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Executive Functioning Predicts Reflective Functioning in Mothers

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Abstract

Parental reflective functioning (PRF) describes a parent's capacity for considering both their own and their child's thoughts, feelings, and behaviors, which can help parents to guide interactions with children. Given the cognitive demands of keeping infants in mind whilst caregiving, we examined the association between aspects of executive function (i.e., working memory and set-shifting) and PRF (employing the Parental Reflective Functioning Questionnaire) in recent mothers. In Study 1 (N=50), we found that better working memory was associated with higher levels of maternal interest and curiosity in their child's feelings. In Study 2 (N=68), we found that visual working memory and set-shifting capacity were also associated with higher levels of maternal interest and curiosity in their child's thoughts and feelings. Our results provide preliminary support for the association between executive processes and maternal reflective functioning. The implications of these findings and important future directions are discussed, including advancing our understanding of executive processes and PRF to support the broader family system.

Keywords

motherhood; reflective functioning; executive functions; working memory

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Disclosure of potential conflicts of interest

The authors declare they have no conflicts of interest.

Research involving Human Participants and/or Animals

The Human Investigations Committee at Yale School of Medicine, in accordance with the Declaration of Helsinki (1975/1983), approved all procedures prior to recruitment. This work was completed in compliance with APA ethical standards.

Informed consent

Informed consent was obtained from all participants.

Author Contributions

HJVR and SPB collaborated in the writing and editing of the final manuscript. HJVR, MJC, JB, DJM, and LCM collaborated with the design, data analysis, and execution of the studies. All authors contributed and approved the final manuscript.

Introduction

Parental reflective functioning (PRF) describes a parent's capacity to consider their own thoughts and feelings as well as their child's thoughts and feelings, and how they are associated with behavior (Slade, 2002, 2005; Slade, Bernbach, Grienberger, Levy, & Locker, 2002). Assessed via interview and self-report methods, the extent to which a mother is interested and curious about her child's feelings is a core component of PRF (Slade, 2007). PRF is associated with observed parenting behavior (Grienberger, Kelly, & Slade, 2005) and tolerance of infant cries (Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013). Associations between reflective functioning and children's attachment security have also been reported (Fonagy, Steele, Steele, Moran, & Higgitt, 1991). Consequently, a number of attachment- and mentalization-based interventions focus on enhancing PRF to improve the quality of the dyadic relationship (Slade, 2005, 2007). Despite the importance of PRF for children's development, few studies have examined cognitive functions that may be associated with this important process.

Measurement of reflective functioning in parent and non-parent samples has been adopted as an approach to overtly measure mentalization – the ability of an individual to consider their own thoughts and feelings as well as another's thoughts and feelings, to predict behavior and navigate the social world (Fonagy, 1991; Fonagy, Gergely, Jurist, & Target, 2006). Interest in PRF was motivated in part by prior research that examined reflective functioning as measured by the Adult Attachment Interview (AAI; Fonagy, Steele, Steele, & Target, 1998), with parents responding to questions capturing their relationship with their own parent, rather than their relationship with their child. Given the unique demands and experiences of early caregiving, including reliance on non-verbal communicative bids from the infant, measurements that specifically target PRF (rather than a global reflective functioning capacity) were warranted. Consequently, a parental reflective functioning coding system was developed, which could be used to measure PRF based on responses to the Parent Development Interview (PDI) and therefore capture parents' relationships with their own children (Slade et al., 2002). In a similar vein, self-reported questionnaire measures of reflective functioning (Fonagy et al., 2016) and PRF (Luyten, Mayes, Nijssens, & Fonagy, 2017) have also been developed, particularly for research contexts that incorporate multiple assessments, where interview-based approaches may be less feasible to employ.

