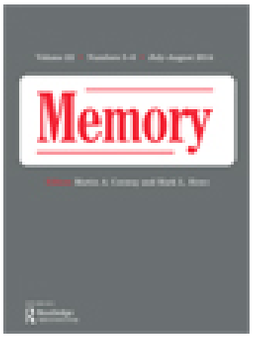

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Adults' perceptions of forgetful children: the impact of child age, domain, and memory type

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ABSTRACT
Prospective memory (PM) tasks have been described as social in nature because carrying out one's intentions often has an impact on others. Despite the claim that PM errors [compared to retrospective memory (RM) errors] are perceived as character flaws, little empirical work has tested this assertion. In particular, no study has examined how adults perceive children's PM errors. Thus, the aim of the current studies was to examine adults' perceptions of children's forgetfulness depending on child age (4 vs. 10-year-olds), domain of the memory error (academic vs. social), and memory type (PM vs. RM). In Study 1, adult participants rated children's PM errors on seven traits. Findings showed that social errors were rated more negatively than academic errors, and age and domain interacted such that 10-year-olds were rated more negatively than 4-year-olds for making social errors but not academic errors. Study 2 examined the impact of child age, domain, and memory type on perceptions of forgetful children to specifically test differences between PM and RM errors. Results showed a larger difference between ratings of 10-year-olds for their academic and social memory errors compared to 4-year-olds, but only for RM errors.

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Prospective memory; perceptions of forgetfulness; children; academic; social

Hundreds of studies have examined the development of children's episodic retrospective memory (RM; memory for events that occurred in the past; e.g., Fivush et al., 1984, 1987; Willoughby et al., 2012) and prospective memory (PM; the ability to remember to carry out future intentions; Einstein & McDaniel, 1990), but very few have investigated the influence these types of memory *errors* have on adults' perceptions of children. While is it important to understand how these memory abilities develop and support children's daily functioning, it is also important to understand what kind of impact memory failures have on children. In general, children are quite forgetful as their episodic RM and PM abilities are rapidly developing during childhood (e.g., Ghetti & Lee, 2011; Kliegel & Jager, 2007; Mahy & Moses, 2011; Naito, 2003). Children's forgetfulness or absentmindedness is likely to be noticed by parents and teachers alike in social and academic settings, making it especially important that we have a more in-depth understanding of how adults interpret children's memory errors. The perceptions are important to understand as they have implications for how adults are likely to treat children in the future as well as their expectations for future behaviour. Thus, the goal of the current studies was to examine the differences in how adults perceive children's memory errors between age (4- and 10-year-olds), domain of memory error (academic and social), and memory type (PM and RM) as well as to examine how prior experience with children affects those perceptions.

PM is an important cognitive ability that we use in our everyday life to successfully carry out our intended actions, such as remembering to meet a friend after work or remembering to take cupcakes out of the oven when they finish baking. PM tasks have both a prospective and retrospective memory component (Smith & Bayen, 2004). For example, when remembering to pick up the mail you must remember *to* go get the mail (prospective component) but also remember *that* you must go get the mail in the first place (retrospective component). Therefore, memory errors in PM tasks can be attributed to these two different components: forgetting to carry out the future intention at the specific time or event (PM error) or forgetting what you had to do (RM error). For example, you could remember that you had to get the mail and fail to remember to go get it when you pass the mailbox (PM error), or you could remember that you had something to do when you walked by your mailbox but not specifically what the task was (RM error; Smith & Bayen, 2004). Another important distinction in the PM literature is between event-based and time-based PM tasks. Event-based PM tasks must be carried out in response to a specific event (e.g., passing a message to a

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friend when you see them next) whereas time-based PM tasks must be carried out at a certain point in time or after a specific amount of time has passed (e.g., removing cupcakes from the oven after 25 min). The research on children's PM development has focused mainly on event-based PM tasks as young children have difficulty understanding time concepts.

RM and PM follow a similar developmental trajectory. The first signs of RM abilities appear in infancy, when babies can remember motor behaviours and sequences even after hours or weeks have passed (e.g., Carver & Bauer, 1999; Herbert & Hayne, 2000; Rovee & Rovee, 1969). PM abilities, on the other hand, seem to emerge around 2–3 years of age. However, only about one-third of 2-year-old children can remember what they were supposed to do in the future and few carry out their intention at the appropriate point in time (e.g., Kliegel & Jager, 2007; Ślusarczyk et al., 2018).

In general, episodic RM rapidly develops during the preschool years (Scarf et al., 2011) and continues to improve through early and middle childhood (Ghetti & Lee, 2011; Hayne et al., 2011). PM abilities also develop dramatically during early childhood (e.g., Kliegel & Jager, 2007; Mahy & Moses, 2011) and the middle childhood years (e.g., Kerns, 2000; Kliegel et al., 2013; Kvavilashvili et al., 2001; Smith et al., 2010). Broadly, PM performance on both experimental tasks (e.g., card-sorting or computer-based tasks) and naturalistic tasks (e.g., reminding the experimenter of something or completed an action) improves between 2 and 6 years of age (e.g., Ford et al., 2012; Guajardo & Best, 2000; Kliegel & Jager, 2007; Mahy & Moses, 2011; Walsh et al., 2014).

By 10 years of age, some aspects of episodic recall, such as memory for where an event took place, reach adult-like levels, whereas other aspects such as when the event happened improve into adulthood (Lee et al., 2016). Similarly by this age, children have advanced PM skills and can employ strategies to improve their performance such as time-monitoring (Ceci & Bronfenbrenner, 1985) and episodic future thinking (Kretschmer-Trendowicz et al., 2019). Kerns (2000) showed that 12-year-olds have superior time monitoring abilities compared with 6-year-olds in a CyberCruiser task where children had to re-fuel their gas tank in a virtual driving game.

Despite children's PM tasks being designed to capture children's interest and motivate them to carry out their future intention, children often perform poorly on PM tasks (e.g., Kerns, 2000; Kliegel & Jager, 2007; Mahy & Moses, 2011). In the lab, children might not be judged negatively for their PM errors, but in everyday life these errors are likely to have an impact on other's perceptions of them. Thus, a question is: are children who fail PM tasks evaluated more negatively in a social context than those who succeed? Forgetfulness for events in the past may be seen as a fault of a person's memory whereas PM errors may be interpreted as a failure of one's character (e.g., Erber et al., 1996; Munsat, 1966). In this case, a person who makes a RM error may be perceived as having an unreliable memory but this forgetfulness might not carry the same negative connotation that PM forgetfulness has for an individual's character.

