2008). All data, analysis code, and research materials are available from the corresponding author upon request. Data were analyzed using SPSS 27.0 (IBM Corp., 2020). This study's design and analyses were not preregistered.

Abstract

Little is known about the development of procrastination, the tendency to postpone undesirable but necessary tasks, during early childhood. Only one study has measured procrastination behaviour in preschool children using a single behavioural task (Sutter et al., 2018). Thus, the present study investigated the emergence and development of everyday procrastination behaviour in preschool children and to explore its relations with executive function and future thinking using an adapted version of Lay's (1986) General Procrastination Scale for use with parents of preschool children. Parents (81% White, 82% with an annual household income of over $40,000, and 92% had a post-secondary education) of 3- to 6-year-olds (N = 396; 175 girls) completed the Preschool Procrastination Scale, the Behaviour Rating Inventory of Executive Function – Preschool Version (Gioia et al., 2003), and the Children's Future Thinking Questionnaire (Mazachowsky & Mahy, 2020). Naturalistic examples of children's procrastination behaviour were collected to better understand the domains in which preschool children procrastinated. Results revealed that: (1) procrastination emerges early in preschool, (2) procrastination became more characteristic with age, (3) executive function and future thinking were negatively related to procrastination tendencies, (4) different components of future thinking and executive function predicted younger and older children's procrastination, and (5) children procrastinated in different domains depending on their age and responsibilities. Our results suggest that children's procrastination tendencies increase with age and develop alongside self-regulatory and future-oriented cognitive abilities.

Keywords: procrastination; development; future thinking; executive function; preschool

The emergence of procrastination in early childhood: Relations with executive control and future-oriented cognition

When bedtime rolls around, young children can suddenly become very busy with tasks that need to be finished *before* they put on their pajamas, brush their teeth, and go to bed. The tendency to postpone undesirable, but necessary, tasks is known as procrastination (Lay et al., 1986). Procrastination occurs in many contexts including academic (e.g., leaving homework until the last minute), home (e.g., putting off cleaning up toys), and decision making (e.g., delaying decisions on who to invite to a party) domains. A common feature of procrastination is that the postponed task elicits negative feelings (Lay & Schouwenburg, 1993). Thus, procrastination is a form of affect regulation in which the procrastinator effectively punishes their future self to avoid negative feelings in the present. Although there is evidence that procrastination can promote creativity (e.g., Shin & Grant, 2021), in the vast majority of situations it is considered a maladaptive behaviour (e.g., Baumeister & Heatherton, 1996; Burka & Yuen, 1983; Ferrari, 1992; Harris & Sutton 1983; Knaus, 1998; Steel, 2007, 2010). Indeed, adults' tendency to procrastinate is associated with reduced: inter- and intra-personal functioning (Ferrari et al., 1995), academic performance (Rabin, Fogel, & Nutter-Upham, 2011), life satisfaction (Beutal et al., 2016), and higher levels of stress, anxiety, and depression (Beutal et al., 2016). To date, research has largely focused on academic procrastination in school-aged children, adolescents, and adults; very little is known about preschool children's procrastination, particularly in everyday life. Given that children begin to regulate their behaviour in service of goals (Carlson, 2005) and to reason about the future (Atance, 2015) early in development, procrastination behaviour may also emerge during this period. Understanding the emergence and development of procrastination in early childhood is an important endeavour due to its negative long-term

outcomes and can inform intervention. The current study will examine: whether preschool children procrastinate, whether and how procrastination develops in early childhood, and the cognitive correlates of procrastination.

Procrastination versus Task Avoidance

What differentiates procrastination from task avoidance? Avoiding an undesirable task is an inherent feature of procrastination, but the two are conceptually distinct. Procrastination involves having an intention to complete a task and acting contrary to that intention by postponing its initiation or completion (Steel, 2007). Importantly, the intention to complete the task remains intact despite its postponement. By contrast, task avoidance does not contradict a person's intention (Anderson, 2003) – that is, the person avoiding an undesirable task may never intend to complete it. Thus, avoiding a task can be a rational decision that aligns with a person's intentions whereas procrastination is always in conflict with the procrastinator's original intention to complete the task (Ferrari et al., 1995). One of the most commonly used measures of procrastination, Lay's (1986) self-report General Procrastination Scale originally designed for use with student populations references the intention to complete postponed tasks in several items (e.g., "I often find myself performing tasks that I intended to do days before.", and "I usually accomplish all the things I plan to do in a day."). Indeed, Steel (2010) found that Lay's General Procrastination Scale measures irrational delay and not task avoidance. Thus, task avoidance and procrastination are conceptually distinct, and Lay's original scale captures procrastination and not simply task avoidance.

Children's Procrastination

Most research with children and adolescents has not investigated the emergence or development of procrastination but has instead focused on replicating associations with

personality dimensions identified in the adult literature (e.g., Lay et al., 1998; Scher & Osterman, 2002). The first developmental study on procrastination was an unpublished dissertation by Rawlins (1995) who found that 10- and 11-year-olds reported procrastinating schoolwork more than 13- and 14-year-olds, despite reporting similar negative feelings toward undesirable tasks. Using their self-report procrastination questionnaire, Lay and colleagues (1998) found that children as young as 8-years-old engaged in procrastinatory behaviour and that conscientiousness (a personality dimension related to academic success and behaviour adjustment) was strongly negatively correlated with procrastination in 8- to 11-year-olds. Because Lay (1997) argued that adult procrastination resulted from low conscientiousness, they concluded that 8-year-olds' procrastination was already mature and speculated that the emergence of procrastination behaviour occurs prior to 8 years of age. Using Lay's (1998) General Procrastination Scale, Scher and Osterman (2002) replicated the finding that 9- to 12-year-olds indeed procrastinate and reported that children's procrastination was related to lower task mastery than fear of failure compared to undergraduate students.

To our knowledge, only one study has investigated preschool-aged children's procrastination behaviour. Sutter and colleagues (2018) offered 241 3- to 6-year-old children a choice between completing a bead-sorting task today or postponing the task until tomorrow. Sutter and colleagues (2018) did not report an a priori power analysis but a post hoc power analysis using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) suggested that they had sufficient power to detect medium- to large-sized effects (d = .5). One-third of children (n = 83) chose to postpone the task, and younger children procrastinated more frequently than older children (44% of younger children procrastinated compared to 27% of older children). Further, children who postponed the task sorted fewer beads (poorer performance) than non-

procrastinators, even after controlling for age. Thus, the tendency to procrastinate seems related to poorer task performance during preschool. These findings suggest that procrastination behaviour emerges early in childhood; however, this study failed to capture naturalistic forms of procrastination behaviour that occur in daily life since the bead sorting task was a single behavioural task administered in a formal setting.

The Role of Executive Function in Procrastination

Procrastination has been described as a failure of self-regulation (Rabin et al., 2011). Research with adults suggests that procrastinators struggle to control impulses and emotions, are less organized, and show time and task-management deficiencies (Dewitte & Schouwenburg, 2002; Ferrari & Emmons, 1995; Steel, 2007; Tan et al., 2008). Self-regulation falls under the domain of executive function (EF), which encompasses cognitive abilities responsible for the conscious control of thought and action (Miyake et al., 2000). EF is involved in processes relevant to procrastination including the initiation and completion of tasks, generating strategies for complex actions, and regulation of cognition, behaviour, and emotion (Roth et al., 2006; Williams et al., 2009). Interestingly, conscientiousness – a personality trait reflecting responsibility and discipline that has been conceptually linked to procrastination (Rabin et al., 2011) – improves markedly during early adulthood, corresponding with the maturation of the frontal lobe associated with EF (Robins et al., 2001; Welsh et al., 1991).

Each of the core EFs (Miyake, 2000) seem to be relevant to procrastination behaviour. Working memory, responsible for keeping relevant information in mind, may be involved in maintaining task information in the forefront of consciousness. Inhibition, the ability to control automatic responses, may be involved in suppressing negative emotions associated with a task

and resisting desirable distractions. Shifting, the ability to unconsciously shift attention between tasks, may play a role in task initiation and minimizing distraction to complete a task on time.

Despite this conceptual link, little research has directly explored the relation between EF and procrastination behaviour in adults or children. Strub (1989) detailed the case of a 60-year-old man who developed chronic procrastination after damaging his frontal lobe, a brain region associated with EF. Other research has found that adult procrastinators completed fewer items and made more errors on a shape-matching task than non-procrastinators after completing a digit-memorization task (Ferrari, 2001). Rabin et al. (2011) also explored the relation between self-reported procrastination and EF in university students; Initiation, planning, inhibition, self-monitoring, working memory, task monitoring, and organization were significant negative predictors of academic procrastination after controlling for age and conscientiousness. EF shows a similar developmental trajectory to many future-oriented abilities, emerging early and improving rapidly during the preschool years (Carlson, 2005; Zelazo et al., 2003). Based on the relationship between EF and procrastination observed in adults, preschool improvements in EF should similarly reduce the rates of procrastination as children age. Children's emotional control might also be related to their tendency to procrastinate because of the relation between procrastination and negative affect (Lay & Schouwenburg, 1993). Planning and organizing behaviour is also considered an aspect of EF (e.g., McCormack & Atance, 2011) and may be responsible for determining necessary actions to reach a goal and implementing those actions.

