



Published in final edited form as:

Psychol Sci. 2010 January 1; 21(1): 75–79. doi:10.1177/0956797609354073.

Maternal Working Memory and Reactive Negativity in Parenting

Kirby Deater-Deckard¹, Michael D. Sewell¹, Stephen A. Petrill², and Lee A. Thompson³

¹Department of Psychology, Virginia Polytechnic Institute and State University

²Department of Human Development and Family Science, Ohio State University

³Department of Psychology, Case Western Reserve University

Abstract

We examined the role of working memory in observed reactive parenting in a sample of 216 mothers and their same-sex twin children. The mothers and their children were observed completing two frustrating cooperation tasks during a visit to the home. The mothers worked one-on-one with each child separately. Mothers completed the Vocabulary (verbal), Block Design (spatial), and Digit Span (working memory) subtests of the Wechsler Adult Intelligence Scale—Third Edition. We used a within-family quasi-experimental design to estimate the magnitude of the association between sibling differences in observed challenging behaviors (i.e., opposition and distractibility) and the difference in the mother's negativity toward each child. As hypothesized, reactive negativity was evident only among mothers with poorer working memory. Verbal and spatial ability did not show this moderating effect. The effect was replicated in a post hoc secondary data analysis of a sample of adoptive mothers and sibling children. Results implicate working memory in the etiology of harsh reactive parenting.

Keywords

parenting; working memory; self-regulation; behavior problems

Research on cognitive control of emotion is a major emphasis of contemporary psychological science. Our goal in the current study was to extend this research to the study of reactive negativity in parenting. Using a quasi-experimental family design and observations of child and mother behavior, we tested the hypothesis that maternal working memory would differentiate reactive from nonreactive negativity in the face of challenging behavior in children.

Distressed Parenting

Harsh reactive negativity is one of the most substantial and consistent parenting factors in the etiology of child abuse and psychopathology. Poverty, unstable environments, lack of education and child-rearing knowledge, and lack of emotional and instrumental social support, as well as parental personality and psychopathology, powerfully influence parenting behavior (Belsky & Barends, 2002; Deater-Deckard, 2004; Goodnow, 2002). Parental reactive negativity is implicated in the maladjustment of children through its role in

© The Author(s) 2010

Corresponding Author: Kirby Deater-Deckard, Department of Psychology, Virginia Polytechnic Institute and State University, 109 Williams Hall (0436), Blacksburg, VA 24061, kirbydd@vt.edu.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interests with respect to their authorship and/or the publication of this article.

dysregulating children's affect and behavior (Chang, Schwartz, Dodge, & McBride-Chang, 2003) and reinforcing oppositional behavior (Patterson, 1997).

Angry, oppositional behavior in children is aversive and challenging to parents. To avoid responding reactively to such behavior, a parent must appraise the situation and respond in a way that promotes regulation of her or his own negative emotions and thoughts, as well as those of the child (Lorber, O'Leary, & Kendziora, 2003). If emotionally reactive parental behavior becomes chronic, it can escalate toward abuse and also powerfully reinforce aggressive and oppositional behavior in children (Deater-Deckard, 2004; Dodge, Bates, & Pettit, 1990; Patterson, 1997).

Little is known about the role of parents' specific cognitive skills involved in self-regulation that might explain the link between challenging behavior in children and parental reactive negativity. The literature indicates a modest but consistent association between harsher parenting and lower maternal IQ (typically measured as verbal ability) or less education, attributable in part to the effects of poverty, parenting stress, and lack of knowledge about child development (Huang, Caughy, Genevro, & Miller, 2005; McLoyd, 1998). However, to our knowledge, this literature has not examined cognitive control and harsh reactive parenting.

To address this gap, we examined reactive negativity and child challenging behaviors (i.e., negative affect, opposition, unresponsiveness, and distractibility) in relation to maternal working memory. We focused on working memory because of its central role in the regulation of thoughts and emotions via reappraisal and because it is a simple and reliable indicator of a broader set of interrelated executive functions that serve self-regulation (for an overview, see Ochsner & Gross, 2005, 2008). Behavioral and neuroimaging studies of adults have shown overlap in working memory performance and capacity for cognitive reappraisal, with activation of prefrontal cortical brain regions being critical to these processes. Reappraisal serves self-regulation of emotion by allowing an individual to reinterpret an event or experience, such as a child's angry oppositional behavior, in order to better understand the cause of the event and to modulate one's own emotional response. Working memory is fundamental to cognitive control of emotion, because it is the main cognitive tool that allows an individual to reflect on information and choose an action (i.e., to reason quickly), as opposed to simply behave reactively (Baddeley, 1998).