As shown in the adult literature, our relationships with others are evaluated based on what we remember to do and how reliably we carry out our intentions, as the onus is placed on the person who made the PM error (Brandimonte & Ferrante, 2008). PM task performance is also influenced by the social value of the task, such as improvement if the task is important to others or if others will receive a benefit from the task's completion (Brandimonte et al., 2003). Graf (as cited in Graf, 2012) tested how adults between 20 and 80 years old were perceived based on whether they made PM or RM errors and individual or social errors. Those who made PM errors (such as forgetting to put a stamp on a letter) were rated as lacking motivation and being unreliable whereas RM errors (such as forgetting a phone number) were attributed to cognitive processes. These effects were stronger when vignettes contained social PM errors (compared to individual PM errors). Importantly, adults' perceptions of children's PM errors have not been tested empirically, so little is known about the perception of children's PM errors and whether perceptions differ depending on whether the PM error has an obvious social impact. Why are PM and RM errors interpreted differently? Perhaps the answer to these questions is in the fundamentally social nature of PM. According to Meacham (1988), the study of PM should include social relationships since PM is inherently social in nature and relationships are influenced by how well we remember future intentions. Social PM tasks such as remembering to meet someone are also more likely to be remembered than personal PM tasks, like remembering to go to the post office (Meacham & Kushner, 1980). This evidence points to PM being an important part of our social interactions and could be important to our evaluations of others, and thus is inherently different from RM.

The effect of task importance on PM has been well-documented. For instance, emphasising the importance of the PM task leads to performance improvements in adults (Smith & Hunt, 2014). Moreover, tasks that have greater personal importance are completed more often than those with low personal importance (Ihle et al., 2012). Schnitzspahn et al. (2020) showed that young and old adults completed a higher percentage of their self-assigned time-based PM tasks than those assigned by the researcher, indicating that more self-relevant tasks might be considered more important than assigned ones, and thus completed more frequently. In the same vein, PM tasks from the social domain could be remembered better because they are considered more important than other domains, such as those relating to academics or personal safety. Several studies that have demonstrated the higher importance of PM tasks within the social domain. For example, Cicogna and Nigro (1998) compared

low versus high importance PM intentions, where the intention was to place the phone receiver back on the hook after five minutes either as a favour to the experimenter because they were expecting an important call (high importance) or because they were expecting a call from a colleague (low importance). Results showed that adult participants remembered the PM task significantly more in the high importance condition compared to the low importance condition. Other findings suggest that PM tasks are more likely to be remembered when they involve meeting another person or keeping an appointment (Meacham & Kushner, 1980), or have a prosocial benefit to a collaborative group (Brandimonte et al., 2010). Similarly, Penningroth et al. (2011) also demonstrated that not only were social PM tasks rated as more important by adult participants, but they were performed more often than non-social PM tasks regardless of if they were trivial (e.g., to remember to call a radio station for a movie ticket) or consequential (e.g., to remember to call to provide a recommendation for a job). Notably, children's PM tasks are often framed as prosocial games, such as helping a puppet or the experimenter to complete a task. As Nigro et al. (2014) noted, children pay special attention to the social importance of the PM task (reminding the experimenter to return a phone), suggesting that this motivation to help others improves the ability to complete the PM task. Thus, many PM tasks given to children have a significant social component that might be especially motivating and thereby increase performance.

As children age, caregivers give them more responsibility, as older children are perceived as more autonomous and responsible for their own behaviour. For example, children 8–16 years old take on more responsibility for their own health as they age by taking their medication at the correct time (McQuaid et al., 2003). Parents also rated older children as being allowed to travel independently to and from school more than younger children (Ayllón et al., 2019). As children become increasingly responsible for their actions, they should also become more responsible for their memory abilities, and in particular, their memory failures. Children's metacognition (knowledge of one's own cognitive abilities) and metamemory (knowledge of one's own memory abilities) also improve with age, which should support their ability to remember and increase their ability to use strategies in order to remember better (Schneider, 2008). Moreover, there is evidence that ratings of children can change depending on how much experience with children individuals have. For example, Morey and Gentzler (2017) demonstrated that with more past experience with children, participants rated children more favourably. Thus, when asking adults to evaluate children's memory errors, an important variable might be the amount of experience the individual has with children, as this is likely to affect their judgements based on the amount of knowledge they have of child development or first-hand experience with children's abilities.

There is also mounting evidence to suggest that parents tend to have more knowledge than non-parents of child development (Karraker & Evans, 1996; Vale-Dias & Nobre-Lima, 2018; Zand et al., 2015) and that parents tend to perform better on surveys based on child development compared to non-parents (Bornstein et al., 2010; Furnham et al., 2003; but also see Botey et al., 2017). These results suggest that parents, or those with more experience with children, may have a better understanding of child development compared to non-parents. Moreover, Kliegel and Jager (2007) showed that parent's reports of their children's PM (using the Prospective and Retrospective Memory Questionnaire) were correlated with child behavioural performance. However, children's performance on PM tasks was correlated with both the RM and PM parent-report scales suggesting that parents do not make a distinction between PM and RM in their assessment of their child's memory performance.

Research from the aging literature also suggests that individuals are judged based on their forgetfulness. Erber et al. (1997) showed that young and older adult participants were more lenient with older adults' forgetfulness and their memory errors were attributed to mental difficulty. The memory errors in the stories were both prospective and retrospective in nature; however, the difference between these types of memory errors was not examined. Further, Erber et al. (1992) found that participants were more likely to assign tasks to those who were not forgetful compared to those who were moderately or very forgetful (in other words, perceptions of memory performance were significantly related to task assignment). Thus, perceptions of memory performance can change an individual's behaviour towards those who are perceived or described as forgetful. Importantly, no studies to our knowledge have examined adults' perceptions of forgetful children, which is the focus of the current study.

Current studies

Critically, few empirical studies have directly tested the assumption that PM errors are judged more negatively than RM errors. Further, the social consequences of PM failures have not been directly examined by evaluating whether individuals who make social PM failures are judged more harshly than PM failures in other domains. The current studies fill this gap by providing the first empirical evidence that children may be perceived differently based on their age (4- or 10-year-olds), domain of the memory error (academic or social), and type of memory error they make (retrospective or prospective). These two age groups were selected because PM undergoes rapid development starting around 4 years of age (e.g., Kliegel & Jager, 2007; Mahy & Moses, 2011; Mahy et al., 2014) and 10-year-old children have more established PM abilities and more experience in both academic and social settings (e.g., Kerns, 2000). These perceptions

might lead to differences in how parents, teachers, and caregivers treat children and what they expect of them in the future.