Future-Oriented Cognition and Procrastination

Another way that procrastination can be conceptualized is as a failure to consider or accurately estimate one's future states. In this way, procrastination can be considered a failure of future thinking rather than simply a failure of present self-regulation. Poor future thinking may

be related to procrastination in two ways: (1) procrastinators may not consider how their decision to postpone an undesirable task will affect their future self, or (2) they may hold the faulty belief that an undesirable task will be more appealing to them at a future time. Despite the inherently temporal nature of procrastination (i.e., procrastination involves delaying a task to a future point in time), little research has investigated the relations between procrastination and future-oriented cognition, the ability to reason about and mentally travel to the future (Bélanger et al., 2014; although see Rebetez et al, 2016 for findings with adults).

Future-oriented cognition encompasses abilities including: episodic foresight, planning, delay of gratification, saving, and prospective memory (Mazachowsky & Mahy, 2020). Reasoning about the future, the past, and perspective-taking are all thought to be supported by self-projection (Buckner & Carrol, 2007). Self-projection involves shifting one's consciousness to reason from perspectives outside that of the immediate present. This ability allows individuals to separate themselves from any emotional or psychological arousal in the present to make adaptive future choices (Buckner & Carrol, 2007). Procrastination may be a consequence of poor future-oriented cognition in that procrastinators may fail to accurately predict the future consequences of postponing timely tasks, instead focussing on their current discomfort. In fact, research has found that adult procrastinators are less likely to consider the future when making decisions (e.g., Díaz-Morales et al., 2008; Gupta et al., 2012; Rebetez et al., 2016). We argue that some level of future thinking ability is necessary for procrastination – recall that an intention to complete a task in the future distinguishes procrastination from task avoidance and holding such an intention by definition indicates a consideration of the future. Given that children begin thinking about the future around age 3 (Atance & O'Neill, 2005; Kliegel & Jäger, 2007) and show rapid improvement between the ages of 3 and 6 (Atance & Meltzoff, 2005), procrastination

behaviour may begin to emerge during this period as children develop their ability to reason about (or disregard) future outcomes. One aim of the current study is to examine the relation between procrastination and future-oriented cognition.

Three future-oriented cognitive abilities that we expect to be particularly relevant to procrastination behaviour are: episodic foresight, planning, and delay of gratification. Episodic foresight is the ability to mentally project oneself into a future situation or event (Atance & O'Neill, 2001). More than just imagining future events, episodic foresight involves constructing detailed representations of future events using information stored in episodic memory. Projecting the self forward and pre-experiencing the consequences of postponing timely tasks should be related to a reduced tendency to procrastinate and lead to adaptive decision making. In line with this prediction, Rebetez et al. (2015) found that students' procrastination was related to less consideration of future consequences and difficulties in simulating future events. Thus, we expect that difficulty imagining future consequences would also be related to greater procrastination in young children.

Planning for the future involves forming goals, constructing plans, and envisioning the actions necessary to achieve future outcomes (Shapiro & Hudson, 2004). More specifically, it involves a consideration of hypothetical future event sequences prior to choosing a course of action (McCormack & Atance, 2011). Procrastination can be considered both a failure to anticipate the consequences of delaying important tasks and a failure to construct concrete plans in service of a goal. One study with university students found that the delay from an intended start time was reduced by 6.5 hours when students formed intentions using an *if-then* format detailing when and how they planned to act in service of a goal (e.g., If it is Wednesday at 8:30, then I will perform arithmetic tasks), compared to intentions without *if-then* statements

(Oettingen et al., 2000). Thus, greater procrastination might be related to difficulty formulating and reasoning about multi-step plans in early childhood.

Delay of gratification is the voluntary postponement of immediate gratification for the sake of future gains (Mischel et al., 1989). Prioritizing short-term gratification over long-term benefit is intrinsic to procrastination behaviour. Numerous studies have reported that procrastinators, compared with non-procrastinators, struggle to resist social temptation, immediate reward, and pleasurable activities when the benefits of completing a task are distant (e.g., Dewitte & Schouwenburg, 2002; Ferrari, 2001; Tan et al., 2008). Delay of gratification can be considered the opposite of procrastinatory behaviour in that it necessitates the ability to forgo immediate reward in favour of greater gains in the future (vs. forgo punishment now in favour of potentially greater punishment later). Younger children struggle more to delay currently available gratification compared with older children (Prencipe & Zelazo, 2006). Thus, procrastination should be more characteristic of younger children (compared to older children) who prioritize immediate gratification and might also avoid punishment consistent with prioritizing positive affect.

We believe that the conceptualization of procrastination as involving deficits in both self-regulation (EF) and future-thinking provides the most comprehensive account of this maladaptive behaviour. In addition, the classic conceptualization of procrastination as a failure of self-regulation, we posit that future oriented cognition plays an equally important role and that some level of future thinking is necessary for children to engage in procrastination. Given that both EF and future thinking rapidly develop in the early childhood years, we expect procrastination behaviour to emerge during this period and that both EF and future thinking abilities play a role in predicting individual differences in procrastination tendencies.

The Current Study

Building on the findings of Sutter and colleagues (2018), we investigated preschool procrastination using parent-report measures. We focused on 3- to 6-year-old children because both future thinking (Atance & Meltzoff, 2005) and EF (Carlson, 2005) emerge around age 3 and show substantial improvements through the preschool and early school years. This allowed us to examine whether procrastination differed between young children (3- to 4-year-olds) whose EF and future thinking abilities are just emerging and older children (5- to 6-year-olds) whose EF and future thinking abilities are more developed. Further, these younger and older preschool children also differ in their experience with formal education with children 3 to 4 often attending daycare or preschool and children 5 or 6 attending more formal school settings such as kindergarten or first grade. Thus, splitting our sample into younger and older children allowed us to compare children: (1) as their EF and future thinking abilities were emerging and developing, and (2) who had and had not yet entered a more formal school setting where requirements to perform undesirable tasks might increase (e.g., completing homework and school tasks). We were interested in exploring the emergence and development of procrastination behaviour in preschool, as well as determining the cognitive correlates of preschool procrastination. Finally, to obtain a more naturalistic picture of procrastination during the preschool period, we asked parents to provide a recent example of their children's procrastination behaviour from everyday life. We expected that according to parent reports: (1) preschool children would show evidence of procrastination behaviour, (2) younger children would procrastinate more often than older children in line with Sutter et al.'s (2018) findings, (3) EF would be negatively correlated with procrastination based on research showing that procrastinators show less self-regulation (Rabin et al., 2011), and (4) episodic foresight, planning, and delay of gratification (abilities that rely on

self-projection) would be negatively correlated with children's procrastination. Finally, we predicted that younger and older preschool children might differ in the domains in which they procrastinate due to an increase in activities outside the home and responsibilities that emerge between 3 and 6 years.

Method

Participants

A G*Power 3.1 (Faul et al., 2007) a priori power analysis was performed for sample size estimation. For a linear multiple regression with six predictors, the analysis suggested that we needed 98 participants to detect a medium effect size ($f^2 = 0.15$, power = .80, alpha = .05). We collected data from 500 participants to ensure substantial power and to compensate for expected data loss from online participation.

Five hundred and one parents of 3- to 6-year-old children were recruited to participate in the current study via the online recruiting platform Prolific (www.prolific.co). Participants' children were required to be typically developing, and parents were required to be native English-speaking residents of the United States with a Prolific rating of at least 98%. Neither children nor parents were restricted by gender. One hundred and five participants were excluded from data analysis for the following reasons: child was outside the 3 to 6 age range ($n = 18$), child was not typically developing ($n = 20$), completing the survey in greater than 2 SD above the mean completion time ($M = 36.17$ minutes; $n = 21$), providing two child birthdates that did not match ($n = 47$), errors in estimating their child's age (by more than 1 year; $n = 9$), failing to pass at least 4 of 5 attention check questions ($n = 1$), or responses that were clearly duplicates ($n = 3$). The final sample consisted of 396 parents (213 mothers, 177 fathers, 1 other, 5 did not disclose). Of these participants, 117 were parents of a 3-year-old (54 parents of girls; M_{age} =

41.00 months, *SD* = 3.27), 126 were parents of a 4-year-old (56 parents of girls; M_{age} = 53.98 months, *SD* = 3.44), 94 were parents of a 5-year-old (40 parents of girls; M_{age} = 64.57 months, *SD* = 3.42), and 59 were parents of a 6-year-old (25 parents of girls; M_{age} = 78.08 months, *SD* = 3.80). Seventy-one percent (*n* = 171) of parents of younger children (3- and4-year-olds) reported that their children attended either daycare or preschool and 73% (*n* = 112) of parents of older children (5- and 6-year-olds) reported that their children attended school (kindergarten or first grade). Parents were mostly White (81.8% white, 12.1% Black or African American, 7.3% Hispanic, Latino, or Spanish, 2.8% Asian, 2% Alaskan Native or American Indian, .8% Other .5% Asian Indian, and .3% Middle Eastern) and from middle-class backgrounds (5.6% reported income of less than $25,000, 11.5% between $25,000-$40,000, 32.9% between $40,000-$75,000, 22.4% between $75,000-$100,000, and 27.6% over $100,000).