Accordingly, parents with poorer working memory should have more difficulty with cognitive control of their emotions, thoughts, and behaviors and be more likely to show reactive negativity in response to children's challenging behaviors. If this is true, working memory should statistically moderate the correlation between children's challenging behavior and parental negativity. Thus, our hypothesis was that among parents with poorer working memory skills, there would be a substantial association between challenging behavior in children and parental negativity, because those parents have difficulty cognitively regulating emotion and behavior. In contrast, for parents with better working memory skills, this association would be negligible because the parents are more effectively regulating their emotions and behaviors.

We tested the hypothesis using an observational quasi-experimental design involving mothers and two of their children, modeled in part on the experimental round robin design used by Anderson, Lytton, and Romney (1986). Fathers were not included, although we have every reason to believe that the hypothesis would apply to them too. We observed mothers interacting separately with two of their children as they completed some frustrating cooperation tasks in the home. Sibling relative-difference scores were computed for the children's observed challenging behaviors (i.e., Child 1 behavior minus Child 2 behavior)

and for the mothers' behavior directed at each child (i.e., negativity toward Child 1 minus negativity toward Child 2).

We operationalized *reactivity* based on the degree to which mothers' differential negativity (i.e., negativity toward one child compared with negativity toward the sibling) could be predicted from the magnitude of the sibling difference in challenging behavior. If the sibling difference in challenging behavior did not statistically predict mothers' differential negativity toward their two children, it would suggest that the mothers' negativity was not a reaction to those challenging behaviors. In contrast, if the sibling difference in challenging behavior did predict mothers' differential negativity toward their two children, it would suggest that their behavior was, at least in part, a reaction to those challenging behaviors.

Observation of mothers' differential behavior toward two children was critical to the design. Examining only one mother-child dyad per family would yield data that were more ambiguous with respect to the operationalization of reactive parent behavior. With only one parent-child dyad, it would be unclear as to whether maternal behavior was a response to (rather than the cause of) challenging behavior in children or whether there were other variables (e.g., maternal education or depression) that might account for the observed variation in parental negativity between mothers.

In sum, our hypothesis was that maternal working memory would moderate the association between sibling difference in challenging behavior and differential maternal negativity. We anticipated that this association would be substantial for mothers with poor working memory skills (reflecting reactive negativity), but negligible for mothers with strong working memory skills. We also examined verbal and spatial ability as statistical moderators, to test whether the hypothesized effect was specific to working memory.

Method

Participants

Participants included 216 mother-twin (same-sex) triads from the Western Reserve Reading Project (Petrill, Deater-Deckard, Thompson, DeThorne, & Schatschneider, 2006). Mothers were 37.74 years old on average ($SD = 5.27$, range: 23 to 53 years); 92% were White, 5% were African American, and 3% were in other race groups; 94% were married/cohabiting, and 6% were single. Children were 6.12 years old on average ($SD = 0.68$), 56% were girls and 44% were boys, and 58% were fraternal twins and 42% were identical twins. Parent education varied widely (for mothers and fathers)—10% to 13% had high school or less, 22% to 23% had some college or an associate's degree, 33% to 36% had a bachelor's degree, 26% to 28% had some postgraduate education or a degree, and 4% did not specify.

Procedure

During a visit to the home, we videotaped each mother interacting separately with each of her twins for 10 min, as they completed two frustrating cooperation tasks: drawing pictures using an Etch A Sketch drawing toy and moving a marble through a tilting maze box. For each game, the mother and child were assigned one of two dials that operated the toy and were instructed not to touch each other's dials.

The mother also completed several cognitive performance tasks. After the home visit, two different research assistants coded each mother-child dyad using the Parent-Child Interaction System (PARCHISY; Deater-Deckard, 2000), so that each dyad was coded by a different observer. The PARCHISY includes global 7-point Likert-type rating scales that range from 1, *none*, to 7, *very frequent/constant*. Coders achieved reliability (Cronbach's $\alpha > .75$) during training and maintained reliability throughout data collection.

Measures

Maternal working memory and other skills—Mothers completed three subtests of the Wechsler Adult Intelligence Scale—Third Edition (WAIS—III; Wechsler, 1997). Working memory was measured using the raw score from the Digit Span task, which includes scores for Forward and Backward Digit Span ($r = .60$). Findings were not different for Forward versus Backward Digit Span, so the standard total score was used. Mothers also completed the Vocabulary (verbal) and Block Design (spatial) subtests.