Study 1 examined the effect of child age (4 vs. 10 years old) and the memory error domain (academic vs. social) on adults' ratings of children's character traits, whether the memory error was the child's fault, and the likelihood that the child would make a similar memory error in the future. The extent of experience that adult participants had with children was measured and used as a covariate in our analyses to examine its influence.

Study 2 replicated and extended Study 1 to examine the effect of the type of memory error (PM versus RM) on adults' perceptions of children's forgetfulness. Because of the notion that people view PM errors as failures in one's character whereas RM errors are seen as failures of one's memory (Brandimonte & Ferrante, 2008; Munsat, 1966), we hypothesised that in addition to main effects of child age and domain, Study 2 would show that PM errors are rated more harshly than RM errors, particularly in social domains. Experience with children was again used as a covariate.

Study 1

Study 1 used a mixed design to examine adults' perceptions of young (4-year-olds) and older (10-year-olds) children's PM errors in academic and social domains. The vignettes were designed specifically to focus on memory errors that would have a significant impact on the academic or social domain. Young adults read a brief vignette and then rated each child on a number of character traits, the extent to which the error was the child's fault, and whether the child was likely to repeat the errors in the future. The following hypotheses were tested

(1). Young children's memory errors will be evaluated more positively compared to older children's errors because older children are expected to be more independent in carrying out their future intentions.
(2). Because of the negative consequences, PM errors can have in social contexts, children who make PM errors in social domains will be rated more negatively than those who make errors in academic domains.
(3). Older children's PM errors in social domains will be evaluated most negatively.
(4). Older children will be rated as more at fault for their PM errors but will be rated as less likely to repeat the PM error in the future compared to younger children.
(5). Adults will rate children as more at fault and more likely to repeat PM errors in the social domain compared to the academic domain.
(6). Adults with more experience with children may be more lenient in how they rate children such that they will view children's PM errors more positively than adults with less experience with children.

Method

Participants

Participants were recruited through the online platform Prolific. Participants met the following criteria: between 18 and 30 years old, residents of the United States, spoke English as a first language, and had a Prolific approval rating of 98% or above. Of the 298 participants who completed the study, 96 participants were excluded for: failing either of the two attention check questions ($n = 87$), taking an exceptionally long time to complete the study (2 standard deviations above the mean completion time; $M_{duration} = 8.11$ min, $SD = 6.09$ min; $n = 11$), or being older than 30 years old ($n = 2$). The final sample consisted of 202 participants (103 males, 98 females, 1 declined to answer; $M_{Age} = 24.69$, $SD = 3.70$) who were mainly white (62.4%), well-educated (83.1% had at least some college or a 2-year degree), and had low annual incomes (59.4% below $40,000). In terms of experience with children, 68.3% of individuals reported having 0–10 h of experience with children per week, 5.9% had 10–20 h, 5.4% had 20–30 h, 3% had 30–40 h, 13.4% had 40+ hours, and 4% did not provide data.

Procedure

Participants first completed a consent form and then a demographic questionnaire in which they were asked about their sex, age, birth year, parental status (including grandparent and aunt/uncle status), the ages of their children (if applicable), education level, occupation and spouse's occupation (if applicable), amount of experience with children in hours per week, total annual income, and ethnic background.

Participants then completed a Vignette Rating Task. Each participant was randomly assigned to an age condition (between-subjects), which determined whether they would see eight vignettes about 4-year-old or 10-year-old children (see Table 1). Four vignettes described children making PM errors in the social domain and four vignettes described children making PM errors in the academic domain (within-subjects). The vignettes within each domain were presented in a fixed order. Whether participants received the academic or social domain vignettes first was counterbalanced across participants. The sex of the child in each vignette was also counterbalanced in each domain, such that participants were randomly assigned two vignettes about boys and two vignettes about girls in the social domain and the academic domain. For each vignette, participants made a total of nine judgements about the child described. First, they rated how: (1) kind, (2) friendly, (3) trustworthy, (4) capable, (5) competent, (6) intelligent, and (7) conscientious each child was on a 7-point Likert scale ranging from very negative to very positive (e.g., very unfriendly to very friendly). These adjectives were chosen for their

Table 1. List of vignettes for Study 1.

Academic	Alex is 4(10) years old. Alex forgets to do his homework. Jamie is 4(10) years old. Jamie forgets to bring home a permission slip for his upcoming fieldtrip. Riley is 4(10) years old. Riley forgets to hand his worksheet in to the teacher. Charlie is 4(10) years old. Charlie forgets to raise his hand before he answers the teacher's question.
Social	Avery is 4(10) years old. Avery forgets to return the toy he had borrowed from his friend. Taylor is 4(10) years old. Taylor forgets to wait for his friend after swim lessons. Sam is 4(10) years old. Sam forgets to keep his friend's surprise party a secret. Jordan is 4(10) years old. Jordan forgets to bring a birthday present to his friend's party.

Note: Children were described as either male or female in each vignette in a counterbalanced order.

relevance to social and academic domains respectively, with conscientiousness relevant to both domains. These seven adjectives were presented in a randomised order for each vignette. After rating the adjectives, participants also rated: (1) whether the scenario in the vignette was the child's fault on a 7-point Likert scale from "strongly disagree" to "strongly agree" and (2) the likelihood that the child would make the same error in the future on a 7-point Likert scale from "very unlikely" to "very likely". There were two attention check questions embedded within the Vignette Rating Task which appeared in a random order. In these attention checks, participants were instructed to choose a specific option (e.g., "Please select a little bit competent for this question"). At the end of the Vignette Rating Task, participants were asked five additional questions about COVID-19, which they answered on 7-point Likert scales from "very slightly or not at all" to "extremely" (see Table 2) to examine any effects of the pandemic on participant responses. Participants were paid £1.88 GBP (the equivalent of $2.00 USD) for their participation and data was collected on 15 July 2020.

Analytic strategy

Fault and repeatability were reverse coded prior to analyses such that lower scores represented more negative ratings and higher scores represented more positive ratings. First, a principal component analysis (PCA) was conducted on the seven character traits to evaluate whether they should be combined to form a composite trait measure. Then, three mixed ANCOVAs were conducted to examine the impact of child age and domain on trait composite, fault, and whether the errors were likely to be repeated in the future.