Measures

Preschool Procrastination Scale

Lay's (1986) original 20-item adult General Procrastination Scale was modified into a parent-report measure of preschool children's procrastination, the Preschool Procrastination Scale (PPS; Appendix A). Items from Lay's (1986) original scale were adapted to be appropriate for preschool-aged children and age-appropriate examples were added to each item. Five items were removed from the original scale because they could not be adapted for children (e.g., shopping for gifts or essential items (#16 and #17), mailing a letter (#5), returning a phone call (#6), completing tasks before settling down for the evening (#20). Parents rated the degree to which certain procrastination behaviours were characteristic of their child on a 5-point Likert scale ranging from "Extremely Uncharacteristic" to "Extremely Characteristic". Parents'

responses to the 15 items were summed and averaged (1-5) and higher scores reflected greater tendency to procrastinate. The internal consistency of the full PPS scale was excellent, α = .831.

Behaviour Rating Inventory of Executive Function—Preschool Version

The Behaviour Rating Inventory of Executive Function—Preschool Version (BRIEF-P; Gioia et al., 2003) is a 63-item measure of children's EF. It features five subscales measuring children's working memory, inhibition, shifting, emotional control, and planning abilities. Parents rated how often each behaviour has been a problem in the last six months on a 3-point Likert scale ranging from "Never" to "Often". Their responses to the 63 items were summed (63-189) and higher scores reflecting greater executive impairment. Internal consistency coefficients for subscales and global scale were excellent: working memory (α = .914), inhibition (α = .887), shifting (α = .851), emotional control (α = .878), planning (α = .851), and global executive composite (α = .962).

Children's Future Thinking Questionnaire

The Children's Future Thinking Questionnaire (CFTQ, Mazachowsky & Mahy, 2020) is a reliable and valid 44-item parent-report that measures five aspects of children's future-oriented cognition, including planning (e.g., "Does not plan what he or she is going to take on a vacation"), delay of gratification (e.g., "Prefers to win one item with less effort rather than win two items with more effort"), saving (e.g., "Saves money in a piggy bank for future purchases"), episodic foresight (e.g., "Fails to anticipate future physical states"), and prospective memory (e.g., "Remembers what items need to be purchased/picked up"). Parents rated how well each statement described their child on a 6-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". Non-response options ("Don't Know", "Does Not Apply", and "Prefer Not to Answer") were also included. Parents' responses to each subscale and the full scale were

summed and averaged (1-6) and higher scores indicated higher future-thinking ability. The five subscales revealed acceptable internal consistencies: saving (α = .588), delay of gratification (α = .701), prospective memory (α = .791), planning (α = .759), episodic foresight (α = .766). The full scale had excellent internal consistency (α = .875).

Naturalistic Procrastination Examples

In an open-ended prompt, we asked parents to describe a recent everyday example of their children's procrastination (i.e., "Please describe in a sentence or two the last time your child put off an activity or task [procrastinated]."). This question was asked in order to capture the domains in which preschool children procrastinate in their daily lives and was not included in our inferential statistical analyses. Responses were coded by two independent coders into the following categories (that were formed based on responses): (1) Cleaning their own space/a mess that they made; (2) Chores (e.g., doing dishes, folding laundry, feeding the dog); (3) Class/schoolwork/learning; (4) Routines (e.g., meals/eating, using the washroom, morning/bedtime routine, getting dressed, brushing teeth, bath time, etc.); and (5) Other (e.g. "building a crossword puzzle"). Inter-rater reliability was almost perfect, k = .99, and discrepancies were resolved through discussion.

Procedure

After providing consent, participants completed all measures in this study using the online survey platform Qualtrics (www.qualtrics.com). Data were collected as part of a larger study on preschool procrastination which also included measures of personality (The Hierarchical Personality Inventory for Children; Mervielde & De Fruyt, 1999), temperament (The Child Behaviour Questionnaire; Rothbart et al., 2003), and parenting (The Parenting Styles and Dimensions Questionnaire; Robinson et al., 1995) not reported here. Questionnaires were

presented in a random order. The items within each questionnaire were presented in a fixed order according to their original administration. One attention check question was randomly inserted into each questionnaire. At the end of the study, participants provided basic demographic information. The average study completion time was approximately 36 minutes (maximum completion time was 115 minutes). All procedures for this study were approved by the Research Ethics Board at Brock University.

Transparency and Openness

We report how our sample size was determined (an a priori power analysis), describe our reasons for data exclusion, all manipulations, and measures in the study (following JARS; Kazak, 2008). All data, analysis code, and research materials are available from the corresponding author upon request. Data were analyzed using SPSS 27.0 (IBM Corp., 2020). This study's design and analyses were not preregistered.

Results

Preliminary analysis indicated that child's sex was not related to their PPS score, t (394) = -1.67, p = .16, so it was excluded from subsequent analyses. Mean scores and standard deviations of all measures are presented in Table 1. Relations among all measures are shown in Table 2.

[Insert Table 1 here]

[Insert Table 2 here]

Emergence and Development of Procrastination

First, we set out to determine whether preschool children show evidence of procrastination. We conducted a one-sample t-test comparing children's scores on the PPS to the lowest value on the scale (i.e., one, "Extremely Uncharacteristic") to determine whether

children's scores were on average significantly above the minimum, thus indicating at least some evidence of procrastination tendency. The one-sample t-test determined that PPS scores were significantly above one, t (396) = 59.74, $p < .001$, indicating that preschool-aged children showed some tendency to procrastinate. We then divided the sample into younger (3- and 4-year-olds) and older (5- and 6-year-olds) children. Both younger, t (243) = 49.55, $p < .001$, and older, t (152) = 34.70, $p < .001$, children's PPS scores were significantly above one (referring to "extremely uncharacteristic" on the PPS), indicating that children as young as 3 years old showed at least some tendency to procrastinate.

Next, we examined the relation between PPS score and age. There was a weak, positive correlation between age and PPS score (Table 2), showing that the tendency to procrastinate increased with age. This relation held for younger children, r (241) = .16, p =.014, but not for older children, r (151) = .12, p =.14. An independent samples t-test revealed that older children had more of a tendency to procrastinate than younger children, t (394) = -1.52, $p < .01$.

The Relation Between Procrastination and Executive Function

All subscales of the BRIEF-P were moderately positively correlated with children's PPS scores (Table 2), such that deficits in EF were related to higher scores on the PPS. This relation held after controlling for age. All five BRIEF-P subscales remained significantly positively correlated with PPS score for both younger, rs (241) > .26, ps < .001, and older children, rs (151) > .29, ps < .001.

A regression analysis was conducted to determine whether the BRIEF-P subscales predicted children's procrastination when controlling for age. Children's age in months, working memory, plan/organize, and emotional control subscales were significant independent predictors of PPS score (Table 3A). In younger children, working memory, emotional control, and

plan/organize subscales independently predicted PPS score (Table 3B). In older children, only the plan/organize subscale independently predicted PPS score (Table 3C).

[Insert Table 3 here]

The Relation Between Procrastination and Future Thinking

All subscales of the CFTQ were moderately negatively correlated with children's PPS scores even after controlling for age in months (Table 2). All five subscales remained significantly negatively correlated with PPS score in younger, *r*s (241) > -.40, *p*s < .001, and older children, *r*s (151) > -.40, *p*s < .001.

A regression analysis was conducted to determine which CFTQ subscales predicted children's PPS scores when controlling for age. Children's age in months, delay of gratification, and episodic foresight significantly independently predicted PPS score (Table 4A). In younger children, only the delay of gratification subscale independently predicted PPS score (Table 4B). In older children, the episodic foresight and delay of gratification subscales independently predicted PPS score (Table 4C).

Executive and Future Thinking Predictors of Procrastination

To determine the relative contribution of executive and future oriented abilities to children's procrastination, we conducted a regression analysis including only the abilities that significantly independently predicted PPS score in our two previous models. Age, episodic foresight, delay of gratification, working memory, emotional control, and plan/organize subscales were regressed onto PPS score. Children's age in months, episodic foresight, delay of gratification, and plan/organize all remained significant independent predictors of children's PPS score (Table 5A). In younger children, age, delay of gratification, working memory, and

emotional control independently predicted PPS score (Table 5B). In older children, episodic foresight and plan/organize only predicted PPS score (Table 5C).

[Insert Table 5 here]

Mediation Analyses

The regression analyses suggested that two future-oriented abilities (i.e., delay of gratification and episodic foresight) were independent predictors of 3- to 6-year-old children's procrastination but these abilities may in themselves be determined by EF ability. We conducted two exploratory mediation analyses to determine whether children's EF may have mediated the relation between future thinking and procrastination. These analyses were exploratory as the causal direction among these variables cannot be established given that these measures were collected at a single time point. The analyses were performed using PROCESS (Hayes, 2002) with bias-corrected 95% confidence intervals (n = 5000).

In the first model, the CFTQ delay of gratification subscale was the predictor variable with the BRIEF-P global executive composite as a mediator. The outcome variable was the PPS score. Also, children's age was included in the model as a covariate (Figure 1).