The parental reflective functioning questionnaire (PRFQ; Luyten et al., 2017) is one such self-report measure of PRF which encompasses three domains: (1) parental interest and curiosity in their child's mental states, where adaptive RF is evident by parents being actively engaged in understanding their infant's mental states; (2) parental certainty of their child's mental states, wherein parents evidence that they are aware that they will not always know what their child needs or wants; and (3) parental pre-mentalizing modes wherein parents may evidence malevolent or developmentally-insensitive attributions to their child's mental states. The PRFQ is an offline assessment (i.e., it does not capture mentalization and therefore reflective functioning in the moment), and likely reflects more of a trait-PRF capacity. Nevertheless, the interest and curiosity and pre-mentalizing subscales of the PRFQ have been associated with maternal tolerance of infant distress measured during interactions with a crying infant simulator (Rutherford, Booth, Luyten, Bridgett, & Mayes, 2015;

Rutherford et al., 2013) as well as in experimental tasks examining maternal neural responses to infant cries (Rutherford, Maupin, Landi, Potenza, & Mayes, 2016). The pre-mentalizing subscale has also been reported as important to the relationship between attachment anxiety and satisfaction in parenting (Burkhart, Borelli, Rasmussen, Brody, & Sbarra, 2017). Therefore, there is significant value in employing the PRFQ to capture individual differences across the different dimensions of PRF that may be important to parenting.

While multiple measures exist that provide insight into PRF, as a field we are limited in our understanding of the cognitive architecture that may be associated with mentalization and reflective functioning - an assertion that applies to parent and non-parent samples. Understanding cognitive mechanisms potentially underlying or playing a role in facilitating PRF will provide greater precision in our understanding of contexts where mentalization may be compromised. Emotion regulation has already been recognized as important for facilitating mentalization (Fonagy et al., 2006). However, other potential mechanisms and correlates of mentalization and reflective functioning, such as executive functioning, have not been considered. Executive functioning describes a set of higher level cognitive processes, including attention, working memory, set-shifting, and inhibitory control, which allow the control of behavior and emotion, facilitating goal attainment (Alvarez & Emory, 2006). Executive functioning is a likely candidate correlate of reflective functioning, and PRF in particular, for at least two reasons. First, executive functioning has already been implicated in emotion regulation (Schmeichel & Tang, 2014) which, as noted above, has been identified as being important for mentalization. Second, executive functions have been implicated in a number of parenting behaviors (Bridgett, Burt, Edwards, & Deater-Deckard, 2015). For instance, during a frustration-based task, mothers with poorer verbal working memory evidenced greater negative reactivity toward their child (Deater-Deckard, Sewell, Petrill, & Thompson, 2010). Furthermore, poorer executive functions have been associated with more harsh reactive parenting (Deater-Deckard, Wang, Chen, & Bell, 2012), with recent work suggesting that maternal executive functioning may be one of the mechanisms by which parenting is transmitted across generations (Bridgett, Kanya, Rutherford, & Mayes, 2017).

Of the core executive functions, working memory seems particularly relevant to PRF. In general, working memory refers to the extent to which an individual can hold and manipulate information in mind (Baddeley, 2003). PRF requires mothers to simultaneously process, and hold “online”, both her own and her infant’s mental states and behavior during caregiving, whilst also managing other demands, such as preparing to leave the house to go to the park or the doctor’s office. A second core executive function, set-shifting (or task-switching) may also be important to PRF. Set-shifting refers to the online capacity to switch between behaviors, typically following external feedback, and therefore represents an important capacity for adaptive behavior (Miller & Cohen, 2001). Pragmatically, mothers are often required to switch between tasks whilst caring for their child; for example, the ability of mothers to change behaviors when caring for their crying infant to find alternative soothing behaviors that may provide comfort. Affectively, mothers need to shift between the self and the other (i.e., the child) during these caregiving interactions, to understand both the child’s affective state as well as their own – processes that seem key to effective PRF.