Table 2. List of COVID-19 Questions.

1. To what extent do you feel anxious about the COVID-19 virus?
2. To what extent has COVID-19 negatively impacted your life?
3. To what extent has COVID-19 negatively impacted your overall well-being?
4. To what extent has COVID-19 disrupted your daily life (e.g., work, time with friends and family)?
5. Has COVID-19 caused you financial stress?

Results & discussion

Preliminary analyses

A PCA revealed that all seven traits were highly correlated with each other (*rs* > .65) and loaded onto a single factor with an Eigenvalue of 5.70 that explained 81.38% of the variance in ratings of children's forgetfulness. The character traits were also highly reliable (Cronbach's alpha = .96) thus we combined them into one trait composite score for further analysis. Only significant effects will be reported in the following analysis. Our COVID-19 questions were also analysed as covariates in our ANCOVA, but none were significant, so they were excluded from further analyses.

Age and domain effects on character traits

A 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) mixed ANCOVA with experience with children as a covariate was performed on the trait composite. There was a significant effect of domain, $F(1, 191) = 44.06$, $p < .001$, $\eta_p^2 = .19$, such that children's PM errors in the social domain ($M = 3.98$, $SD = .90$) were rated significantly more negatively than those who made errors in the academic domain ($M = 4.29$, $SD = .86$; see Table 3). There was also a significant interaction between domain and child age, $F(1, 191) = 5.81$, $p = .02$, $\eta_p^2 = .03$, such that 10-year-olds' PM errors were rated more negatively than 4-year-olds' in the social domain ($M_{\text{Diff}} = .30$, $SE = .12$, $p = .02$, CI [.057, .54]) but not in the academic domain ($M_{\text{Diff}} = .11$, $SE = .12$, $p = .35$, CI [-.12, .35]). In line with our prediction, social PM errors were rated more harshly than academic PM errors lending some support for the assertion that PM errors in the social domain have greater consequences for perception of character than those in academic contexts, which are seen as faults in memory ability. Ten-year-olds' PM errors are judged more harshly in social domains compared to 4-year-olds suggesting that adults have higher expectations for older children's PM when it comes to social activities. Interestingly, 10-year-olds were

Table 3. Means and standard deviations for the trait composite in study 1.

Academic Domain			Social Domain		
4-year-olds	10-year-olds	Total	4-year-olds	10-year-olds	Total
4.35 (.85)	4.22 (.87)	4.29 (.86)	4.13 (.83)	3.81 (.94)	3.98 (.90)

Note: Higher scores indicate more positive trait ratings (range of ratings: 1–7).

not judged more negatively than 4-year-olds for PM errors in the academic domain suggesting that these types of errors are seen as normative for both younger and older children.

The amount of experience that the participant had with children had a significant impact on their trait composite score, $F(1, 191) = 14.15$, $p < .001$, $\eta_p^2 = .07$, indicating that the more experience with children a participant had, the more positively they rated children's PM errors. Thus, adults with more experience with children might be more familiar with children's memory capabilities and more lenient with their judgments than those with less experience with children (Karraker & Evans, 1996; Vale-Dias & Nobre-Lima, 2018; Zand et al., 2015).

Age and domain effects on fault

A 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) mixed ANCOVA with experience with children as a covariate was performed on ratings of fault. There was a significant effect of age, $F(1, 191) = 18.32$, $p < .001$, $\eta_p^2 = .09$, such that participants rated 10-year-olds ($M = 2.96$, $SD = 1.04$) as more at fault than 4-year-olds ($M = 3.64$, $SD = 1.35$) for their PM errors. Thus, in line with past research, adults expect older children to be more responsible for carrying out their intentions compared to younger children. Additionally, when older children fail to do so they place blame on them compared to younger children (e.g., Ayllón et al., 2019; McQuaid et al., 2003;).

Age and domain effects on repeatability

Finally, a 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) mixed ANCOVA with experience with children as a covariate was performed on how likely the child was to repeat the memory error. There was a significant effect of domain, $F(1, 191) = 8.08$, $p = .01$, $\eta_p^2 = .04$, such that children who made academic errors ($M = 2.98$, $SD = .97$) were rated more likely to repeat their memory errors than those who made social errors ($M = 3.36$, $SD = 1.06$). Contrary to our hypothesis that social PM errors would be seen as more likely to be repeated in the future and that younger children would be more likely to repeat them, participants viewed academic PM errors as more likely to be repeated. There are three explanations for this result. The first is that academic PM errors might have been viewed as more consistent over time because children might not repeat social PM errors after experiencing the negative consequences of such errors. The second possibility is that academic PM errors were seen as more normative for children and thus likely to recur in the future, whereas social PM errors might have been seen as more dependent on situational factors. Finally, if PM tasks in social contexts are more motivating and emotionally salient, children might be less likely to experience PM errors in the social domain and thus would be less likely to occur in the future.

In sum, Study 1 showed that adults perceive PM errors in academic versus social domains differently. In line with our hypothesis, children were judged more harshly for PM errors in social contexts than in academic contexts. Interestingly, age effects emerged in the social domain but not in the academic domain: 10-year-olds were rated more negatively for social PM errors compared to 4-year-olds but there was no difference between ratings of 4- and 10-year-olds in the academic domain. Taken together with the finding that 10-year-olds were rated as more at fault for their PM errors overall, it appears individuals are particularly harsh when older children are forgetful in social contexts. Forgetfulness in academic contexts seems to be viewed more normatively as children are rated as more likely to repeat these errors in the future. Finally, greater amounts of experience with children led to participants rating children more favourably in our trait composite overall suggesting that individuals with more knowledge of child development might be less critical of forgetfulness as they might be aware it is still developing during early and middle childhood (Furnham et al., 2003; Vale-Dias & Nobre-Lima, 2018).

Study 2

Because PM is often described as "social in nature" (Meacham, 1988), we wanted to contrast PM errors with RM errors directly to examine the impact it had on adults' perceptions of children. Given past literature, it might be the case that PM errors in particular will lead a child to be perceived as less reliable, less trustworthy, or even less friendly than children who make RM errors since PM errors are seen as indicative of one's character rather than one's memory ability (Brandimonte & Ferrante, 2008; Munsat, 1966). Building upon Study 1, Study 2 examined the differences between how people perceive PM versus RM errors of 4- and 10-year-olds in academic and social domains. We also asked participants to suggest ways in which children might avoid making PM and RM errors in the future. In the adult literature, Reese-Melancon et al. (2019) allowed adults to generate and use their own strategies during a PM task, and these fell into six categories: (1) monitoring/maintenance and rehearsal, (2) physical reminders, (3) association, (4) elaboration, (5) imagery, and (6) other. In contrast, Frankenmolen et al. (2018) found that different strategies, such as concentration and repetition, were the most-reported strategies used by adult participants when trying to remember facts from an RM task. As there are differences between the types of self-reported strategies in PM and RM tasks, we expect strategies to improve children's memory to fall into many of these categories.

