

The Development of Self-Regulation in Early Childhood

How Experience Shapes Brain Development and Self-Regulation
Abilities Important for Success in School and in Life

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School Readiness

- * Teachers in the United States say that self-regulation is most important for school readiness
- * Taking turns, getting along with others, controlling emotions, following instructions, and being self-directed is most important for school readiness
- * Almost no teachers say that letters and numbers or other types of academic knowledge are essential or most important

What is Self-Regulation?

- * Self-regulation is composed of cognitive and emotional aspects
- * Cognitive aspects are referred to as executive functions
- * Emotional aspects refer to the regulation of the timing and intensity of emotional responses

Executive Functions

- * Executive functions include working memory, inhibitory control, and the flexible shifting of the focus of attention
- * Executive functions are important for planning and problem solving and for regulating emotion – both increasing as well as decreasing emotion levels
- * Executive functions are distinct from intelligence, particularly crystallized intelligence

Luria's Peg Tapping Task

When I tap one
time, you tap
two times ...

peg

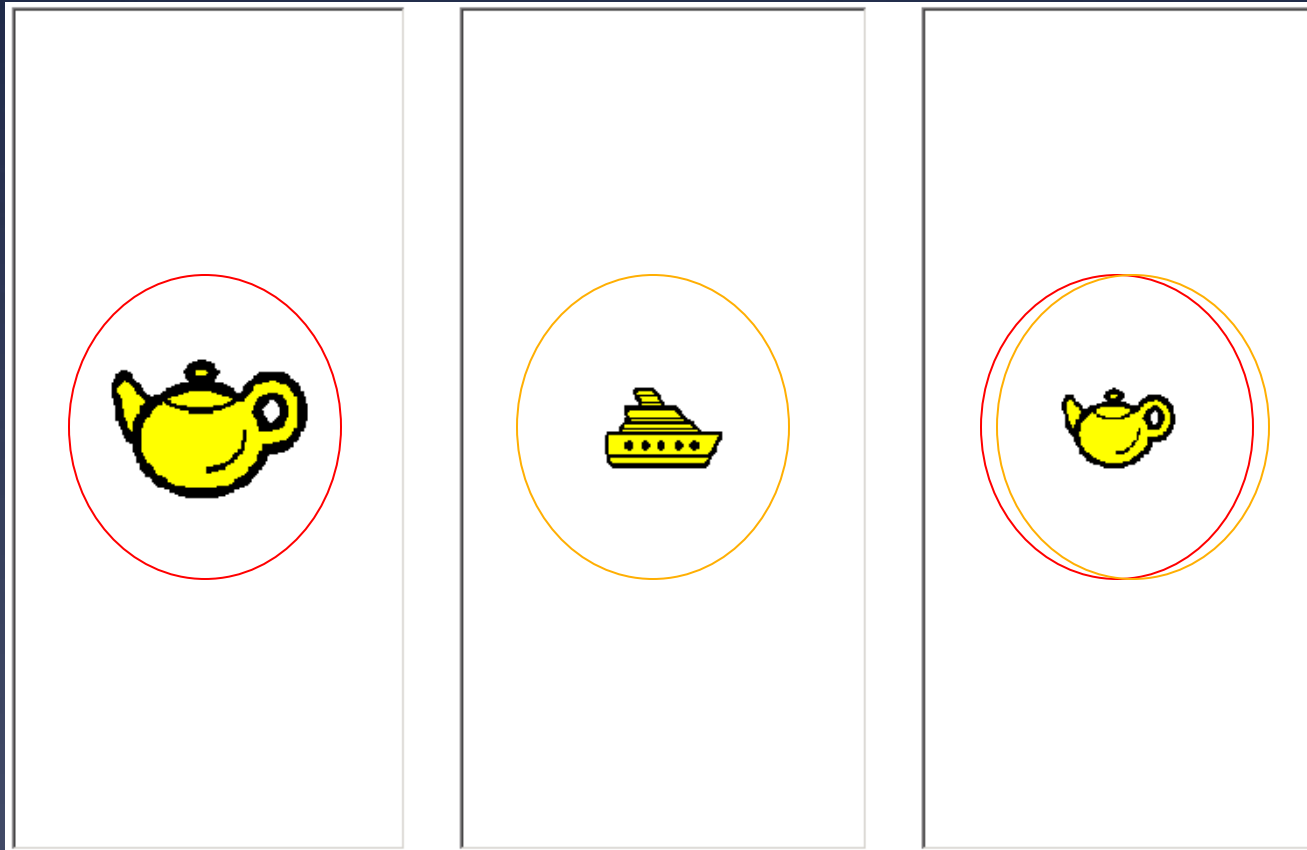


okay...