Considering the potential relevance of executive functioning for PRF, as outlined above, in the current study, we examined the association between two specific executive functions, working memory and set-shifting, and PRF by employing the PRFQ (Luyten et al., 2017). The PRFQ evaluates parental interest and curiosity in their infant's emotional states, certainty in the recognition of their infant's mental states, and presence of pre-mentalizing states. In Study 1, we examined the relationship between a mother's PRF and her working memory. In Study 2, we were interested in the relationship between PRF and working memory (i.e., replicating Study 1) and set-shifting (i.e., extending Study 1). Demonstration of associations between these aspects of executive functioning and PRF represents an important first step in understanding linkages between these processes. We hypothesized that better working memory and set-shifting capacity would be associated with better PRF; specifically, we hypothesized that greater working memory capacity and set-shifting would be associated with decreased pre-mentalizing, increased interest and curiosity, and increased certainty in the recognition of mental states as measured by the PRFQ.

Study 1

Participants

Fifty mothers (M age = 28 years, SD = 6 years) were recruited from the local community as part of a larger parenting study, with data collection taking place at Yale Child Study Center (parenting variables presented in Table 1, including level of maternal education, infant age, and parity – whether mothers were first-time parents or not). Self-reported race was African American (n=24), Caucasian (n=15), Hispanic or Latino (n=5), Asian (n=1), African American, Caucasian (n=1), and other (n=4). Marital status was Married (n=13), Single (n=36), and Separated (n=1). The University Institutional Review Board (IRB) approved all procedures, and women provided informed consent. Mothers were compensated \$40 for their participation.

Procedure

Mothers first completed the PRFQ and then trained research staff administered the working memory assessments. Participants completed the Corsi Blocks task first, followed by the digit span.

Measures

Parental Reflective Functioning Questionnaire (PRFQ)—The PRFQ (Luyten et al., 2017) consists of 18 statements that participants are asked to rate about their child that are relevant to the three PRFQ dimensions: (1) interest and curiosity surrounding mental states (e.g., “I like to think about the reasons behind the way my child behaves and feels”); (2) pre-mentalizing or difficulties in the acknowledgement of mental states and their influence on behavior – including malevolent attributions towards the infant's expressed behavior (e.g., “My child sometimes gets sick to keep me from doing what I want to do”); and (3) certainty in the recognition of mental states (e.g., “I always know why my child acts the way he or she does”). Each statement is rated using a 7-point Likert-type scale from “1 - strongly disagree” to “7 - strongly agree”. Mothers were asked to complete the measure while keeping their youngest child in mind. Optimal reflective functioning is indicated by higher scores on the

interest and curiosity subscale and lower scores on the pre-mentalizing subscale. The certainty subscale is scored linearly with higher scores indicating parental certainty in understanding their infant's thoughts, feelings, and emotions. The PRFQ subscales have good internal consistency, are associated with parental attachment and distress, parental emotional availability, and show small to moderate associations with some demographic variables reported in prior research (Luyten et al., 2017; Rutherford et al., 2013). Internal consistency (Cronbach's alpha) was 0.8, 0.6, and 0.8 for the pre-mentalizing, certainty, and interest and curiosity subscales, respectively.

Working Memory—We employed two well-established working memory assessments, which have been used in past maternal research (Rutherford, Booth, Crowley, & Mayes, 2015). The Corsi Block Tapping Test was used to assess visuospatial working memory (Milner, 1971). Nine black blocks are mounted on a white board and the examiner touches a pre-determined sequence of blocks, and asks the participant to duplicate this sequence. The length of the sequences gradually increases across the test and is discontinued when the participant cannot successfully complete three out of five consecutive sequences of the same span. Each participant receives a raw score of the number of correct responses made before the task was terminated.

The Wechsler Adult Intelligence Scale (WAIS-IV) Backward Digit Span (Wechsler, 1981) was employed to measure verbal working memory. During this task, the examiner states a sequence of numbers, requiring the participant to repeat the number sequence in reverse order. The length of the sequence increases across the test, with two trials per increase in span length. The test is discontinued when the participant cannot successfully complete two consecutive sequences of the same span.