Study 2 aimed to replicate the findings of Study 1 and also test the following novel predictions

(1). Adults will evaluate children's PM errors more negatively than their RM errors.
(2). Adults will rate children as more at fault when they make PM errors than RM errors, and they will rate PM errors as more likely to be repeated than RM errors because they will be seen as more indicative of an unreliable person.
(3). Children will be most negatively evaluated when they make social PM errors compared to all other error types.
(4). Adults will generate different types of memory strategies in response to PM and RM errors and to 4- and 10-year-olds' forgetfulness when asked to provide strategies for how children could improve their memory performance in the future.

Method

Participants

Five hundred participants completed Study 2 (255 male, 243 female, 2 declined to answer; $M_{age} = 24.64$, $SD = 3.69$). An a priori power analysis conducted using G*Power (Faul et al., 2007) suggested that a sample size of 179 participants was necessary to detect a medium effect size (based on the effect size of the interaction in Study 1; Cohen's $F = .25$, power = .80, alpha = .05). To guard against data loss and maximise power, we recruited 500 participants through the online platform Prolific. Like Study 1, participants met the following criteria: between 18 and 30 years old, resident of the United States, spoke English as a first language, had a Prolific approval rating of 98% or higher, and did not previously participate in Study 1. One hundred sixty-five participants were excluded for one or more of the following reasons: not passing all of the attention checks ($n = 153$), completing the task two standard deviations slower than the mean completion time ($n = 13$; $M_{duration} = 11.06$ min, $SD = 10.31$ min), and being over 30 years of age ($n = 3$).

Of the 335 participants included (170 male and 165 female, $M_{age} = 24.52$, $SD = 3.66$) the sample was mainly white (64.5%), well-educated (86.5% had at least some college or a 2-year degree), and almost half of our sample had lower incomes (48.0% annual incomes less than $40,000). This sample had relatively little experience with children, 67.2% of individuals reported having 0–10 h of experience with children per week, 8.1% had 10–20 h, 6.3% had 20–30 h, 4.8% had 30–40 h, 10.4% had 40+ hours, and 3.3% did not provide data.

Procedure

The methods for Study 2 were pre-registered through the Open Science Framework (OSF; https://osf.io/jrzv6)[1]. Similar to Study 1, participants first completed a demographic questionnaire. They then completed a modified Vignette Rating Task. Type of memory error (RM vs. PM) was added as a second between-subjects variable, so participants were randomly assigned to a condition where they saw children either 4 or 10 years old, making RM or PM errors, in both academic and social contexts (see Table 4). Participants were also asked: "What strategies could these children use to improve their performance?" Otherwise, the procedure was identical to Study 1. Data was collected on 11 August 2020.

Analytic strategy

The same analytic strategy described in Study 1 was employed in Study 2. Additionally, strategies to help children remember produced by participants were coded into the following categories by two independent coders: asking for adult help, paying attention, using a reminder, practicing more and learning from past mistakes, and other. Chi-square analyses were used to examine whether the distributions among categories differed between PM and RM errors and for younger and older children.

Results & discussion

Preliminary analyses

Similar to Study 1, a PCA was first conducted to examine if all seven character traits loaded onto one factor. The

Table 4. List of Vignettes for Study 2.

	Prospective Memory	Retrospective Memory
Academic	Alex is 4(10) years old. Alex forgets to do his homework. Jamie is 4(10) years old. Jamie forgets to bring home a permission slip for his upcoming fieldtrip. Riley is 4(10) years old. Riley forgets to hand his worksheet in to the teacher. Charlie is 4(10) years old. Charlie forgets to raise his hand before he answers the teacher's question.	Alex is 4(10) years old. Alex forgets that he has to do his homework. Jamie is 4(10) years old. Jamie forgets that he has to bring home a permission slip for his upcoming fieldtrip. Riley is 4(10) years old. Riley forgets that he has to hand his worksheet in to the teacher. Charlie is 4(10) years old. Charlie forgets that he has to raise his hand before he answers the teacher's question.
Social	Avery is 4(10) years old. Avery forgets to return the toy he had borrowed from his friend. Taylor is 4(10) years old. Taylor forgets to wait for his friend after swim lessons. Sam is 4(10) years old. Sam forgets to keep his friend's surprise party a secret. Jordan is 4(10) years old. Jordan forgets to bring a birthday present to his friend's party.	Avery is 4(10) years old. Avery forgets that he has to return the toy he had borrowed from his friend. Taylor is 4(10) years old. Taylor forgets that he has to wait for his friend after swim lessons. Sam is 4(10) years old. Sam forgets that he has to keep his friend's surprise party a secret. Jordan is 4(10) years old. Jordan forgets that he has to bring a birthday present to his friend's party.

Note: Children were described as either male or female in each vignette based in a counterbalanced order.

covariance matrix revealed that all seven character traits were highly correlated with each other (*rs* > .61). All character traits loaded onto a single factor with an Eigenvalue of 5.48 that explained 78% of the variance in ratings of forgetfulness. Further, ratings of the seven character traits were highly reliable (Cronbach's alpha = .95). Thus, as in Study 1, we combined the trait ratings to form a composite trait score for the academic and social domains separately. In the following results, only significant effects will be reported. Our COVID-19 questions were also analysed as covariates in the ANCOVA, but none were significant so they were excluded from further analyses.