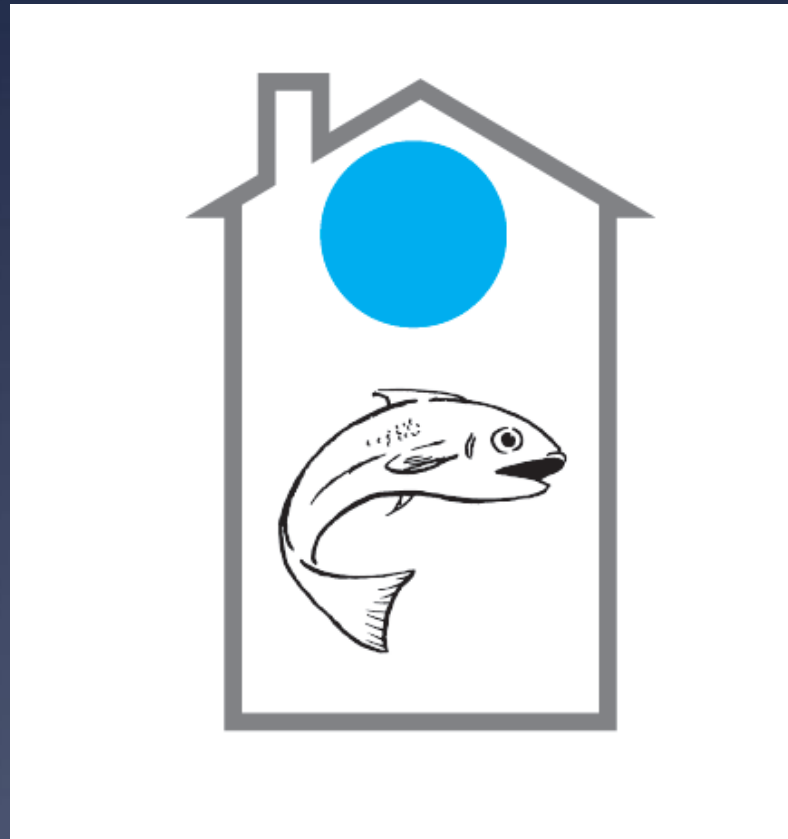
...and when I tap
two times, you tap
one time.

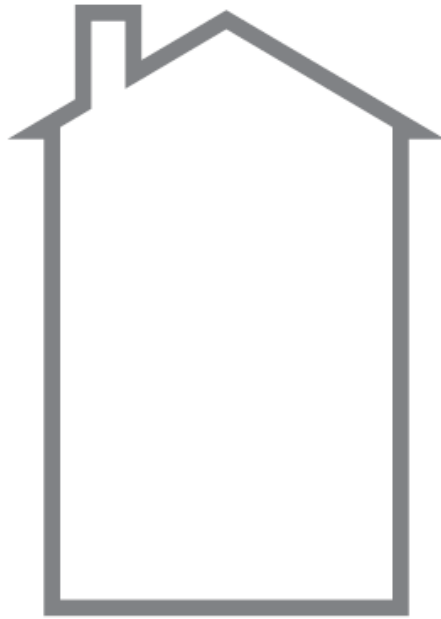
alright ...