Maternal negativity—A negative affect global rating score (i.e., verbal and nonverbal expressions of anger, frustration, or annoyance) and a negative control global rating score (i.e., verbal and nonverbal manipulation of child or games, such as taking over the task or criticizing the child) were coded using the PARCHISY. These two scores were correlated .60 and so were averaged to compute a negativity composite score. For data analyses, differential maternal negativity was computed using a relative-difference score based on the mother's negativity with one child (Child 1) subtracted from her negativity with the other child (Child 2).

Challenging behavior in children—We used four global ratings: child negative affect (i.e., verbal and nonverbal expressions of frustration or anger), noncompliance with requests or demands from the mother, responsiveness to mother (reverse-scored), and persistence or on-task behavior (reverse-scored). In a principal components analysis of these four indicators, the first component explained 50% of the variance (loadings from .48 to .82), so they were averaged into a composite, and a sibling relative-difference score (computed in the same way as for the differential maternal negativity score) was computed for analyses.

Results

Descriptive statistics and correlations are shown in Table 1. Mothers' Digit Span, Vocabulary, and Block Design raw scale scores were widely and normally distributed, as were maternal differential negativity (from -2.25 to 3.00) and sibling difference in challenging behavior (from -2.62 to 1.52). Average relative-difference scores were near zero, so there were no systematic differences for Child 1 versus Child 2. Mothers' cognitive performance scores were moderately intercorrelated with each other, as was differential negativity and sibling difference in behavior—the child who showed more challenging behavior relative to her or his sibling also was the recipient of more maternal negativity relative to the sibling. In contrast, maternal cognitive performance was uncorrelated with differential maternal negativity and sibling difference in challenging behavior.

To test our hypothesis, we used hierarchical linear regression (Step 1: main effects; Step 2: two-way interactions between sibling difference in behavior by working memory/verbal ability/spatial ability) to predict differential maternal negativity. Maternal age and education had no effects, and so were excluded. Test statistics and standardized regression coefficients are shown in Table 2. The hypothesized interaction between sibling difference in behavior and maternal working memory was statistically significant. To interpret this effect, we estimated partial correlations (controlling for verbal and spatial ability) between differential maternal negativity and sibling difference in behavior, separately for mothers below versus above the sample mean for memory. For mothers with lower memory scores ($n = 113$), there was a moderate positive correlation ($r = .55, p < .001$), but for those with higher memory scores ($n = 103$), there was a modest association ($r = .19, p < .06$). We also estimated simple slopes for those with working memory scores greater than 1 standard deviation above or below the sample mean (Holmbeck, 2002). For mothers with poor working memory, sibling difference in behavior explained 36% of the variance in maternal differential negativity, $F(1,$

29) = 16.59, $p < .001$, $\beta = 0.60$. For mothers with strong working memory, the equation explained only 1% of the variance, $F(1, 36) = 0.34$, $p > .5$, $\beta = 0.10$.

Although not part of the current study, we conducted a post hoc secondary data analysis of a small sample of genetically unrelated mother-sibling triads from a prior study, in which we used the same observational procedures and measures (Petrill et al., 2006). We estimated the correlation between differential negativity and sibling difference in behavior in 21 pairs of same-sex, biologically unrelated siblings who had been adopted (at 1 year of age on average) and who were less than 3 years apart in age. The finding was replicated. The correlation was significant among mothers with working memory scores below the sample mean, $r(11) = .48$, $p < .05$ (one-tailed), but not among mothers with memory scores above the mean, $r(8) = -.05$, n.s.

Discussion

For parents, cognitive control is important to self-regulation of emotion and behavior when faced with challenging behavior in children, such as angry opposition and nonresponsiveness. We tested the hypothesis that mothers with poorer working memory would show more reactive negativity compared with mothers with better working memory. Using a quasi-experimental sibling design involving same-sex twins, we found that sibling differences in challenging behaviors (i.e., noncompliance, being off-task, unresponsiveness, and frustration/anger) were substantially associated with differential maternal negativity, but only among mothers with poorer working memory skills. This effect could not be attributed to verbal or spatial cognitive skills, and it was replicated in a small sample of genetically unrelated mothers and adopted sibling children. Our interpretation is that for mothers with poorer working memory, their negativity is more reactive because they are less able to cognitively control their emotions and behaviors during their interactions with their children. In contrast, the observed negativity of mothers with better working memory is not tied to challenging behavior in children. These mothers still exhibit negativity toward each child, but it is not a reaction to their children's challenging behaviors.