Age, domain, and Memory Type Effects on character traits

A 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) by 2 (Memory type: RM vs. PM) mixed ANCOVA with experience with children as a covariate was performed on the trait composite. In line with our prediction and findings of Study 1, there was a significant effect of domain, $F(1, 319) = 39.65$, $p < .001$, $\eta_p^2 = .11$, such that social domain errors ($M = 3.93$, $SD = .85$) were rated more negatively than academic domain errors ($M = 4.16$, $SD = .84$) across memory types. There was also a significant domain by age interaction, $F(1, 319) = 5.20$, $p = .02$, $\eta_p^2 = .016$, such that the difference between ratings of 4- and 10-years were smaller in the academic domain ($M_{Diff} = .03$, $SE = .09$, $p = .77$, *CI* [-.16, .22]) compared to the social domain ($M_{Diff} = .15$, $SE = .09$, $p = .12$, *CI* [-.04, .33]). Finally, there was a significant 3-way interaction between age, domain, and memory type, $F(1, 319) = 3.95$, $p = .048$, $\eta_p^2 = .012$. In order to examine the nature of the interaction, a 2-way ANCOVA was conducted to examine the effects of age and domain separately for PM and RM errors using child experience as the covariate (see Figure 1). For PM errors, there was no interaction between age and domain, $F(1, 156) = .05$, $p = .83$, $\eta_p^2 < .001$. In contrast, for RM errors there was a significant interaction between age and domain, $F(1, 162) = 9.02$, $p = .003$, $\eta_p^2 = .053$, such that the difference between ratings in academic and social domains was larger for 10-year-olds ($M_{Diff} = .33$, $SE = .05$, $p < .001$, *CI* [.23, .43]) than for 4-year-olds ($M_{Diff} = .12$, $SE = .05$, $p = .02$, *CI* [.02, .22]). Contrary to our hypothesis, 10-year-olds' PM errors were not rated significantly more harshly than RM errors. Children's social memory errors overall were rated more harshly than their academic memory errors. Surprisingly, however, the interaction between age and domain seemed to be driven by results of the RM errors (not PM errors): 10-year-olds' RM social errors were rated more harshly than their RM academic errors, whereas 4-year-olds academic and social errors were rated more similarly. There was a significant effect of child experience, $F(1, 319) = 5.71$, $p = .02$, $\eta_p^2 = .02$, indicating that the more experience with children a participant had, the more positively they rated children's memory errors.

These findings suggest that overall adults did not rate children's PM more negatively than their RM errors. However, adults rated children's memory errors of 10-year-olds in the social domain most negatively. Interestingly, children's RM errors showed a different pattern by domain and age with 4-year-olds being more similarly rated in academic and social domains, whereas 10-year-olds RM errors in the academic domain were rated much more positively than their RM errors in the social domain.

Age, domain, and Memory Type Effects on fault

Next, a 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) by 2 (Memory type: RM vs. PM) mixed ANCOVA with experience with children as a covariate was performed on ratings of how at fault the child was for their memory error. In line with our hypothesis, there was a significant effect of age, $F(1, 319) = 30.44$, $p < .001$, $\eta_p^2 = .087$, such that 10-year-olds ($M = 3.06$, $SD = 1.02$) were rated as more at fault for their memory errors than 4-year-olds ($M = 3.73$, $SD = 1.33$). Replicating findings of Study 1, it seems that adults consistently assign more fault to older children's memory errors, regardless of

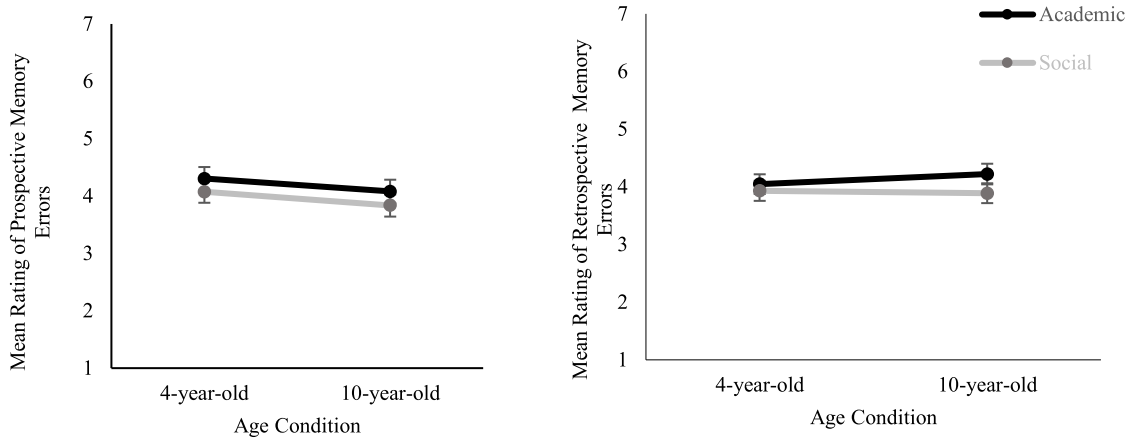

Figure 1. Mean Ratings of Character Traits in the Prospective Memory and Retrospective Memory Error Conditions in Study 2.

whether they are PM or RM errors and regardless of their amount of experience with children.

Age, domain, and Memory Type Effects on repeatability

Finally, a 2 (Age: 4-year-old vs. 10-year-old) by 2 (Domain: academic vs. social) by 2 (Memory type: RM vs. PM) mixed ANCOVA with experience with children as a covariate was conducted on ratings of whether the child would repeat the memory error in the future. As in Study 1, there was a significant effect of domain, $F(1, 319) = 55.45$, $p < .001$, $\eta_p^2 = .148$, such that those who made academic domain errors ($M = 3.06$, $SD = .97$) were rated as significantly more likely to repeat their errors than those who made social domain errors ($M = 3.55$, $SD = 1.00$). Again, it seems that academic memory errors (regardless of the type of memory these errors represent) are seen as more consistent than social memory errors that might represent a single error rather than a broader pattern of behaviour.

Age and Memory Type Effects on strategies

A secondary and exploratory goal of Study 2 was to examine the strategies that adults suggested to improve children's memory performance. Specifically, we explored whether suggested strategies differed between PM and RM errors and child's age (4-year-olds vs. 10-year-olds). Participants' open-ended suggestions for strategies were coded into the following categories: (1) asking for adult help, (2) paying more attention, (3) using reminders, (4) practicing or learning from past mistakes, and (5) other (strategies that did not fit into one of the first four categories, such as meditation, conscientiousness, and using memory games to promote memory). Two independent raters coded the responses and inter-rater reliability was substantial (Cohen's Kappa = .71). Coding disagreements were resolved through discussion. Chi-square analyses were used to examine whether the distributions among categories differed between PM and RM errors and between 4-year-olds and 10-year-olds. The distribution of strategies differed significantly by child age, X^2 (5, N = 335) = 31.70, $p < .001$. Inspection of the analysis revealed that participants suggested: (1) 4-year-olds should get help from adults 2.3 times as frequently as they suggested for 10-year-olds, (2) 10-year-olds should use reminders 1.6 times as frequently as they suggested for 4-year-olds ($p < .05$), and (3) 10-year-olds should pay more attention or focus more on their surroundings 3.1 times as frequently as they suggested for 4-year-olds ($p < .05$; see Table 5). Of interest, participants also did not provide data 3.6 times as frequently for 4-year-olds compared to 10-year-olds ($p < .05$), suggesting that fewer participants could generate strategies for younger children's memory errors possible indicating that they thought that there was no available strategy that would help these young children's remembering. This could also stem from our participants' overall lack of experience with children on a regular basis, as they may not have been aware of children's average cognitive abilities.