Item Selection Task



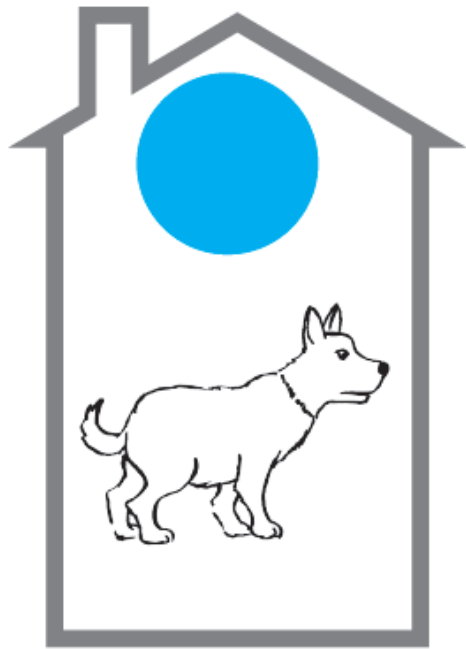
Working Memory Span



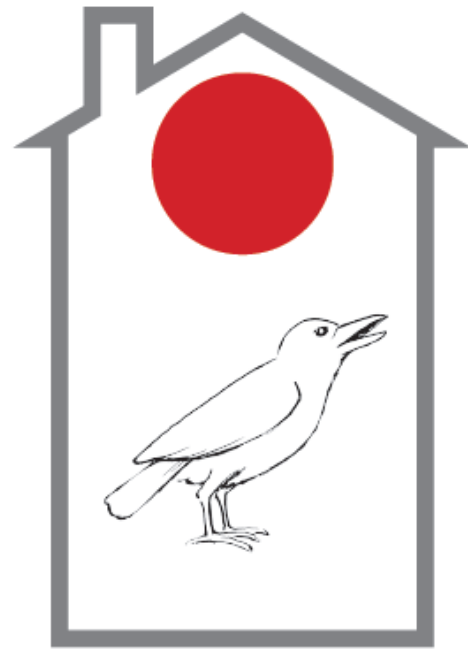


A

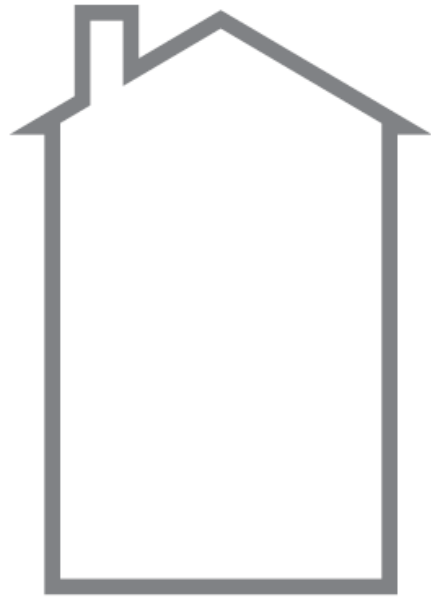
Item 1