We found a direct effect of the CFTQ delay of gratification subscale on PPS score even after controlling for EF and age (β = -.31, b = -.24, 95% CI [-.31, -.17], t = -6.175, p < .001), indicating that children with better delay of gratification abilities had less of a tendency to procrastinate. Also, the BRIEF-P global executive composite (β = .39, b = .01, 95% CI [.01, .01], t = 8.60, p < .001) and age (β = .18, b = .01, 95% CI [.005, .013], t = 4.52, p < .001) predicted children's PPS score even after the direct effect of delay of gratification was controlled for. More importantly, there was an indirect effect of the CFTQ delay of gratification subscale on PPS score mediated through the BRIEF-P global executive composite (b = -.14, β = -.18, 95% CI [-

.24, -.13]). That is, children better able to delay gratification tended to have less EF impairment which was associated with less procrastination tendency.

[Insert Figure 1 here]

In the second model, we examined whether the relation between episodic foresight and procrastination was also mediated by executive functioning. The CFTQ episodic foresight subscale was a predictor variable with the BRIEF-P global executive composite as a mediator. The outcome variable was PPS score. Again, children's age was included in the model as a covariate (Figure 2).

There was a direct effect of the CFTQ episodic foresight subscale on children's PPS score even after controlling for executive function and age, β = -.29, *b* = -.18, 95% CI [-.25, -.12], *t* = -5.44, *p* < .001. This finding suggests that children with better episodic foresight had less tendency to procrastinate. Also, the BRIEF-P global executive composite (β = .42, *b* = .01, 95% CI [.010, .015], *t* = 9.27, *p* < .001) and age (β = .169, *b* = .01, 95% CI [.004, .01], *t* = 4.11, *p* < .001) predicted children's PPS score. More importantly, we found an indirect effect of the CFTQ episodic foresight subscale on PPS score mediated through the BRIEF-P global executive composite (*b* = -.14, β = -.19, 95% CI [-.25, -.14]). Children with better episodic foresight tended to have less EF impairment, which was associated with less tendency to procrastinate.

[Insert Figure 2 here]

Naturalistic Examples of Children's Procrastination

A subset of the parents (N = 312) provided a recent example of their child's procrastination behaviour (Table 6). A Chi-square analysis was conducted to examine whether different categories of children's procrastination changed with age. This analysis was performed to help better understand the domains in which younger and older preschool children

procrastinated in everyday life. There were statistically significant differences in the categories of tasks in which younger and older preschool children procrastinated, $\chi^2(4) = 37.74$, $p < .001$. Younger children were more likely to procrastinate: cleaning up their messes (1.34 times as likely), completing routines (1.97 times as likely), and other undefined tasks (1.65 times as likely) compared to older children. In contrast, older children were more likely to procrastinate doing chores (2.88 times as likely) and schoolwork (5.43 times as likely) compared to younger children.

In order to examine whether children of parents who did and did not provide an example of their child's procrastination differed in meaningful ways, we conducted two independent samples t-tests to determine whether these two groups of children differed significantly in age or preschool procrastination scale score. The results showed that children of parents who did and did not provide procrastination examples significantly differed in age, t (313) = 3.15, p = .001, and PPS score, t (313) = 2.49, p = .014. Children whose parents did not provide a procrastination example tended to be younger (M = 52.35 months, SD = 12.62) and have a lower PPS score (M = 2.74, SD = .53) than those whose parents provided a procrastination example (M = 57.28 months, SD = 12.97 and M = 2.91, SD = .64, respectively). Thus, parents who did not provide a naturalistic procrastination example had younger children and children rated as having less of a tendency to procrastinate overall.

[Insert Table 6 here]

Discussion

The purpose of this study was to investigate naturalistic procrastination in preschool children, specifically its emergence, development, and relation to EF and future thinking. We found that: (1) procrastination emerged early in the preschool years, (2) procrastination was rated

as more characteristic of older children than younger children, (3) the tendency to procrastinate was related to poorer EF and future thinking, (4) predictors of procrastination differed between younger and older children, (5) EF partially mediated the relation between future thinking and procrastination in an exploratory mediation analysis, and (6) children procrastinated in different domains depending on their age.

The main focus of the current study was to investigate the emergence and development of procrastination in preschool. All age groups were rated as having at least some tendency to procrastinate, replicating Sutter and colleagues' (2018) initial findings that 3- to 6-year-olds showed evidence of procrastination behaviour. Unlike Sutter and colleagues (2018) who reported that younger children procrastinated at higher rates compared to older children, we found that the tendency to procrastinate was rated as more characteristic of older than younger children. There are several possible reasons for the discrepancy between these studies. First, the present study used parent-reports to assess children's procrastination whereas Sutter and colleagues (2018) used a behavioural task in a laboratory setting. Research on other future-oriented abilities has reported low correlations between parent-report and laboratory measures (e.g., Mazachowsky & Mahy, 2020; Fuke & Mahy, 2022). Laboratory tasks may be too narrow in scope to capture procrastination as it occurs in daily life (Einstein & McDaniel, 1996), instead measuring valent abilities such as older children's better understanding of future consequences or awareness of social pressures to complete a task when requested. In fact, many adult procrastination studies have reported a lack of convergence between self-report and behavioural measures (e.g., DeWitte & Schouwenburg, 2002; Moon & Illingworth, 2005; Steel et al., 2001). Second, older children might have more responsibilities than younger children and thus more opportunities to postpone tasks in their everyday lives. This is reflected in the naturalistic examples collected

from parents; whereas younger children procrastinated their routines and tidying their own messes, older children had obligations such as schoolwork and assigned chores that they tended to put off. Finally, it may be easier for parents to report on the habits of their older children who are better able to articulate their internal processes whereas younger children's procrastination may be misinterpreted as forgetfulness or task avoidance. Returning to the issue of whether this increase in procrastination could simply reflect an increase in task avoidance, research on the developmental trajectory of avoidance in early childhood has shown that task avoidance tends to decrease with age in early childhood (e.g., Brody et al., 2018; Laursen et al., 2021). In contrast, our age-related findings suggest that procrastination tendency increases with age as children have more opportunities to put off tasks that they must accomplish during their entry into formal schooling.

All subscales of the BRIEF-P were positively correlated with procrastination as measured by the PPS, indicating that poorer EF was related to a greater tendency to procrastinate. This is in line with findings with adults that self-reported EF was related to increased procrastination (Rabin et al., 2011). Younger children's procrastination was independently predicted by working memory, emotional control, and planning, while older children's procrastination was only predicted by planning. This suggests that younger children's procrastination might be motivated by a desire to control negative affect and by an inability to keep necessary tasks in mind or to keep in mind the potential consequences of putting tasks off. Planning, but not emotional control, remained a significant predictor of procrastination throughout the preschool years, despite the desire to avoid negative feelings being a core feature of procrastination. Perhaps once young children develop basic emotional control skills, it is the inability to develop actionable strategies to achieve goals that keeps children from achieving them, rather than managing the

negative feelings associated with a task. Planning/organization as measured by the BRIEF-P but not the CFTQ predicted procrastination. Planning/organization items in the BRIEF-P assess the ability to generate action and event sequences in service of a goal without necessarily reasoning from the perspective of the future self (Hudson et al., 2011), indicating that some additional aspect of planning unrelated to future thinking may be related to procrastination. The BRIEF-P measured planning and organization together, thus organization items may have been more predictive of children's procrastination.

As predicted, future thinking was inversely related to the tendency to procrastinate. This supports our hypothesis that procrastination involves the failure to consider or accurately predict future consequences and is in line with past research suggesting that adult procrastination is related to poorer future thinking (Rebetez et al., 2016). Delay of gratification emerged as a predictor of procrastination in both younger and older children, lending support to our position that procrastination is the complementary process to delay of gratification. Whereas procrastination involves delaying unpleasantness, delay of gratification involves enduring some unpleasantness in the present for greater future gains. Durden (1997) found that delay of gratification was negatively related to procrastination in adults, indicating that these processes may be related across the lifespan. Episodic foresight only emerged as a predictor in older children which aligns with the development of episodic foresight later in the preschool years (e.g., Atance & Meltzoff, 2005; Suddendorf & Busby, 2005). This may indicate that self-projection, the system thought to underly episodic foresight (Buckner & Carrol, 2007), may be related to procrastination. Indeed, the richness of detail provided about a hypothetical future scenario was related to procrastination in adults (Rebetez et al., 2016). Future research should explore the relation between self-projection and procrastination during early development.

When examining all the significant predictors from the previous regressions in one model to determine the relative contributions of EF and future thinking, an interesting pattern emerged; younger children's procrastination tendency was predicted by age, delay of gratification, working memory, and emotional control and older children's procrastination tendency was predicted by episodic foresight and planning/organization. Delay of gratification and emotional control fall under the domain of "hot" cognitive processes that involve an affective or motivational component (Zelazo & Carlson, 2012). By contrast, episodic foresight and planning/organization fall under the domain of "cool" cognitive processes that are not influenced by affect or motivation. This suggests that younger preschool children's procrastination is related to greater impulsivity or difficulty regulating their emotions, whereas the tendency to procrastinate in older children seems to be related to higher-order reasoning abilities including self-projection into future episodes and constructing and carrying out multi-step plans.