Table 5. Percentage of strategies suggested by age condition in study 2.

	Age Condition	
Strategy Type	4-year-olds	10-year-olds
Adult help	23.3%	10.5%
Paying more attention/focusing more	7.4%	19.2%
Using reminders	19.6%	29.7%
Practice/learning from past mistakes	12.9%	12.8%
Other	21.5%	23.8%
N/A	15.3%	4.1%
Total	100.0%	100.0%

General discussion

Across two studies, we found that: (1) participants rated children who made memory errors in the social domain more negatively than children who made memory errors in the academic domain, (2) older children were blamed more for their forgetfulness than younger children, (3) academic memory errors were viewed as more likely to be repeated than social memory errors, and (4) participants rated children more positively when they had more experience with children. Whereas Study 1 showed that social PM errors were rated more negatively than academic PM errors, Study 2 suggested that this domain effect was not specific to PM. In fact, Study 2 suggested that RM errors were rated more harshly in the social domain compared to the academic domain, especially for 10-year-old children compared to 4-year-old children. Adults also suggested different strategies for 4- and 10-year-old children: they were more likely to suggest that 4-year-olds should seek adult help or not provide any strategy, whereas they suggested that 10-year-olds should pay more attention or use external reminders.

Effect of child age

In typically developing children, PM abilities (e.g., Kliegel & Jager, 2007; Yang et al., 2011) and episodic RM abilities (Scarf et al., 2011) increase during early and middle childhood. Adults' perceptions of these abilities also increase with age. For example, Nunez et al. (2011) found that adults' perceptions of children's memory and attention increased with age between 4 and 10 years old in a legal setting. Despite developmental increases in PM and RM and evidence that adults perceived these memory abilities to improve with age, our studies show that adults do not perceive children's memory errors differently in terms of character traits based on the child's age. Further, children's age did not influence adults' judgments of whether the memory error would be repeated in the future. These null findings suggest that, while there is development in these memory abilities over time, a child's age does not impact adults' perceptions of them. Adults may have not

been sensitive to the developmental changes in memory ability that occurs between ages 4 and 10 years old and therefore evaluated them equally. An alternate possibility is that adults understand that younger and older children have different memory abilities, but this did not factor in when rating the character traits of these children. Perhaps manipulating child age within-subjects would have led to a significant effect of children's age on these perceptions of character traits and whether the error would be repeated in the future because participants would have been asked to directly compare 4- and 10-year-old children.

In line with our hypothesis, however, there was a significant effect of child age on how much blame children were assigned for their memory error in both studies, indicating that child age influenced how much participants blamed children for being forgetful. Ten-year-olds were consistently rated as more at fault than 4-year-olds for memory errors across both studies. This finding suggests that older children might be expected to be more responsible for their own behaviour and actions compared to younger children. Perhaps this is because children are given more autonomy with age: older children are often more responsible for their behaviour and actions including taking asthma medication (McQuaid et al., 2003), travelling independently to school (Ayllón et al., 2019), and have greater decision-making autonomy (Wray-Lake et al., 2010).

Effect of domain

Across our two studies, there was a consistent effect of domain on adults' ratings of children's character traits and likelihood of repeating the memory error in the future. For the trait composite, adults rated social memory errors more harshly than academic memory errors. This finding might have been due to children's social memory errors being viewed as indicative of a character flaw (i.e., untrustworthy, incompetent) or as more unreliable as a person rather than unreliable in their memory ability (Brandimonte & Ferrante, 2008). The consequences of social PM errors are likely more costly because social errors are part of a social contract and involve other people: those dependant on the child's performance. Thus, PM errors in the social domain are perceived more negatively compared to academic errors. Much of the PM literature has focused on the social importance of PM tasks to explain performance (Altgassen et al., 2010; D'Angelo et al., 2012). Evidence from several studies shows that participants pay attention to the social importance of the task and perform better when the task involves another person (Brandimonte et al., 2003; Meacham & Kushner, 1980; Nigro et al., 2014). Further, PM intentions are carried out more often when social motive was present (Brandimonte et al., 2010; Penningroth et al., 2011). Walter and Meier (2014) hypothesised that the inclusion of a social motive in PM tasks increases intrinsic motivation and is thus more important than monetary rewards, or extrinsic motivation. The fact that children's character traits were rated more negatively when they made social memory errors compared to academic memory errors highlights the greater consequences of making a social domain error: children's character will be perceived more negatively.

In contrast to our original prediction that social memory errors would be seen as more likely to be repeated in the future compared to academic memory errors, academic memory errors were rated as more likely to be repeated. Why did this pattern emerge? We offer three possible explanations. First, if social memory errors are seen as reflective of the individual's character rather than having a poor memory, these errors might have greater costs for children, like putting friendships at risk or not being invited to future birthday parties. Thus, social memory errors might be less likely to be repeated since children are likely to experience negative consequences and potentially learn to avoid these costly errors in the future. Second, academic errors could be seen as having fewer negative consequences than social errors due to their specific effect on the child (and not on a broader social group) leading to these errors continuing in the future. Third, academic memory errors may be seen as more developmentally normative for children and thus might be rated as more likely to continue to occur in academic contexts because those errors seem more typical and less negative than social memory errors.

There was no effect of domain in how at fault the child was, indicating that adults do not place more blame on children who make memory errors in the academic versus social domain. This finding suggests that social memory errors are not viewed as the child's fault any more than academic memory errors. Adults seem to perceive both academic and social memory errors as equally the child's fault, however, it is interesting to note that levels of blame for memory errors were moderate for children across the two studies.