Results

Given that performance on the corsi blocks ($M=23.64$; $SD=3.39$) and digit span ($M=7.48$; $SD=1.76$) measures were correlated, $r(50) = .28$, $p = .048$, following log transformation, performance was standardized to z-scores for each assessment and a mean working memory variable was obtained. Employing a mean working memory score was selected to enhance the reliability of the working memory assessment and therefore increase statistical power. Prior to regression analyses, simple correlations were conducted to examine the associations between demographic variables and the working memory and PRFQ measures. Table 1 demonstrates that working memory was only associated with the PRFQ interest and curiosity subscale.

Next, a multivariate linear regression (backwards elimination, with a removal criteria of $p > .10$) was conducted to assess whether working memory remained associated with the PRFQ interest and curiosity subscale when controlling for maternal education, maternal age, infant age, parity, and marital status (Table 2). The most parsimonious model indicated that working memory ($\beta = .41$, $p = .03$) was associated with the PRFQ interest and curiosity subscale even when adjusting for parity ($\beta = .57$, $p = .050$) and marital status ($\beta = .47$, $p = .02$).

Study 2

Given that working memory was associated with PRF in Study 1, we sought to replicate this finding using a different measure of working memory to examine the reliability of the association between working memory and parental interest and curiosity in their child's mental states. Furthermore, we wanted to evaluate whether better set-shifting would also be associated with parental interest and curiosity given the potential implications this aspect of executive functioning has for caregiving and PRF. Specifically, we anticipated that greater set-shifting may be associated with a better capacity to distinguish between self and other, and therefore higher levels of parental interest and curiosity.

Participants

Sixty-eight mothers (M age = 28 years, SD = 7 years) were recruited through flyers posted in the local community as part of a larger parenting study. Data collection occurred at Yale Child Study Center (parenting variables presented in Table 3, including maternal age, maternal education, parity, infant age, and marital status). Self-reported ethnicity in the maternal sample was African American (n = 34), Caucasian (n = 17), Hispanic (n = 7), Asian (n = 3), other (n = 1) and six did not report. Self-reported marital status was Married (n=22), Single (n=17), in a Relationship (n=15), Living Together (n=9), and five did not report. The University IRB approved all procedures prior to recruitment, and all women provided informed consent. Mothers were compensated with \$60 for their participation.

Procedure

Mothers first completed the PRFQ and then completed the working memory task followed by the set-shifting task.

Measures

Parental Reflective Functioning Questionnaire (PRFQ; Luyten et al., 2017)—

The PRFQ was completed as described in Study 1. Internal consistency (Cronbach's alpha) was 0.3, 0.7, and 0.6 for the pre-mentalizing, certainty, and interest and curiosity subscales, respectively.

Working Memory and Set-Shifting—Executive function tasks that were developed by Cogstate Ltd (www.cogstate.com), a cognitive science company specializing in the development of standardized cognitive assessments to be employed across cultures, samples, and developmental stages, were used to assess working memory and set-shifting. These cognitive assessments have been reported to have good test re-test reliability (Falleti, Maruff, Collie, & Darby, 2006) and construct and criterion validity (Maruff et al., 2009).

Participants completed a two-back task presented on a laptop computer to assess visual working memory through the continuous assessment of the participant's ability to actively maintain information in mind. During this task, for each trial, a single playing card was presented on a computer screen. The participant responded by indicating whether the current card was the same as that presented two cards previously or different by pressing one of two buttons indicating either "yes" or "no". Participants were instructed to respond as quickly

and accurately as possible; performance was assessed by response times (RT) for correct trials consistent with the recommendations by Cogstate Ltd. The mean RT for each participant was the dependent variable included in data analysis.

To assess set-shifting, a second computerized task was administered during which a single playing card was presented on each trial. Participants learned through the set of cards what the expected correct dimension was, number or color, based on feedback to their answers. The correct dimension changed throughout the task requiring participants to learn to “shift set” and change their responses as the correct dimension changed from number to color or color to number. The number of errors that were made across the task with the shift in dimensional category assessed performance consistent with the recommendations by Cogstate Ltd. The mean error rate for each participant was the dependent variable included in data analysis.