Although using a quasi-experimental design aided in the interpretation of maternal behavior as being reactive, the data were correlational, so there is at least one alternative interpretation of these data. Mothers who were more differential in their negativity could have been causing their sibling children to behave more differently—but only if the mother had poorer working memory skills. However, it seems implausible that differential parenting would cause sibling differences in behavior only if the parent had poorer working memory, particularly when considering that there was no direct association between the degree of differential negativity and working memory performance. Furthermore, we are not aware of a theory of parenting or of self-regulation that would lead to this alternative hypothesis.

Why working memory?

Working memory is a key aspect of cognitive control of emotion, and this capability should figure prominently in how a mother behaves during interactions with her children—particularly when the child's behavior is challenging. It is under such conditions that parents must regulate their own feelings of frustration and anger, and when those with poorer cognitive control are more likely to be reactive. Working memory is a key aspect of cognitive control (Baddeley, 1998) and of the cognitive reappraisal that is essential for effective emotion and behavioral regulation (Ochsner & Gross, 2008). Although rarely studied in parenting research, working memory seems to play a critical role in modulating emotionally reactive behavior directed at children. In our next study, we plan to examine a broader set of measures of maternal executive attention and memory, to determine how

critical these working memory processes are when considered within the context of other aspects of executive function.

The benefit of the sibling quasi-experimental design is that it permits stronger inferences about observed maternal behavior as being in part a reaction to child behavior, because each parent is being compared with herself across two children. Such an inference regarding maternal reactivity would be less plausible if we had observed only one mother-child dyad per family. The results suggest that if working memory plays a role in reactive negativity, it may be very difficult to detect on the basis of maternal behavior alone. Instead, maternal working memory probably operates as a moderator of the degree of the mother's reactivity to her children's challenging behaviors, and, therefore, it should be examined as a moderator within the dyadic context. This notion is consistent with the theory that emotion regulation not only operates within the individual, but also involves interpersonal social interaction processes (Diamond & Aspinwall, 2003).

Caveats and conclusions

There are several limitations to be considered. The brief observations we used may be valid indicators of sibling differences in challenging behaviors and differential parenting, but they are only "snapshots" and may not generalize to broader samples of behavior. Also, the findings may not generalize to opposite-sex sibling pairs or to nontwin siblings who differ in age—although we did replicate the finding in a small sample of adoptive siblings that differed in age. Finally, the sample was not representative of the U.S. population of families with school-age children. The vast majority were White two-parent households, and parental education was above the national average (i.e., over half had a college degree).

These limitations aside, the findings implicate working memory in the etiology of parents' reactive negativity, which is one of the strongest and most consistent components of interparental and parent-child conflict and maltreatment (Krishnakumar & Buehler, 2004; Milner, 1994). For parents, cognitive control is important for behaving in a nonreactive way, particularly when children's behavior is challenging. Appraisals that allow for rapid and accurate information processing and control of negative emotions are critical for effective parenting. Education and intervention efforts for reducing maltreatment and improving parenting may do well to target strategies that support or enhance working memory. Working memory training can be highly effective (Olesen, Westerberg, & Klingberg, 2003). Whether this generalizes to improving outcomes in parenting interventions remains an important question for future research.

Acknowledgments

We thank the study participants and research staff.

Funding

The Western Reserve Reading Project twin study was supported by grants from the National Institute of Child Health and Human Development (HD38075) and National Institute of Child Health and Human Development/U.S. Department of Education, Office of Special Education and Rehabilitative Services (HD46167). The adoption study was supported by the National Science Foundation (BCS-9907860, BCS-9907811, and BCS-0196511), the Society for the Psychological Study of Social Issues, and the Kathryn Rudolph Memorial Research Fund of the University of Oregon Foundation.

References

- Anderson K, Lytton H, Romney DM. Mothers' interactions with normal and conduct-disordered boys: Who affects whom? *Developmental Psychology*. 1986; 22:604–609.