Effect of memory type

In contrast to our predictions, memory type (PM vs. RM) did not have any significant effect on adults' perceptions of children's forgetting. Participants rated children similarly in vignettes regardless of memory error type described. Specifically, PM errors were not perceived more negatively in terms of the child's character traits, nor were they judged to be repeated more in the future, nor were children more at fault for making these types of memory errors. The only influence memory type had was in conjunction with child age and domain, in which the difference between social and academic errors was greater for 10-year-olds compared to 4-year-olds but only for RM errors. In Study 1, in which vignettes only contained PM errors, 10-year-olds who made social PM errors were perceived worse on our trait composite than 4-year-olds whereas there was no difference between

perceptions of 4- and 10-year-olds in the academic domain. This age by domain interaction was not replicated in the PM condition in Study 2. Instead, the significant interaction was observed in the RM condition. While there were no differences between 4-year-olds and 10-year olds in either domain in either memory type condition, in the RM condition the difference between domains in 10-year-olds was greater than 4-year-olds.

It is important to note that there were only subtle differences between PM and RM errors in Study 2. We manipulated whether children were described as forgetting *to* do something (PM condition) or forgetting *that* they had to do something (RM) between-subjects so that the differences between the memory types might not have been apparent to individual participants. Kliegel and Jager's (2007) findings that parents do not differentiate between their children's PM and RM lends support to the idea that adults might not distinguish between these two types of memory.

Future research could employ a within-subjects design to contrast PM and RM errors more directly. However, a strength of Study 2's design was that the RM and PM vignettes differed only to the extent that the child was described as "forgetting *to do* something" in the PM condition and "forgetting *that they had* to do something" in the RM condition. Despite this subtle distinction, it does seem like older children were rated more negatively for social errors than academic errors compared to younger children in the RM domain. Perhaps adults understand that as children get older the cost of their memory errors in the social domain are much greater than those in academic domains, particularly for memory for past information and details.

Child experience

As we hypothesised, with greater experience with children, adults were less harsh in their character trait judgments for children's forgetting. It is likely that individuals with more experience with children understand that children in general make memory errors and thus are less likely to see these errors as character flaws. Interestingly, individuals' amount of experience with children did not influence judgements of blame or how likely the error would be repeated in the future. Past research has suggested that more experience with children has a positive impact on individuals' perceptions of children (e.g., Morey & Gentzler, 2017) and that it improves their knowledge of children's cognitive abilities (Bornstein et al., 2010; Vale-Dias & Nobre-Lima, 2018). Thus, it seems that more experience with children makes individuals more likely to rate children favourably.

Strategies

Exploratory analyses showed that the kinds of memory strategies adults generated did not differ based on memory type, but did differ based on the child's age. Participants more often suggested that 4-year-olds seek help from adults compared to 10-year-olds, and suggested more often than 10-year-olds use strategies and pay attention or focus on their surroundings compared to 4-year-olds. These patterns align with past findings that children are expected to become more autonomous with age (e.g., Wray-Lake et al., 2010) and thus are expected to employ self-initiated strategies to improve their memory whereas young children are expected to rely on adults for help. Other strategies, such as meditation, improving conscientiousness, and playing memory games, were suggested but were not as common and were grouped together as "other". These complex strategies suggest that participants understood strategy use, but perhaps lacked knowledge of developmentally-appropriate strategies for children. Future studies could explore this issue more thoroughly. There was also a pattern of missing or no-strategy data: fewer adults who read vignettes of 4-year-olds provided a memory strategy compared to those who saw vignettes describing 10-year-olds. We believe that this pattern is due to fewer participants being able to generate meaningful strategies that would help 4-year-olds in comparison to 10-year-olds. Perhaps adults did not believe there were any strategies that could help 4-year-olds improve their memory performance, or they did not feel confident in their knowledge of young children in order to provide a potential strategy.

Limitations and future directions

Although we crafted our vignettes to be nearly identical to minimise possible differences between conditions, we only observed an effect of memory type in a three-way interaction. This finding suggests that there are some differences between PM and RM, but these differences may only be detected in terms of the age and domain patterns within them. It is likely that our manipulation of memory type was too subtle and participants did not detect the prospective versus retrospective nature of the memory errors they judged, considering them all to be general "forgetfulness" or "memory errors" (see Kliegel & Jager, 2007 for an illustration of parent's inability to tease apart PM and RM).

Throughout this paper, we argued that the consequences of social memory errors are more negative than academic memory errors. However, several of our academic vignettes involved other people, which might have blurred the line between purely academic and purely social errors. Additionally, there might have been differences across academic and social vignettes in perceived importance of memory errors (e.g., Ihle et al., 2012; Penningroth et al., 2011), however, Schnitzspahn et al. (2016) noted that other factors besides task importance could play a role in naturalistic PM performance in younger and older adults. We did our best to include different vignettes that varied in level of importance, but it was not possible to ensure vignettes were equal in

importance across these two domains. Future studies could ensure importance is similar across domains by pilot testing vignettes and ensuring that importance or severity of the memory errors are similar across conditions.

The samples in each of our studies on average had little experience with children with the majority of participants reporting 0–10 h of experience with children per week. This lack of experience could explain why we did not find an age effect in either study, as participants with little to no knowledge of children's cognitive development might have not made the distinction between a preschooler and older child. In future research, experience with children could be measuring using a continuous measure in order to obtain a clearer picture of adults' experience.

Finally, our current study focused on adults' perceptions of children without taking into account participants' own meta-cognitive ability. It is possible that adults' meta-memory ability might have influenced their judgements of children's memory and thus, is an important consideration for future research.

Conclusion

The present study demonstrated that adults' perceptions of children are affected by the child's age (4 or 10 years old), the domain of memory error (academic or social), and to some extent the type of memory error (PM or RM), and that these ratings differ depending on the amount of prior experience an individual has with children (similar to Furnham et al., 2003; Vale-Dias & Nobre-Lima, 2018). Children, regardless of age, who make social memory errors are perceived more negatively than when they make academic errors. The claim that individuals might be perceived differently based on the type of memory error they make was first made in the literature over 50 years ago (Munsat, 1966), but the current study was the first to examine adults' perceptions of children forgetting. Although we did not find support for PM errors being judged more harshly than RM errors, we found that social PM errors were perceived more negatively than academic PM errors. The memory errors used in the current study's vignettes are representative of the challenges children face in their daily lives while navigating their academic and social worlds. This study paves the way for future research on how children's memory errors are perceived and by extension, if children might be treated differently based on their memory performance. The impact of children's memory errors on adults' perceptions should be further explored as it has important practical implications for parenting and how children are treated by adults in school and other caregiving contexts.

Note

1. Initially, we planned to use MANCOVAs to analyze data, however, upon further investigation, we concluded that several ANCOVAs would be a more appropriate plan of analysis.

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