Results

Table 3 presents the descriptive statistics and correlations between demographic, executive functioning, and PRF measures. Working memory and set-shifting were associated only with the PRFQ interest and curiosity subscale. Consistent with Study 1, two multivariate linear regressions (backwards elimination, with a removal criteria of $p > .10$) were conducted to assess whether working memory (Table 4) and set-shifting (Table 5) remained associated with the PRFQ interest and curiosity subscale when controlling for maternal education, maternal age, infant age, parity, and marital status. With respect to working memory, the most parsimonious model suggested that performance on the two-back task ($\beta = 1.32$, $p = .01$) was associated with the PRFQ interest and curiosity subscale, even when adjusting for Parity ($\beta = -.45$, $p = .050$). With respect to set-shifting, the most parsimonious model suggested that performance on the set-shifting task ($\beta = -0.02$, $p < .001$) was associated with the PRFQ interest and curiosity subscale, even when adjusting for Infant Age ($\beta = .13$, $p = .095$).

Taken together, Study 2 findings replicate and extend Study 1 by showing that working memory, as well as set-shifting, are associated with the PRFQ interest and curiosity subscale.

Discussion

Parental reflective functioning (PRF) is thought to be important for the quality of the parent-child relationship (Slade, 2005, 2007). Consistent with this notion, the number of studies that have documented relations between PRF, including subscales of the PRFQ employed in the current investigation, and parenting-relevant outcomes is growing (Burkhart et al., 2017; Rutherford, Booth, Luyten, et al., 2015; Rutherford et al., 2013; Rutherford et al., 2016). In light of the growing recognition of the importance for PRF for facilitating adaptive parent-child relationships, alongside interest in understanding the cognitive processes involved with PRF, such as emotion regulation (Fonagy et al., 2006), we examined the associations between aspects of maternal executive functioning and PRF in two studies. As hypothesized, in Study 1 and 2, higher levels of working memory were associated with more parental

interest and curiosity in their child's mental states. Similarly, set-shifting was associated with increased parental interest and curiosity in Study 2. We did not find associations between the PRFQ subscales that capture maternal pre-mentalizing and maternal certainty in knowing their infant's mental states. To our knowledge, this study is the first to demonstrate a relation between executive functioning and specific aspects of PRF.

Converging empirical research has shown a relation between parenting and executive functions (Bridgett et al., 2015; Bridgett et al., 2017; Deater-Deckard et al., 2010; Deater-Deckard et al., 2012). Therefore, our findings of associations between PRF and executive functions is consistent with this independent but related literature. However, this association was only obtained for the PRFQ subscale that measured maternal interest and curiosity in the infant's emotions and feelings. Maternal interest and curiosity is considered central to PRF, with a mother's desire to be interested in and curious about their child's emotional states representing a prerequisite for PRF (Slade, 2005, 2007). Although we cannot determine the directionality or causal pathways of the association between PRF and executive functions, one interpretation may be that greater executive functioning allows for more cognitive resources to be allocated by mothers to interest and curiosity towards their child, whilst balancing the other demands of motherhood. For instance, during periods of infant distress, greater working memory capacity may facilitate a mother's ability to hold their infant in mind, while managing her own emotions and behavioral responding. Further, better set-shifting may support the ability of mothers to flexibly change her behaviors during dyadic interactions, both with respect to flexibility in caregiving behaviors and distinguishing between self and other (i.e., the infant). Although we did not assess PRF or executive functions under emotionally-charged contexts, it is worth noting that the PRFQ interest and curiosity subscale has also been associated with maternal behavioral and neural responding to infant cries (Rutherford et al., 2013; Rutherford et al., 2016). Therefore, this dimension of PRF may be particularly valuable for understanding the more "online" components of parent-child interactions.