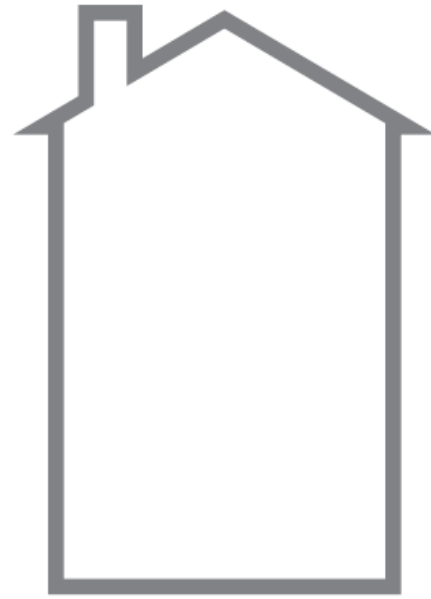
A



B

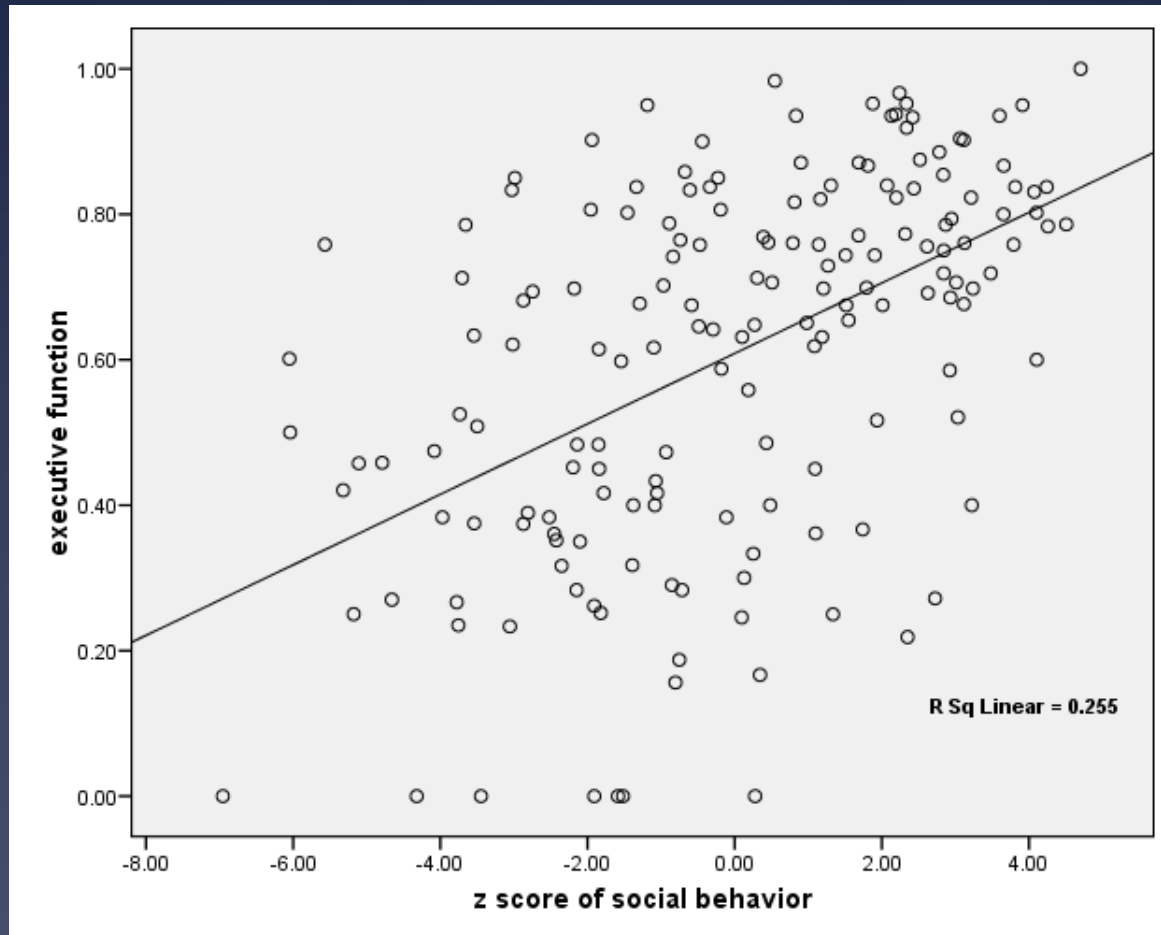


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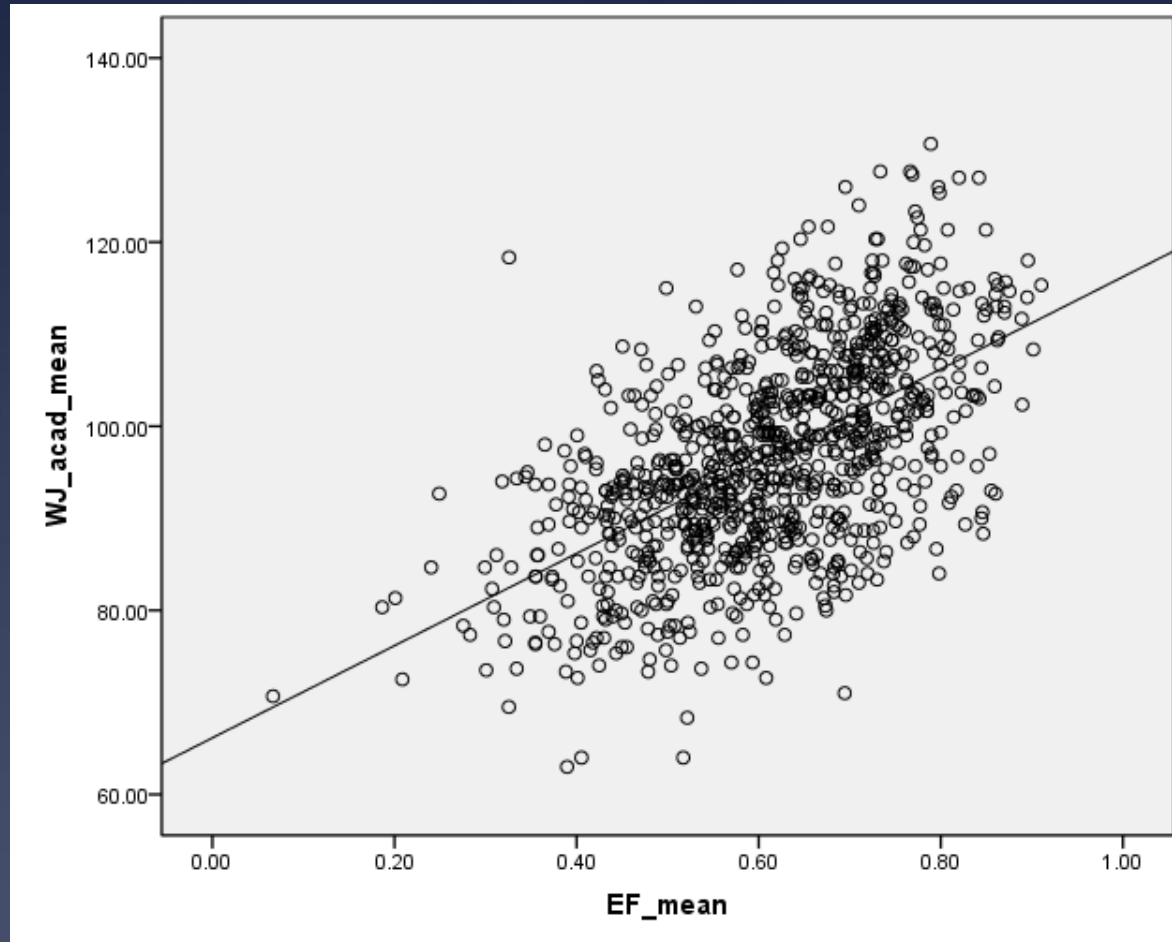