Procrastination has commonly been conceptualized as a failure of self-regulation (Rabin et al., 2011). Based on our current results, however, we argue that both EF and future thinking contribute to young children's procrastination and thus a comprehensive account of procrastination in young children should consider both cognitive capacities. Since future thinking might also be supported by EF, we investigated whether future thinking makes a significant independent contribution to procrastination in preschool. Executive ability was found to partially mediate the relation between future-oriented abilities and procrastination tendency. However, there was still an independent effect of future thinking on procrastination tendency. So, EF accounted for some (but not all) of the variance in the relation between future thinking and procrastination. This finding lends support to our conceptualization of procrastination involving both failures of executive function and future thinking.

An important contribution of this study was the collection of naturalistic examples of preschool children's procrastination behaviour. Younger children were reportedly more likely to procrastinate cleaning up after themselves, completing routines, and other undefined tasks whereas older children more often procrastinated chores and schoolwork. Older children's procrastination seemed to reflect the increasing responsibilities and obligations that come with increasing age. This may suggest that procrastination increases as children gain autonomy and are assigned more undesirable tasks in home and academic settings. Indeed, the majority of older children in our sample attended school which is likely accompanied by demands to complete time-sensitive tasks, whereas the majority of the younger children in our sample were enrolled in preschool or daycare programs which might have fewer tasks that need to be completed on a particular timeline.

This study had some limitations. No behavioural data could be collected for the current study due to limitations of the COVID-19 pandemic, thus we could not compare children's behavioural procrastination with parent reports. Further, the PPS measured the tendency to procrastinate as a trait (i.e., how characteristic procrastination was of children) rather than behavioural frequency. This may have been subject to reporting bias as different parents may have had different conceptualizations of what qualifies as "characteristic" behaviour. Further, traits are generally related to personality and temperament which are thought to be relatively stable throughout the lifespan (Ferguson, 2010). Future work might adapt the PPS to capture frequency of procrastination behaviour.

Because parent reports cannot capture children's internal thoughts, we could not confirm that children truly held intentions to complete the tasks described in the PPS, or whether observed tendencies reflected task avoidance, poor compliance, slow task completion, or

prospective memory failures. Future research should include measures of children's thought processes when delaying tasks to determine whether they reflect procrastination or other processes. Indeed, it is possible that age-related changes in task avoidance and compliance might contribute to what we assume are age-related changes in procrastination. Similarly, our data could not confirm that children are truly considering their current and future selves or states when deciding to postpone tasks. Importantly, however, even behavioural research (including Sutter et al., 2018) might fail to capture this self-projection process unless children are explicitly asked why they chose to postpone a task. Because children begin reasoning about the future in preschool (Atance & Meltzoff, 2005), however, it is possible that young children do in fact consider their future selves when choosing to postpone a task, even if their reasoning is faulty (e.g., forecasting that they will enjoy completing the task more in the future). Future behavioural research should try to capture children's decision making processes by asking them to explain why they chose to postpone (or not postpone) a task.

Finally, the results of our mediation analyses should be interpreted with caution as these were exploratory analyses. Because our measures were taken at a single point in time it is not possible to establish causal directions among our variables so future longitudinal work should further explore the mediating role of executive function in the relation between future thinking and procrastination.

In conclusion, the current study found that preschool children engage in procrastination and that procrastination behaviour becomes more characteristic of children with age. The tendency to procrastinate was related to worse EF and future thinking and specific future-oriented and executive abilities emerged as predictors of procrastination for younger and older children. Both EF and future thinking made independent contributions to children's

procrastination behaviour, suggesting that conceptualizing procrastination as a failure of self-regulation without considering future oriented reasoning is incomplete. Finally, naturalistic examples of procrastination were collected and the domains in which children procrastinated differed according to age and corresponded to developmentally appropriate tasks. Future research should continue to examine the emergence and development of this behaviour in preschoolers as well as its relation to other cognitive and social abilities.

References

Anderson, C. J. (2003). The psychology of doing nothing: forms of decision avoidance result from reason and emotion. *Psychological Bulletin*, *129*, 139. https://doi.org/10.1037/0033-2909.129.1.139

Atance, C. M. (2015). Young children's thinking about the future. *Child Development Perspectives*, *9*, 178-182. https://doi.org/10.1111/cdep.12128

Atance, C. M., & Meltzoff, A. N. (2005). My future self: Young children's ability to anticipate and explain future states. *Cognitive Development, 20*, 341-361. https://doi.org/10.1016/j.cogdev.2005.05.001.

Atance, C. M., & O'Neill, D. K. O'Neill, D. K. (2005). The emergence of Episodic Foresight in humans. *Learning and Motivation, 36*, 126-144. https://doi.org/10.1016/j.lmot.2005.02.003.

Atance, C. M., & O'Neill, D. K. (2001). Episodic Foresight. *Trends in Cognitive Sciences*, *5*, 533-539. https://doi.org/10.1016/S1364-6613(00)01804-0

Baumeister, R. F., & Heatherton, T. F. (1996). Self-regulation failure: An overview. *Psychological Inquiry*, *7*(1), 1-15. https://doi.org/10.1207/s15327965pli0701_1

Bélanger, M. J., Atance, C. M., Varghese, A. L., Nguyen, V., & Vendetti, C. (2014). What will I like best when I'm all grown up? Preschoolers' understanding of future preferences. *Child Development, 85*(6), 2419–2431. https://doi.org/10.1111/cdev.12282

Beutel, M. E., Klein, E. M., Aufenanger, S., Brähler, E., Dreier, M., Müller, K. W., . . . Wölfling, K. (2016). Procrastination, Distress and Life Satisfaction across the Age Range – a German representative community study. *PloS One, 11*. https://doi.org/10.1371/journal.pone.0148054

Brody, D. L., Scheiner, E. Y., Ari, M. D. B., Tzadok, Y., van der Aalsvoort, G. M., & Lepola, J. (2018). Measuring motivation in preschool children: A comparison of Israeli, Dutch and Finnish children. *Early Child Development and Care*. https://doi.org/10.1080/03004430.2018.1459593

Buckner, R. L., & Carroll, D.C. (2007). Self-projection and the brain. *Trends in Cognitive Science*, *11*, 49-57. https://doi.org/10.1016/j.tics.2006.11.004

Carlson, S. M. (2005). Developmentally sensitive measures of executive function in preschool children. Developmental *Neuropsychology, 28*, 595–616. https://doi.org/10.1207/s15326942dn2802_3

Dewitte, S., & Lens, W. (2000). Procrastinators lack a broad action perspective. *European Journal of Personality*, *14*, 121–140. https://doi.org/10.1002/(SICI)1099-0984(200003/04)14:2<121::AID-PER368>3.0.CO;2-#

Dewitte, S., & Schouwenburg, H. C. (2002). Procrastination, temptations, and incentives: The struggle between the present and the future in procrastinators and the punctual. *European Journal of Personality*, *16*, 469–489. https://doi.org/10.1002/per.461

Díaz-Morales, J. F., Ferrari, J. R., & Cohen, J. R. (2008). Indecision and avoidant procrastination: The role of morningness–eveningness and time perspective in chronic delay lifestyles. *The Journal of General Psychology*, 135, 228–240. https://doi.org/10.3200/GENP.135.3.228-240

Durden, C. A. (1997). *Life satisfaction as related to procrastination and delay of gratification*. [Unpublished master's thesis]. Angelo State University.

Einstein, G. O., & McDaniel, M. A. (1996). Retrieval processes in prospective memory: Theoretical approaches and some new empirical findings. In M. Brandimonte, G. O.

Einstein, & M. A. McDaniel (Eds.), *Prospective memory: Theory and applications* (pp. 115–141). Lawrence Erlbaum Associates Publishers.

Ferguson, C. J. (2010). A meta-analysis of normal and disordered personality across the life span. *Journal of Personality and Social Psychology, 98*, 659–667. https://doi.org/10.1037/a0018770

Ferrari, J. R. (1992). Procrastination in the workplace: Attributions for failure among individuals with similar behavioral tendencies. *Personality and Individual Differences*, *13*, 315-319. https://doi.org/10.1016/0191-8869(92)90108-2

Ferrari, J. R. (2001). Procrastination as self-regulation failure of performance: Effects of cognitive load, self-awareness, and time limits on "working best under pressure". *European Journal of Personality, 15*, 391–406. https://doi.org/10.1002/per.413

Ferrari, J. R., & Díaz-Morales, J. F. (2007). Procrastination: Different time orientations reflect different motives. *Journal of Research in Personality*, 41, 707–714. https://doi.org/10.1016/j.jrp.2006.06.006

Ferrari, J. R., & Emmons, R. A. (1995). Methods of procrastination and their relation to self-control and self-reinforcement. *Journal of Social Behavior and Personality, 10*, 135–142.

Ferrari, J. R., Johnson, J. L., & McCown, W. G. (1995). *Procrastination and task avoidance: Theory, research, and treatment*. Springer Science & Business Media. https://doi.org/10.12691/education-2-7-5

Fuke, T. S. S., & Mahy, C. E. V. (2022). Executive and retrospective memory processes in preschoolers' prospective memory development. *Cognitive Development*, *62*, 101172. https://doi.org/10.1016/j.cogdev.2022.101172..

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *BRIEF-P: Behavior Rating Inventory of Executive Function–Preschool Version*. Odessa, FL: Psychological Assessment Resources (PAR).