Although some expected associations were observed, neither the PRFQ pre-mentalizing subscale nor the PRFQ certainty subscale were related to the executive functioning indices we examined. Pre-mentalizing captures non-mentalizing modes, wherein parents evidence difficulties in recognizing their infant has an inner world of thoughts, feelings, and emotions (e.g., *Often, my child's behavior is too confusing to bother figuring out*) as well as situations in which parents' evidence malevolent attributions to communicative bids by their child (e.g., *My child cries around strangers to embarrass me*). Therefore, challenges in pre-mentalizing encapsulates elements of emotion recognition and awareness of child development, both factors that are unlikely to rely on executive functioning, and a likely explanation for the lack of association observed in the current investigation. Nevertheless, it is important to note the poor internal consistency of the pre-mentalizing subscale in Study 2, which warrants caution when ruling out any associations between executive functions and pre-mentalizing altogether. Further study of this measure in larger, more heterogeneous samples, incorporating repeated administration over time will be necessary to understand variations in maternal pre-mentalizing. Indeed, this low level of internal consistency has not been reported in other studies employing the PRFQ (e.g., Burkhart et al., 2017; Luyten et al., 2017).

With respect to the PRFQ certainty subscale, the items were designed to measure parental certainty of their child's mental states (e.g., *I can always predict what my child will do*). Arguably, parents endorsing high (i.e., always certain) or low (i.e., rarely certain) in response to the items capturing certainty are non-optimal responses: Luyten et al. (2017) speculate that scoring very low or very high on this subscale may reflect variation from hypomentalizing to hypermentalizing in parents. In both studies reported here, mean scores evidenced that mothers were responding closer to the median of the certainty subscale, which would be consistent with more adaptive responding. Given the potential for non-linearity in responses on items consisting of the certainty subscale, future studies, employing larger samples that are better suited for considering non-linear associations, should directly examine whether a linear or non-linear association between parental certainty about their child's mental states and parent executive functioning exists. Alternatively, future investigators may want to consider developing alternative scoring procedures for the certainty scale. Consideration of either of these possibilities in future work may yield a more nuanced understanding of associations between parent executive functioning and this particular facet of PRF.

Finally, it is worth noting that our analyses revealed that certain demographic characteristics were associated with the PRFQ subscales. In Study 1, we found correlations between the PRFQ interest and curiosity subscale and marital status and parity. Single mothers tended to have lower levels of interest and curiosity in their child's mental states as compared to mothers who were married; however, the association between marital status and interest and curiosity was weak and not-statistically significant in Study 2. Therefore, caution is needed in interpreting this finding, pending more careful consideration of demographic factors that may be associated with PRF in future studies. In regard to parity, first-time mothers had greater levels of interest and curiosity in their child's mental states as compared to experienced mothers (i.e., mothers of more than one child) – a finding that was replicated in Study 2. Though this finding may simply reflect maternal curiosity about parenthood and child development, it may also be that greater interest and curiosity in first-time mothers reflects the changing psychology and neurobiology during the transition to motherhood, strengthening the representation of the child in mind. Alternatively, the demands of caring for more than one child may decrease levels of interest and curiosity, which would be consistent with stress effects being thought to compromise mentalization and therefore reflective functioning (Fonagy et al., 2006). Future research capturing variation in the demands of caregiving may be valuable in beginning to unpack the relationship between parity and PRF. Indeed, a recent review has highlighted the importance of understanding how prior reproductive experience shapes parenting given accumulating behavioral and neurobiological differences that have been reported in primiparous and multiparous women (Maupin, Roginiel, Rutherford, & Mayes, 2016), supporting the notion that parity may affect PRF via some of the mechanisms noted above.

Limitations and Future Directions

Our study should be considered in light of limitations, many of which reflect notable directions for future research. We only examined the executive functions we considered most relevant and it will be important to examine whether our observed relationship between

working memory, set-shifting, and parental interest and curiosity extends to other executive functions, namely inhibitory control. Next, while we assessed, and controlled for key demographic factors that may influence executive functioning and reflective functioning capacity, it will be important to expand these findings to consider how other factors may impact the relationship between these two attributes in larger maternal samples, as well as in samples of high- and low-risk caregivers.