B

Relation between Executive Function and Teacher Report of Self-Regulation



Relation of Executive Function to Academic Achievement



Predicting Math Ability in Kindergarten

	β	β
Vocabulary	** .22	.12
Intelligence	** .25	.13
Teacher observed Self-Regulation	** .27	* .18
Executive Function in preschool		** .30
Executive Function in kindergarten		** .21

from Blair & Razza (2007). *Child Development*

* $p < .05$, ** $p < .01$

Math in Kindergarten II

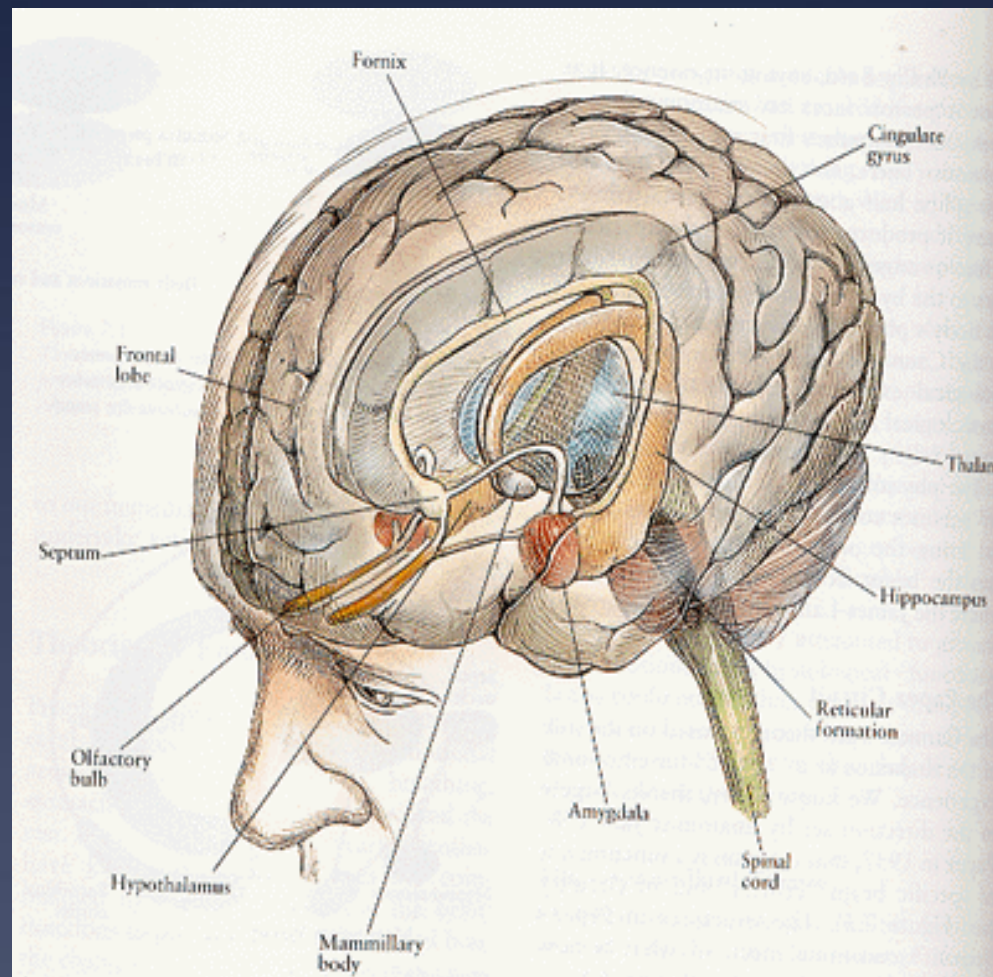
	r	β	β	β
<i>Block Design</i>	.46***	.29***	.22***	.24***
<i>Vocabulary</i>	.34***	.03	-.03	-.03
<u>Early Math Skills</u>				
<i>Applied Problems</i>	.54***	.33***	.21**	.20**
<u>Executive Function</u>				
<i>Beginning Pre-K</i>	.40***	.17*	.02	-.05
<i>End Pre-K</i>	.58***		.42***	.32***
<i>End K</i>	.47***			.30***