Gupta, R., Hershey, D. A., & Gaur, J. (2012). Time perspective and procrastination in the workplace: An empirical investigation. *Current Psychology*, 31, 195–211. https://doi.org/10.1007/s12144-012-9136-3

Harris, N. N., & Sutton, R. I. (1983). Task procrastination in organizations: A framework for research. *Human Relations*, *36*, 987-995. https://doi.org/10.1177/001872678303601102

Hudson, J.A., Mayhew, E.M., Prabhakar, J. (2011). The development of episodic foresight: emerging concepts and methods. *Advances in Child Development and Behaviour, 40*, 95-137. https://doi.org/10.1016/b978-0-12-386491-8.00003-7.

IBM Corp. (2020). *IBM SPSS Statistics for Windows*, *Version 27.0*. Armonk, NY: IBM Corp

Kliegel, M., & Jäger, T. (2007). The effects of age and cue-action reminders on event-based prospective memory performance in preschoolers. *Cognitive Development, 22,* 33–46. https://doi.org/10.1016/j.cogdev.2006.08.003

Knaus, W. J. (1998). *Do it now! Break procrastination habit*. New York: Jonn Wiley & Sons.

Kochanska, G., Coy, K. C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development*, *72*(4), 1091-1111. https://doi.org/10.1111/1467-8624.00336

Laursen, B., Richmond, A., Kiuru, N., Lerkkanen, M. K., & Poikkeus, A. M. (2021). Off on the wrong foot: Task avoidance at the outset of primary school anticipates academic difficulties and declining peer acceptance. *European Journal of Developmental Psychology*, 1-15. https://doi.org/10.1080/17405629.2021.1936491

Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality, 20*, 474-495. https://doi.org/10.1016/0092-6566(86)90127-3

Lay, C. H. (1997). Explaining lower-order traits through higher-order factors: The case of trait procrastination, conscientiousness and the specificity dilemma. *European Journal of Personality, 11,* 267-278. https://doi.org/10.1002/(SICI)1099-0984(199711)11:4<267::AID-PER281>3.0.CO;2-P

Lay, C. H., & Schouwenburg, H. C. (1993). Trait procrastination, time management, and academic behavior. *Journal of Social Behavior & Personality*, *8*, 647–662.

Lay, C., Kovacs, A., & Danto, D. (1998). The relation of trait procrastination to the big-five factor conscientiousness: An assessment with primary-junior school children based on self-report scales. *Personality and Individual Differences, 25*, 187-193. https://doi.org/10.1016/s0191-8869(98)00005-1

Mazachowsky, T. R., & Mahy, C. E. V. (2020). Constructing the Children's Future Thinking Questionnaire: A reliable and valid measure of children's future-oriented cognition. *Developmental Psychology*, *56*(4), 756. https://doi.org/10.31234/osf.io/2uhka

McCormack, T., & Atance, C. M. (2011). Planning in young children: A review and synthesis. *Developmental Review*, *31*, 1-31. https://doi.org/10.1016/j.dr.2011.02.002

Mervielde, I., & De Fruyt, F. (1999). Construction of the Hierarchical Personality Inventory for Children (HiPIC). In *Personality Psychology in Europe. Proceedings of the Eight European Conference on Personality*. Tilburg, Neth: Tilburg University Press.

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science*, *244*, 933-938. https://doi.org/10.1126/science.2658056

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex ‘‘frontal lobe’’ tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49–100. https://doi.org/10.1006/cogp.1999.0734

Moon, S. M., & Illingworth, A. J. (2005). Exploring the dynamic nature of procrastination: A latent growth curve analysis of academic procrastination. *Personality and Individual Differences, 38*, 297–309. https://doi.org/10.1016/j.paid.2004.04.009.

Oettingen, G., Hönig, G., & Gollwitzer, P. (2000). Effective self-regulation of goal attainment. *International Journal of Educational Research, 33,* 705-732. https://doi.org/10.1016/S0883-0355(00)00046-X

Prencipe, A., & Zelazo, P. D. (2006). Development of affective decision making for self and other: evidence for the integration of first- and third-person perspectives. *Association of Psychological Science, 16*(7), 501-505. https://doi.org/10.1111/j.0956-7976.2005.01564.x.

Rabin, L. A., Fogel, J., & Nutter-Upham, K. E. (2011). Academic procrastination in college students: The role of self-reported executive function. *Journal of Clinical and Experimental Neuropsychology, 33*, 344–357. https://doi.org/10.1080/13803395.2010.518597

Rawlins, D. R. (1995). *A study of academic procrastination in middle-school aged children*. [Unpublished doctoral dissertation]. The City University of New York

Rebetez, M. M. L., Barsics, C., Rochat, L., D’Argembeau, A., & Van der Linden, M. (2016) Procrastination, consideration of future consequences, and Episodic

Foresight. *Consciousness and Cognition*, *42,* 286-292. https://doi.org/10.1016/j.concog.2016.04.003

Robins, R. W., Fraley, R. C., Roberts, B. W., & Trzesniewksi, K. H. (2001). A longitudinal study of personality change in young adulthood. *Journal of Personality*, *64*, 618–640. https://doi.org/10.1111/1467-6494.694157

Robinson, C. C., Mandleco, B., Olsen, S. F., & Hart, C. H. (1995). Authoritative, Authoritarian, and Permissive Parenting Practices: Development of a New Measure. *Psychological Reports, 77*, 819-830. https://doi.org/10.2466/pr0.1995.77.3.819

Roth, R. M., Randolph, J. J., Koven, N. S., & Isquith, P. K. (2006). Neural substrates of executive functions: Insights from functional neuroimaging. In J. R. Dupri (Ed.), *Focus on neuropsychology research* (pp. 1–36). New York, NY: Nova Science Publishers. https://doi.org/10.1111/j.1750-8606.2012.00250.x

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development*, *72*, 1394-1408. https://doi.org/10.1111/1467-8624.00355

Scher, S. J., & Osterman, N. M. (2002). Procrastination, conscientiousness, anxiety, and goals: Exploring the measurement and correlates of procrastination among school-aged children. *Psychology in the Schools, 39*, 385-398. https://doi.org/10.1002/pits.10045

Shapiro, L. R., & Hudson, J. A. (2004). Effects of internal and external supports on preschool children's event planning. *Journal of Applied Developmental Psychology, 25,* 49–73. https://doi.org/10.1016/j.appdev.2003.11.004

Shin, J., & Grant, A. M. (2021). When putting work off pays off: the curvilinear relationship between procrastination and creativity. *Academy of Management Journal*, *64*, 772-798. https://doi.org/10.5465/amj.2018.1471

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin*, *133*, 65–94. https://doi.org/10.1037/0033-2909.133.1.65

Steel, P. (2010). Arousal, avoidant and decisional procrastinators: Do they exist?. *Personality and Individual Differences*, *48*, 926-934. https://doi.org/10.1016/j.paid.2010.02.025

Steel, P., Brothen, T., & Wambach, C. (2001). Procrastination and personality, performance, and mood. *Personality and Individual Differences*, *30*, 95–106. https://doi.org/10.1016/S0191-8869(00)00013-1

Strub, R. L. (1989). Frontal lobe syndrome in a patient with bilateral globus pallidus lesions. *Archives of Neurology*, *46*, 1024–1027. doi:10.1001/archneur.1989.00520450096027

Suddendorf, T., & Busby, J. (2005). Making decisions with the future in mind: Developmental and comparative identification of mental time travel. *Learning and Motivation, 36,* 110–125. https://doi.org/10.1016/j.lmot.2005.02.010

Sutter, M., Untertrifaller, A., & Zoller, C. (2018, April 11-12). *Busy little bees–An experiment on diligence and endogenous time scheduling in early childhood* [Conference presentation]. Briq/IZA Workshop on Behavioural Economics of Education, Bonn, Germany.

Tan, C. X., Ang, R. P., Klassen, R. M., Yeo, L. S.,Wong, I. Y. F, Huan, V. S., et al. (2008). Correlates of academic procrastination and students' grade goals. *Current Psychology*, *27*, 135–144. https://doi.org/10.1007/s12144-008-9028-8

Welsh, M. C., Pennington, B. F., & Groisser, D. B. (1991). A normative-developmental study of executive function: A window on prefrontal function in children. *Developmental Neuropsychology*, *7*, 131–149. https://doi.org/10.1080/87565649109540483

Williams, P. G., Suchy, Y., & Rau, H. K. (2009). Individual differences in executive functioning: Implications for stress regulation. *Annals of Behavioral Medicine*, *37*, 126–140. https://doi.org/10.1007/s12160-009-9100-0

Zelazo, P. D., Müller, U., Frye, D., & Marcovitch, S. (2003). The development of executive function in early childhood: VI. The development of executive function: Cognitive complexity and control--revised. *Monographs of the Society for Research in Child Development, 68*, 93–119. https://doi.org/10.1111/j.0037-976x.2003.00260.x

Zelazo, P.D., & Carlson, S.M. (2012). Hot and cool executive function in childhood and adolescence: development and plasticity. *Child Development Perspectives, 6*:354– 60. https://doi.10.1111/j.1750-8606.2012.00246.x