It is valuable to note that as well as being multidimensional, parental mentalization and PRF are dynamic, and likely change as a function of children's development, particularly with the mother-child communicative relationship changing over time (Rutherford, Booth, Luyten, et al., 2015). In keeping with this hypothesis, only in Study 1 did we find a moderate association between the PRFQ interest and curiosity subscale and the PRFQ pre-mentalizing subscale. The maternal sample recruited in Study 1 tended to have older infants ($M=8$ months) than the maternal sample in Study 2 ($M=5$ months). Given increased experience with the infant during a more extended postpartum period, the association between interest and curiosity subscale and the pre-mentalizing subscale may reflect developmental differences in PRF, requiring further investigation.

Several other limitations are worth noting. Namely, our approach was cross-sectional and relied upon self-reported levels of PRF. In the replication and extension of this work, future studies should consider employing cross-panel longitudinal designs that are well suited for teasing apart direction of associations. Future research also could employ an experimental design by manipulating a mother's executive functioning, possibly by altering cognitive demands, to examine how online PRF is affected. Furthermore, it also will be important to examine the association between working memory and reflective functioning measured in dyadic contexts, and employ additional measures of PRF. Consistent with this notion, we only measured PRF, and did not include a general RF measure (e.g., Fonagy et al., 2016); therefore, while we anticipate that PRF would overlap with a general RF capacity, this needs to be empirically tested.

Notwithstanding these limitations, the current study provides important preliminary evidence for an association between executive functions and PRF at the level of mother's interest and curiosity in their child's thoughts, feelings, and emotions. This is one of the first studies to attempt to understand the cognitive correlates of PRF in terms of executive processes, with the long-term goal being to understand the implications of these associations for real-time caregiving. Future studies, addressing some of the limitations noted above, will likely be fruitful in shedding further light on the potential executive processes that may underlie effective PRF, and provide new avenues for interventions that may enhance PRF to the benefit of young children and their families.

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Table 1

Descriptive data and correlations between demographic, PRFQ, and working memory (WM) measures for Study 1.

	M (SD)	1	2	3	4	5	6	7	8
1. Maternal Age (years)	28 (6)								
2. Education (years) [†]	13 (2)	.15							
3. Parity (P/M) [†]	21/27	.28	-.18						
4. Infant Age (months) [†]	8 (5)	-.02	.08	-.07					
5. Marital Status		.22	.47**	-.07	-.24				
6. Pre-Mentalizing	2.00 (0.97)	.15	-.16	.33*	-.05	-.35*			
7. Certainty	3.95 (1.05)	-.15	-.33*	.15	.03	-.02	-.13		
8. Interest & Curiosity	5.41 (1.05)	-.05	.16	-.33*	-.08	.45**	-.62**	.14	
9. Composite WM		-.20	.33*	-.31*	.20	.16	-.21	-.02	.42**

[†] data missing (n=2), these participants were not included in regression models;

* p<.05;

** p<.01

Table 2

Backward elimination regression model predicting PRFQ interest and curiosity from working memory and associated demographic factors in Study 1.

	Predictors	Beta	Significance
Model 1	F(6,41)=3.86, p =.004		
R ² =.36	Maternal Age	0.009	0.736
	Maternal Education	−0.046	0.485
	Parity	−0.630	0.042
	Infant Age (months)	−0.041	0.15
	Marital Status	0.472	0.038
	Composite WM	0.520	0.011
Model 2	F(5,42)=4.71, p =.002		
R ² =.36	Maternal Education	−0.040	0.519
	Parity	−0.596	0.039
	Infant Age (months)	−0.040	0.149
	Marital Status	0.485	0.029
	Composite WM	0.508	0.011
Model 3	F(4,43)=5.86, p =.001		
R ² =.35	Parity	−0.576	0.043
	Infant Age (months)	−0.043	0.120
	Marital Status	0.422	0.032
	Composite WM	0.476	0.013
Model 4	F(3,44)=6.74, p =.001		
R ² =.32	Parity	−0.566	0.050
	Marital Status	0.471	0.018
	Composite WM	0.410	0.029

Table 3

Descriptive data and correlations between demographic, PRFQ, and executive functioning measures from Study 2.