from Welsh et al. (2010). *Journal of Educational Psychology*

* $p < .05$, ** $p < .01$

Executive Functions: Neuroscience

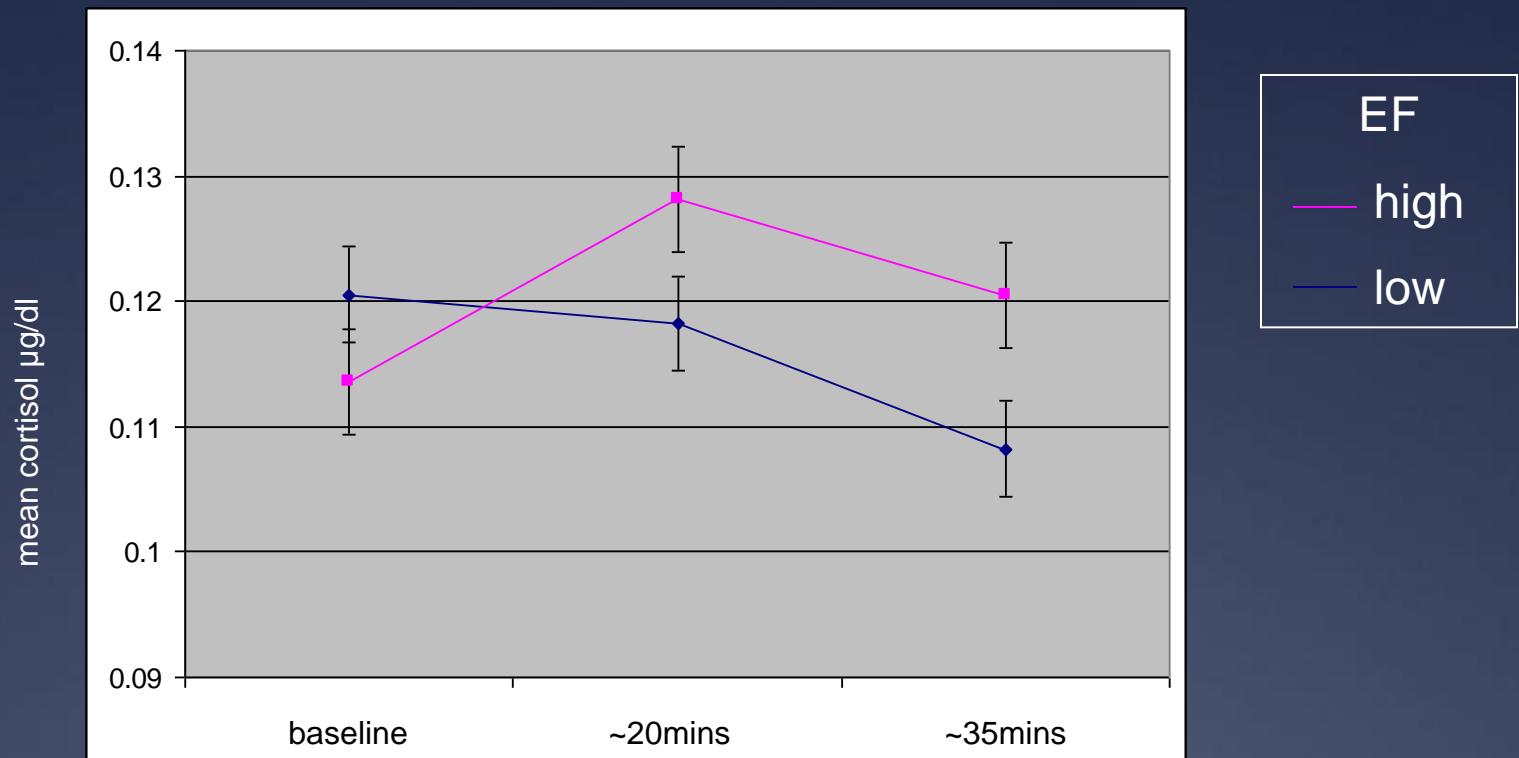
- * Executive functions are associated with prefrontal cortex
- * Prefrontal cortex develops rapidly in early childhood
- * Neural activity in prefrontal cortex is dependent on levels of arousal in limbic system structures associated with emotion and stress



Executive Functions: Neuroscience

- * When we experience interest and engagement, limbic physiological systems produce chemicals that prepare the body and mind for response
- * The limbic system controls levels of hormones, glucocorticoids (cortisol) and catecholamines (norepinephrine) that act as neuromodulators in prefrontal cortex
- * Moderate levels of hormone increase are associated with increased neural activity in prefrontal cortex and higher level of EF
 - * Low or high levels stress are associated with reduced neural activity and lower EF