Table 1

Means and Standard Deviations of Task Performance

	Whole Sample		Younger Children		Older Children	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Age in Months	56.22	(12.98)	47.74	(7.32)	69.70	(7.44)
PPS Score	2.87	(0.62)	2.84	(0.58)	2.93	(0.69)
Future Thinking Measures						
Saving Subscale	3.76	(0.75)	3.62	(0.76)	3.97	(0.67)
Prospective Memory Subscale	4.01	(1.00)	3.90	(1.05)	4.17	(0.89)
Episodic Foresight Subscale	3.69	(0.85)	3.61	(0.89)	3.82	(0.77)
Planning Subscale	3.78	(0.91)	3.71	(0.93)	3.88	(0.87)
Delay of Gratification Subscale	3.46	(0.81)	3.39	(0.78)	3.57	(0.84)
Full Scale CFTQ	3.73	(0.70)	3.64	(0.72)	3.87	(0.66)
Executive Function Measures						
Inhibit Subscale	27.42	(6.38)	27.42	(5.79)	27.42	(7.24)
Shift Subscale	15.38	(4.08)	15.54	(3.96)	15.13	(4.25)
Working Memory Subscale	27.14	(6.74)	27.05	(6.50)	27.29	(7.14)
Emotional Control Subscale	16.17	(4.23)	16.14	(3.82)	16.24	(4.82)
Plan/Organize Subscale	17.13	(4.18)	17.00	(3.79)	17.34	(4.74)
Full Scale BRIEF-P	103.24	(21.72)	103.14	(19.53)	103.42	(24.89)

Note. PPS= Preschool Procrastination Scale; CFTQ = Children's Future Thinking Questionnaire; BRIEF-P = Behavioural Rating Inventory of Executive Function- Preschool.

Table 2

Correlations Among Measures

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age in Months														
2. PPS Score	.14**													
3. Saving Subscale	.23**	-.39** (-0.44)**												
4. Prospective Memory Subscale	.14**	-.40** (-0.43)**	.72** (0.72)**											
5. Episodic Foresight Subscale	.12*	-.42** (-0.45)**	.65** (0.65)**	.70** (0.69)**										
6. Planning Subscale	.11*	-.40** (-0.42)**	.67** (0.68)**	.75** (0.74)**	.64** (0.64)**									
7. Delay of Gratification Subscale	.15**	-.46** (-0.49)**	.48** (0.45)**	.39** (0.37)**	.45** (0.43)**	.39** (0.38)**								
8. Full scale CFTQ	.18**	-.50** (-0.55)**	.85** (0.85)**	.87** (0.86)**	.84** (0.85)**	.85** (0.85)**	.65** (0.64)**							
9. Inhibit Subscale	0.01	.44** (-0.44)**	-.32** (-0.33)**	-.29** (-0.28)**	-.37** (-0.37)**	-.31** (-0.30)**	-.37** (-0.38)**	-.41** (-0.41)**						
10. Shift Subscale	-0.01	.28** (0.28)**	-.20** (-0.20)**	-.20** (-0.18)**	-.27** (-0.27)**	-.20** (-0.172)**	-.29** (-0.29)**	-.28** (-0.27)**	.43** (0.42)**					
11. Working Memory Subscale	0.01	.52** (0.53)**	-.39** (-0.41)**	-.44** (-0.43)**	-.45** (-0.46)**	-.45** (-0.44)**	-.43** (-0.44)**	-.53** (-0.54)**	.76** (0.76)**	.54** (0.52)**				
12. Emotional Control Subscale	0.004	.42** (0.43)**	-.24** (-0.25)**	-.22** (-0.21)**	-.31** (-0.31)**	-.18** (-0.16)**	-.36** (-0.36)**	-.32** (-0.38)**	.69** (0.69)**	.59** (0.58)**	.63** (0.63)**			
13. Plan/Organization Subscale	0.04	.56** (0.56)**	-.38** (-0.40)**	-.41** (-0.41)**	-.43** (-0.45)**	-.40** (-0.39)**	-.45** (-0.47)**	-.51** (-0.52)**	.72** (0.72)**	.45** (0.44)**	.83** (0.83)**	.61** (0.61)**		
14. Full scale BRIEF-P	0.01	.53** (0.54)**	-.37** (-0.39)**	-.38** (-0.37)**	-.44** (-0.45)**	-.38** (-0.36)**	-.45** (-0.46)**	-.50** (-0.50)**	.89** (0.88)**	.68** (0.67)**	.92** (0.92)**	.82** (0.82)**	.87** (0.86)**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. Age-adjusted correlations are in parentheses

Table 3

Executive predictors of children's procrastination

A. Whole Sample (3-6 years old)							
				95.0% CI			
Effect	Beta	B	SE	LL	UL	t	*p*
Age in months	0.12	0.01	0.002	0.002	0.01	3.02	0.003
Inhibit	-0.05	-0.004	0.01	-0.02	0.019	-0.63	0.53
Shift	-0.05	-0.01	0.01	-0.02	0.01	-0.91	0.36
Working Memory	0.19	0.02	0.01	0.002	0.03	2.23	0.03
Emotional Control	0.14	0.02	0.01	0.001	0.04	2.11	0.04
Plan/Organize	0.36	0.05	0.01	0.03	0.08	4.72	<.001
B. Younger Children (3 & 4 years old)							
Age in months	0.20	0.02	0.004	0.01	0.02	3.82	<.001
Inhibit	-0.03	-0.003	0.01	-0.02	0.01	-0.31	0.76
Shift	-0.04	-0.01	0.01	-0.03	0.01	-0.66	0.51
Working Memory	0.27	0.02	0.01	0.01	0.04	2.50	0.01
Emotional Control	0.22	0.03	0.01	0.01	0.06	2.86	0.01
Plan/Organize	0.22	0.03	0.02	0.01	0.06	2.31	0.02
C. Older Children (5 & 6 years old)							
Age in months	0.05	0.01	0.01	-0.01	0.02	0.77	0.44
Inhibit	-0.09	-0.01	0.01	-0.03	0.01	-0.75	0.45
Shift	-0.07	-0.01	0.02	-0.04	0.02	-0.78	0.44
Working Memory	0.13	0.01	0.01	-0.02	0.04	0.90	0.37
Emotional Control	-0.01	-0.001	0.02	-0.03	0.03	-0.08	0.94
Plan/Organize	0.62	0.09	0.02	0.05	0.13	4.71	<.001

Table 4

Future thinking predictors of children's procrastination

A. Whole Sample (3-6 years old)

				95.0% CI			
Effect	Beta	B	SE	LL	UL	t	*p*
Age in months	0.25	0.01	0.002	0.01	0.02	5.92	<.001
Saving	-0.08	-0.07	0.06	-0.18	0.05	-1.19	0.24
Prospective Memory	-0.08	-0.05	0.05	-0.14	0.04	-1.16	0.25
Episodic Foresight	-0.13	-0.10	0.05	-0.19	-0.01	-2.13	0.03
Planning	-0.09	-0.06	0.05	-0.16	0.03	-1.37	0.17
Delay of Gratification	-0.33	-0.26	0.04	-0.33	-0.19	-6.91	<.001

B. Younger Children (3 & 4 years old)

Age in months	0.26	0.02	0.004	0.01	0.03	4.99	<.001
Saving	-0.04	-0.03	0.06	-0.15	0.10	-0.44	0.66
Prospective Memory	-0.08	-0.04	0.05	-0.14	0.06	-0.86	0.39
Episodic Foresight	-0.08	-0.05	0.05	-0.15	0.05	-0.98	0.33
Planning	-0.17	-0.10	0.05	-0.21	-0.001	-1.99	0.05
Delay of Gratification	-0.41	-0.31	0.04	-0.40	-0.22	-6.97	<.001

C. Older Children (5 & 6 years old)

Age in months	0.14	0.01	0.01	0.000	0.03	1.91	0.06
Saving	-0.10	-0.11	0.11	-0.33	0.12	-0.95	0.34
Prospective Memory	-0.09	-0.07	0.09	-0.26	0.11	-0.77	0.45
Episodic Foresight	-0.26	-0.24	0.10	-0.43	-0.05	-2.49	0.01
Planning	0.004	0.003	0.09	-0.18	0.19	0.03	0.97
Delay of Gratification	-0.23	-0.19	0.07	-0.32	-0.06	-2.81	0.01

Table 5

Future thinking and executive predictors of children's procrastination

A. Whole Sample (3-6 years old)

				95.0% CI			
Effect	Beta	B	SE	LL	UL	t	*p*
Age in months	0.19	0.01	0.002	0.01	0.01	4.67	<.001
Episodic Foresight	-0.17	-0.12	0.03	-0.19	-0.06	-3.60	<.001
Delay of Gratification	-0.23	-0.18	0.04	-0.25	-0.11	-4.92	<.001
Working Memory	0.09	0.01	0.01	-0.01	0.02	1.22	0.22
Emotional Control	0.08	0.01	0.01	-0.003	0.03	1.58	0.12
Plan/Organize	0.25	0.04	0.01	0.02	0.06	3.49	<.001