	M (SD)	1	2	3	4	5	6	7	8	9
1. Maternal Age (years)	28 (7)									
2. Education (years) ⁺	14 (2)	.20								
3. Parity (P/M)	30/38	.21	-.17							
4. Infant Age (months) ⁺	5 (2)	-.09	-.06	-.24 [*]						
5. Marital Status ⁺		.17	.34 ^{**}	-.10	.11					
6. Pre-Mentalizing	1.46 (0.54)	.04	.07	.01	-.10	.03				
7. Certainty	3.91 (1.17)	-.35 ^{**}	-.22	.03	-.04	-.14	-.08			
8. Interest & Curiosity	5.81 (0.93)	-.03	.25 [*]	-.26 [*]	.11	-.18	-.19	.12		
9. Two-Back Task	1.09 (0.21)	.08	.39 ^{**}	.03	.08	.34 ^{**}	-.02	-.08	.28 [*]	
10. Set-Shifting Task	44.88 (21.44)	.01	-.36 ^{**}	.09	.14	-.14	.11	-.08	-.39 ^{**}	-.49 ^{**}

⁺ data missing (n=3-5), these participants were not included in regression models;^{*} p<.05;^{**} p<.01

Table 4

Backward elimination regression model predicting PRFQ interest and curiosity from working memory (two-back task) and associated demographic factors in Study 2.

	Predictors	Beta	Significance
Model 1	F(6,56)=1.78, p =.120		
R ² =.16	Maternal Age	−0.010	0.617
	Maternal Education	0.051	0.361
	Parity	−0.298	0.275
	Infant Age (months)	0.047	0.573
	Marital Status	0.028	0.794
	Two-Back Task	1.026	0.097
Model 2	F(5,57)=2.16, p =.072		
R ² =.16	Maternal Age	−0.009	0.641
	Education	0.055	0.315
	Parity	−0.304	0.261
	Infant Age (months)	0.049	0.552
	Two-Back Task	1.069	0.071
Model 3	F(4,58)=2.67, p =.041		
R ² =.16	Maternal Education	0.049	0.352
	Parity	−0.347	0.170
	Infant Age (months)	0.046	0.569
	Two-Back Task	1.077	0.067
Model 4	F(3,59)=3.50, p =.021		
R ² =.15	Education	0.043	0.401
	Parity	−0.388	0.108
	Two-Back Task	1.116	0.055
Model 5	F(2,60)=4.91, p =.011		
R ² =.14	Parity	−0.451	0.05
	Two-Back Task	1.317	0.013

Table 5

Backward elimination regression model predicting PRFQ interest and curiosity from set-shifting and associated demographic factors in Study 2.

	Predictors	Beta	Significance
Model 1	F(6,56)=2.83, p =.018		
R ² =.23	Maternal Age	−0.011	0.562
	Maternal Education	0.027	0.618
	Parity	−0.156	0.541
	Infant Age (months)	0.105	0.195
	Marital Status	0.071	0.475
	Set-Shifting Task	−0.017	0.005
Model 2	F(5,57)=3.39, p =.010		
R ² =.23	Maternal Age	−0.009	0.611
	Parity	−0.191	0.432
	Infant Age (months)	0.100	0.21
	Marital Status	0.087	0.355
	Set-Shifting Task	−0.018	0.002
Model 3	F(4,58)=4.22, p =.005		
R ² =.23	Parity	−0.23	0.317
	Infant Age (months)	0.099	0.210
	Marital Status	0.076	0.401
	Set-Shifting Task	−0.018	0.002
Model 4	F(3,59)=5.42, p =.002		
R ² =.22	Parity	−0.239	0.296
	Infant Age	0.106	0.181
	Set-Shifting Task	−0.019	0.001
Model 5	F(2,60)=7.55, p =.001		
R ² =.20	Infant Age	0.128	0.095
	Set-Shifting Task	−0.020	<0.001