Relation between Executive Function and Cortisol Reactivity in Preschoolers



from Blair, Granger & Razza (2005). *Child Development*

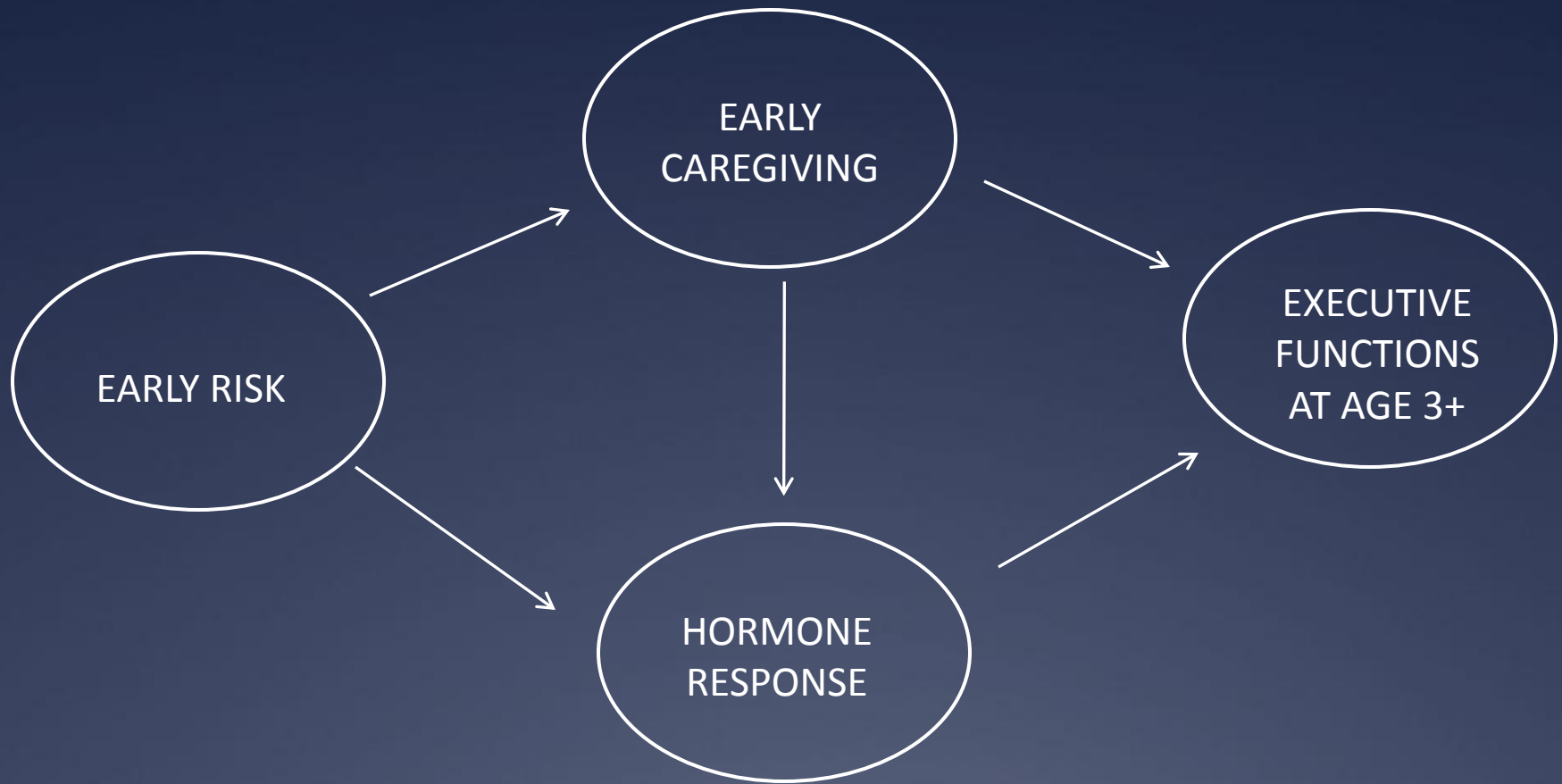
Brain Development

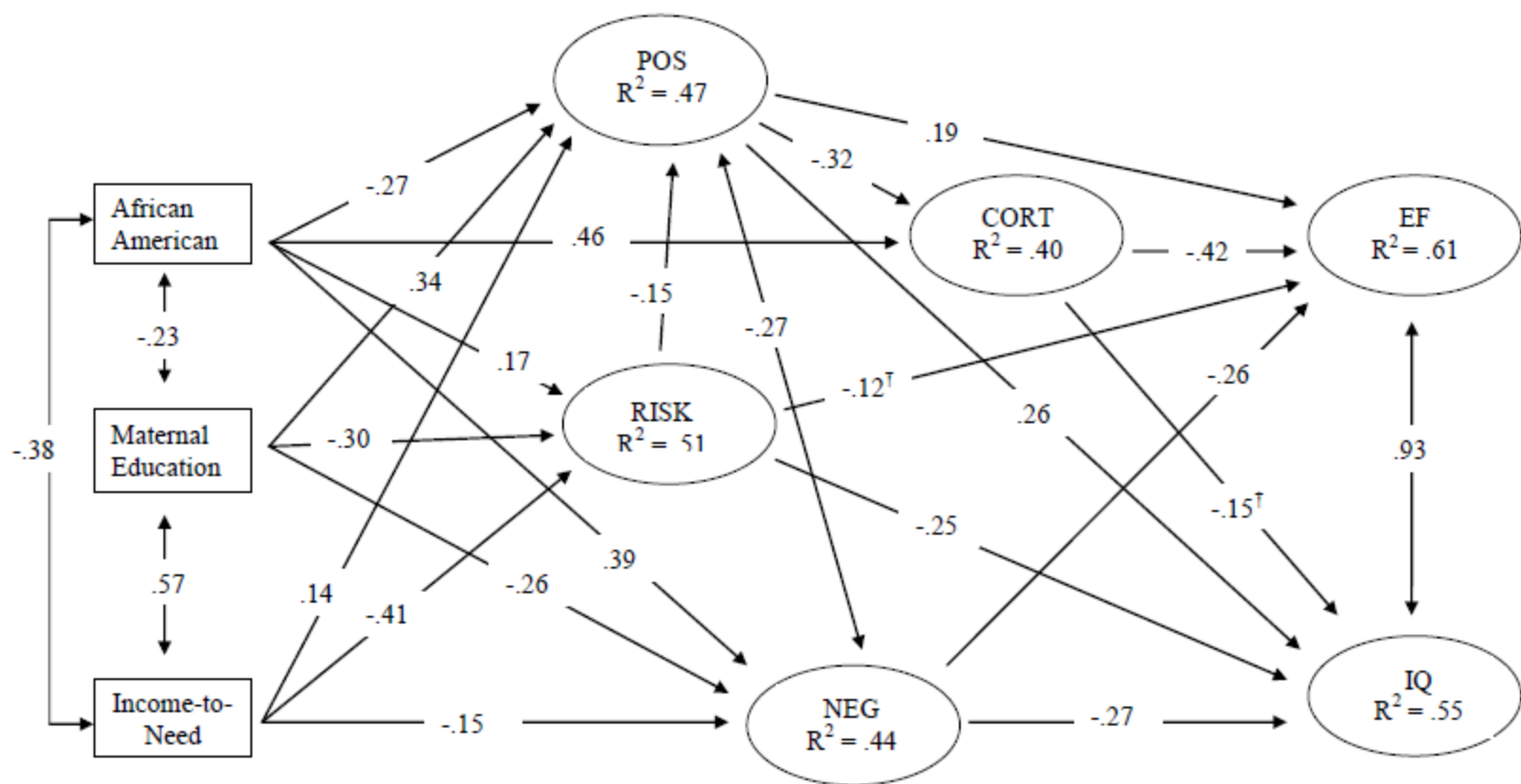
- * Experience dependent neural plasticity
 - * “Cells that fire together, wire together”
- * The brain as a record of experience
- * How do the experiences of early childhood at home and at school lead to higher executive function and self-regulation rather than a predominantly reactive response to experience

Executive Function Development

- * Home and preschool environments influence school readiness and early academic ability by fostering or impeding effective self-regulation
- * Providing children with information and with types of experience that help them to be acquire effective self-regulation skills