- Baddeley A. Recent developments in working memory. *Current Opinion in Neurobiology*. 1998; 8:234–238. [PubMed: 9635207]
- Belsky, J.; Barends, N. Personality and parenting. In: Bornstein, MH., editor. *Handbook of parenting: Vol. 3. Being and becoming a parent*. 2nd ed.. Erlbaum; Mahwah, NJ: 2002. p. 415-438.
- Chang L, Schwartz D, Dodge KA, McBride-Chang C. Harsh parenting in relation to child emotion regulation and aggression. *Journal of Family Psychology*. 2003; 17:598–606. [PubMed: 14640808]
- Deater-Deckard K. Parenting and child behavioral adjustment in early childhood: A quantitative genetic approach to studying family processes and child development. *Child Development*. 2000; 71:468–484. [PubMed: 10834478]
- Deater-Deckard, K. *Parenting stress*. Yale University Press; New Haven, CT: 2004.
- Diamond LM, Aspinwall LG. Emotion regulation across the lifespan: An integrative perspective emphasizing self-regulation, positive affect, and dyadic processes. *Motivation and Emotion*. 2003; 27:125–156.
- Dodge KA, Bates JE, Pettit GS. Mechanisms in the cycle of violence. *Science*. 1990; 250:1678–1683. [PubMed: 2270481]
- Goodnow, JJ. Parents' knowledge and expectations: Using what we know. In: Bornstein, MH., editor. *Handbook of parenting: Vol. 3. Being and becoming a parent*. 2nd ed.. Erlbaum; Mahwah, NJ: 2002. p. 439-460.
- Holmbeck GN. Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology*. 2002; 27:87–96. [PubMed: 11726683]
- Huang K, Caughy MO, Genevro JL, Miller TL. Maternal knowledge of child development and quality of parenting among White, African-American, and Hispanic mothers. *Journal of Applied Developmental Psychology*. 2005; 26:149–170.
- Krishnakumar A, Buehler C. Interparental conflict and parenting behaviors: A meta-analytic review. *Family Relations*. 2004; 49:25–44.
- Lorber MF, O'Leary SG, Kendziora KT. Mothers' overreactive discipline and their encoding and appraisals of toddler behavior. *Journal of Abnormal Child Psychology*. 2003; 31:485–494. [PubMed: 14561057]
- McLoyd VC. Socioeconomic disadvantage and child development. *American Psychologist*. 1998; 53:185–204. [PubMed: 9491747]
- Milner JS. Assessing physical child abuse risk: The Child Abuse Potential Inventory. *Clinical Psychology Review*. 1994; 14:547–583.
- Ochsner K, Gross J. The cognitive control of emotion. *Trends in Cognitive Sciences*. 2005; 9:242–249. [PubMed: 15866151]
- Ochsner K, Gross J. Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science*. 2008; 17:153–158.
- Olesen PJ, Westerberg H, Klingberg T. Increased prefrontal and parietal activity after training of working memory. *Nature Neuroscience*. 2003; 7:75–79.
- Patterson, GR. Performance models for parenting: A social interactional perspective. In: Grusec, JE.; Kuczynski, L., editors. *Parenting and children's internalization of values: A handbook of contemporary theory*. Wiley; New York: 1997. p. 193-235.
- Petrill SA, Deater-Deckard K, Thompson L, DeThorne L, Schatschneider C. Reading skills in early readers: Genetic and shared environmental influences. *Journal of Learning Disabilities*. 2006; 39:48–55. [PubMed: 16512082]
- Wechsler, D. *Wechsler Adult Intelligence Scale—Third Edition*. Psychological Corp.; San Antonio, TX: 1997.

Table 1

Descriptive Statistics and Correlations

Measure	M	Correlation			
		1	2	3	4
1. Digit Span (memory)	18.51 (3.94)	—			
2. Vocabulary (verbal)	45.74 (9.51)	.43**	—		
3. Block Design (spatial)	42.47 (10.67)	.31**	.45**	—	
4. Maternal differential negativity	-.09 (.55)	-.08	-.09	-.02	—
5. Sibling difference in behavior	-.06 (.57)	-.02	-.06	-.07	.44**

Note: Digit Span, Vocabulary, and Block Design are subscales of the Wechsler Adult Intelligence Scale—Third Edition (Wechsler, 1997). Standard deviations are given in parentheses.

**
p < .001.

Table 2

Hierarchical Linear Regression Analysis Predicting Differential Maternal Negativity From Sibling Difference in Behavior and Mothers' Cognitive Performance

Predictor	β
Step 1: main effects ^a	
Sib diff behavior	0.36**
Memory	-0.11
Verbal	-0.04
Spatial	0.05
Step 2: interactions ^b	
Sib Diff Behavior \times Memory	-0.19*
Sib Diff Behavior \times Verbal	-0.04
Sib Diff Behavior \times Spatial	-0.01

Note: Memory, verbal, and spatial were indexes of the mothers' cognitive performance, as measured by subtests of the Wechsler Adult Intelligence Scale—Third Edition (Wechsler, 1997). Sib diff behavior = sibling difference in behavior.

^aThe first step of the equation explained a significant portion of variance, $F(4, 211) = 13.28, p < .001, R^2 = .201$.

^bThe second step of the equation explained an additional significant portion of variance, $\Delta F(3, 208) = 3.04, p < .01, \Delta R^2 = .035$.

* $p < .01$.

** $p < .001$.