B. Younger Children (3 & 4 years old)

Age in months	0.24	0.02	0.004	0.01	0.03	4.86	<.001
Episodic Foresight	-0.09	-0.06	0.04	-0.13	0.02	-1.51	0.13
Delay of Gratification	-0.34	-0.25	0.04	-0.34	-0.17	-6.10	<.001
Working Memory	0.21	0.02	0.01	0.003	0.04	2.31	0.02
Emotional Control	0.16	0.03	0.01	0.01	0.04	2.80	0.01
Plan/Organize	0.07	0.01	0.01	-0.02	0.04	0.75	0.46

C. Older Children (5 & 6 years old)

Age in months	0.05	0.01	0.01	-0.01	0.02	0.80	0.43
Episodic Foresight	-0.25	-0.23	0.07	-0.37	-0.10	-3.37	<.001
Delay of Gratification	-0.10	-0.08	0.07	-0.21	0.05	-1.22	0.23
Working Memory	0.01	0.001	0.01	-0.02	0.02	0.07	0.95
Emotional Control	-0.05	-0.01	0.01	-0.03	0.02	-0.49	0.63
Plan/Organize	0.48	0.07	0.02	0.04	0.11	3.97	<.001

Table 6

Frequencies of Naturalistic Procrastination Examples

	Whole sample			Younger children		Older children		
Category	Frequency	Percent	Valid Percent	Frequency	Valid Percent	Frequency	Valid Percent	Examples:
Cleaning up a mess they made	135	34.1	43.3	79	42.5	56	44.4	"I asked my child to put up away her toys and she refused because she was hungry. I had to get her a snack before she could pick up her toys."
Chores	11	2.8	3.5	3	1.6	8	6.3	"Usually when it comes to chores; cleaning up toys, getting the dog food, taking a bath, etc."
Class/schoolwork /learning	39	9.8	12.5	17	9.1	22	17.5	"When I told him it is time to sign in to next class and he doing everything from moving a robe to another spot to playing with his fidget spinner to changing his socks."
Routines (meals, bedtime, eating)	67	16.9	21.5	46	24.7	21	16.7	"The last time my child put off an activity was when he was taking to long to put his shoes on when we needed to take his sister to school."
Other	60	15.2	19.2	41	22.0	19	15.1	"She procrastinates with everything she doesn't want to do."
Total	312	78.8	100.0	186	100.0	126	100.0	
System	84	21.2		57		27		
	396	100.0		243		153		

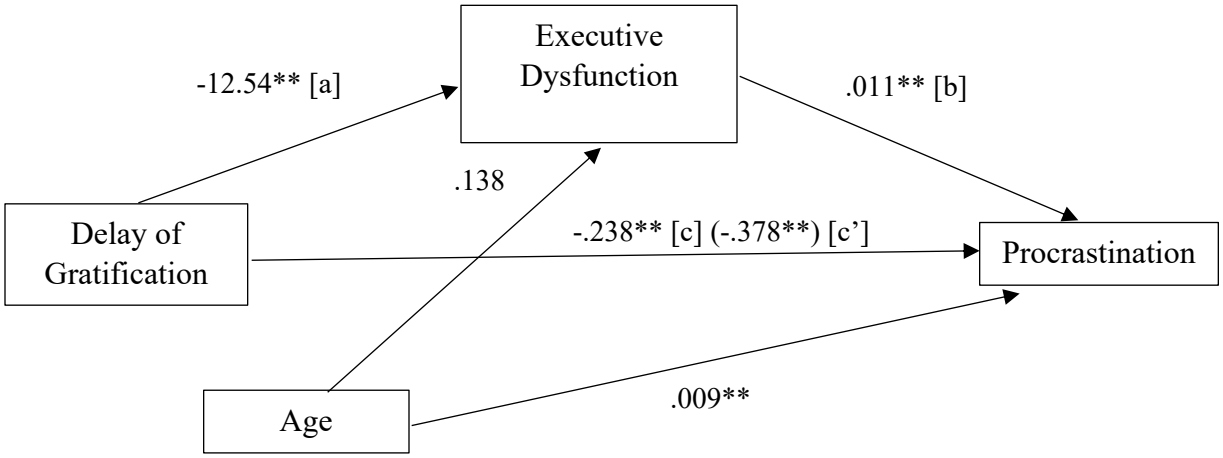

Figure 1

Impairment in executive function as a mediator of the association between delay of gratification and procrastination. The effect of delay of gratification on impairment in executive function is path [a]. The effect of impairment in executive function on procrastination controlling for delay of gratification is path [b]. Path [c] represents the effect of delay of gratification on procrastination. Path [c'] represents the effect of delay of gratification on procrastination after including impairment in executive function in the model. The coefficient for path [c'] is in parentheses. ** $p < .01$.

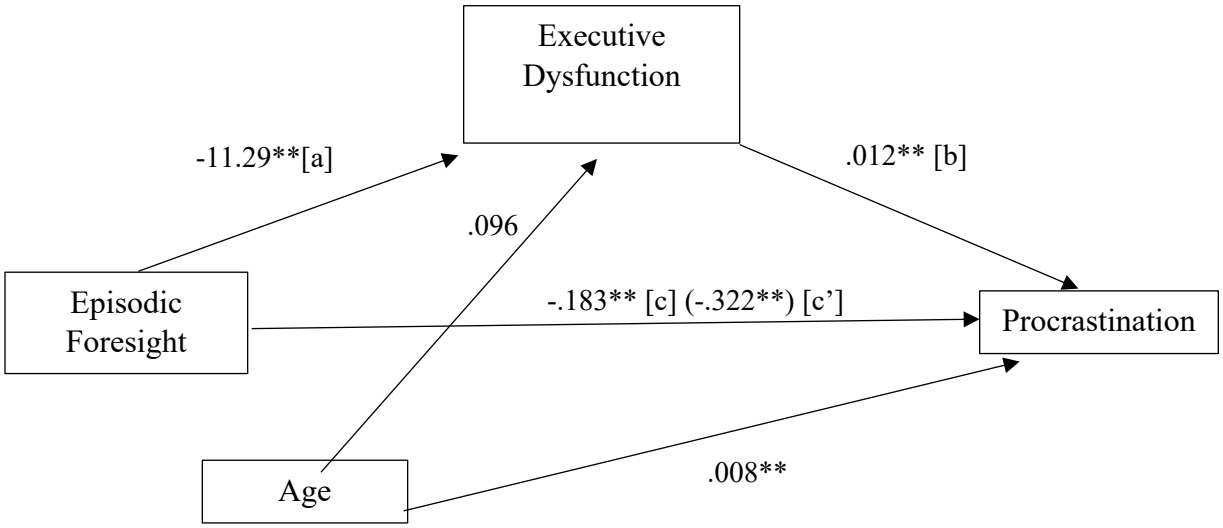

Figure 2

Impairment in executive function as a mediator of the association between episodic foresight and procrastination. The effect of episodic foresight on impairment in executive function is path [a]. The effect of impairment in executive function on procrastination controlling for delay of gratification is path [b]. Path [c] represents the effect of episodic foresight on procrastination. Path [c'] represents the effect of episodic foresight on procrastination after including impairment in executive function in the model. The coefficient for path [c'] is in parentheses. ** $p < .01$.

Appendix A: Preschool Procrastination Scale

Procrastination Scale (Lay, 1986) adapted for parents of preschool aged children

Instructions:

People may use the following statements to describe their child. For each statement, decide whether the statement is uncharacteristic or characteristic of your child using the following 5-point scale. Note that the 3 on the scale is Neutral – the statement is neither characteristic nor uncharacteristic of your child. In the box to the right of each statement, fill in the number on the 5-point scale that best describes your child.
Extremely Uncharacteristic = 1
Moderately Uncharacteristic = 2
Neutral = 3
Moderately Characteristic = 4
Extremely Characteristic = 5

1. I often find my child performing tasks that he/she intended to do days before. (e.g., cleaning their room)

2. My child does not complete tasks until just before they have to be completed. (e.g., packing some toys or games for an upcoming vacation)

3. When my child has something to return, he/she returns it right away regardless of when it needs to be returned. (e.g., returning a toy borrowed from a friend)

4. When it is time to get up in the morning, my child most often gets right out of bed. (e.g., child wakes up right at 7 o'clock when they are woken up)

5. Even with tasks that require little else except sitting down and doing them, my child puts off getting them done for days. (e.g., puts off completing a puzzle or other activity)

6. My child usually make decisions as soon as possible. (e.g., quickly chooses a toy at the store)

7. My child generally delays before starting on tasks that he/she has to do. (e.g., getting ready for bed)

8. My child usually rushes to complete a task on time. (e.g., putting toys away)

9. When preparing to go out, my child is seldom caught having to do something at the last minute. (e.g., going to the bathroom)

10. My child often wastes time by doing other things, instead of completing the task at hand. (e.g., requesting a snack instead of completing a task)

11. My child prefers to leave early for appointments and playdates. (e.g., is at the door ready to go a few minutes early)

12. My child usually starts a task shortly after it is given to them. (e.g., begins task right away)

13. My child often has a task finished sooner than necessary. (e.g., completes a birthday card well in advance of a relative's birthday party)

14. My child usually accomplishes all the things that he/she plans to do in a day. (e.g., completes planned activities)

15. My child continually says "I'll do it tomorrow". (e.g., child says I'll clean my room later)

Note: Reversed-keyed items: 3, 4, 6, 8, 9, 11, 12, 13, 14