

# Frontal EEG and Temperament Correlates of Working Memory in Mothers and Toddlers

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## Background and Aims

There are two separate literatures in which developmental scientists focus on individual differences in working memory (WM) performance.

- *Neuroscience literature* --- WM performance attributed to:
  - brain electrical activity (Bell, 2001, 2002)
  - brain maturation associated with inhibitory control (Diamond, 2002)
  - temperament (Wolfe & Bell, 2004)
- 2) *Behavioral Genetics literature* --- Heritability of:
  - WM performance (Polderman, Stins, & Posthuma, 2006)
  - brain electrical activity (Smit, Posthuma, Boomsma, & DeGeus, 2005)
  - temperament (Deater-Deckard, Ivy, & Smith, 2005)

*This study* --- examination of individual differences in WM using sources of variance from both literatures.

*Unique contributions* --- examination of associations in mothers and their toddler children, thus focusing on mother-child similarity rather than twin similarity.

- Aims:* 1) Examine the correlates of WM performance in toddlers and in their mothers.  
 2) Examine mother-child similarity in these WM correlates.

## Method

*Toddlers* (n=83) --- involved in a longitudinal study (5 mo., 10mo., 24 mo., 36 mo.) on psychobiology of early cognitive development; data from 24 months are reported here.

*Mothers* (n=15) --- subset of toddler's mothers (ages 25-41) were invited to participate in a battery of adult versions of the child tasks, including WM, recall and recognition memory, and inhibitory control tasks.

*WM tasks* --- toddlers → Mommy/Me (toddler version of Day/Night task)  
 mothers → Wisconsin Card Sort (computerized)

*EEG* --- toddlers & mothers → ongoing EEG recorded at baseline and throughout all cognitive tasks

*Temperament* --- toddlers → Rothbart's ECBQ  
 mothers → Rothbart's ATQ

## Correlates of Toddler Working Memory



ECBQ scale	Pearson's <i>r</i>	<i>p</i> -value
Inhibitory control	.32	.007
Motor activation	.24	.04
Perceptual sensitivity	.33	.005

EEG scalp location	Pearson's <i>r</i>	<i>p</i> -value
Baseline F3, F4	.25, .16	.06, .24
Task F3, F4	.30, .35	.03, .01

## Correlates of Mother Working Memory

ATQ scale	Pearson's <i>r</i>	<i>p</i> -value
Neutral perceptual sensitivity	-.67	.012



EEG scalp location	Pearson's <i>r</i>	<i>p</i> -value
Baseline F3, F4	-.13, -.14	.66, .64
Task F3, F4	-.38, -.40	.18, .16

## Mother-Child Similarity

WM performance	Pearson's <i>r</i>	<i>p</i> -value
Mother & Child	.52	.07

F3, F4 EEG power	Pearson's <i>r</i>	<i>p</i> -value
Mother & Child baseline EEG	.16, .37	.70, .36
Mother & Child task EEG	-.31, -.05	.46, .90

Child temperament	Mother temperament	Pearson's <i>r</i>	<i>p</i> -value
Inhibitory control	Frustration	-.52	.06
	Discomfort	-.55	.04
Impulsivity	Frustration	.58	.03
	NEGATIVE AFFECT	.76	.002
Attention shifting	Activation control	.57	.03
	Sadness	.48	.08
	EFFORTFUL CONTROL	.50	.06
Motor activation	High intensity pleasure	.52	.06

## Conclusions

These preliminary data give support to the idea that biological influences associated with temperament affect mother-child similarities and that temperament and EEG affect individual differences in both mother and child WM performance. Potential mechanisms by which this mother-child resemblance is transmitted may include genetics, as well as maternal scaffolding and socialization behaviors (Rueda, Rothbart, & Posner, 2004). As we add more mothers to our data set, we will be able to more systematically examine these mother-child transmission processes.



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