Home Influences on Executive Function Development





School Influences on Executive Function Development

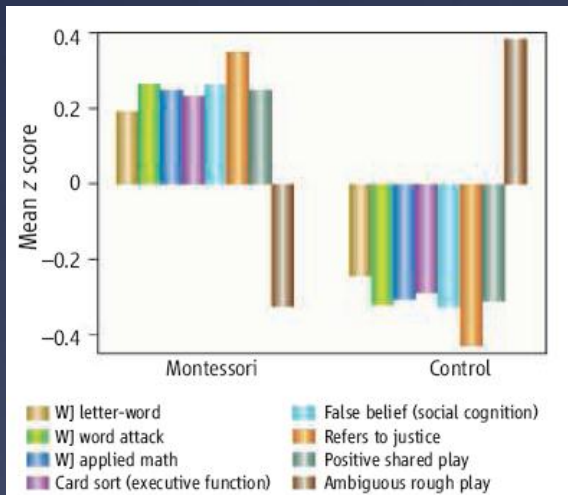
- * The importance of high quality education for children beginning in preschool
- * Evidence from evaluations of Tools of the Mind and Montessori curriculums
- * The need for randomized controlled trials to evaluate what works best for children's learning

THE EARLY YEARS

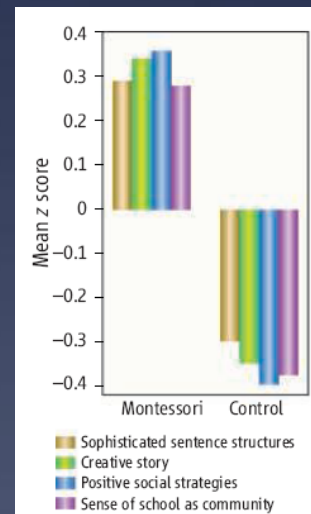
Evaluating Montessori Education

Angeline Lillard^{1*} and Nicole Else-Quest²

An analysis of students' academic and social scores compares a Montessori school with other elementary school education programs.



Results for 5-year-olds. Montessori students achieved higher scores [converted to average z scores (18)] for both academic and behavioral tests.



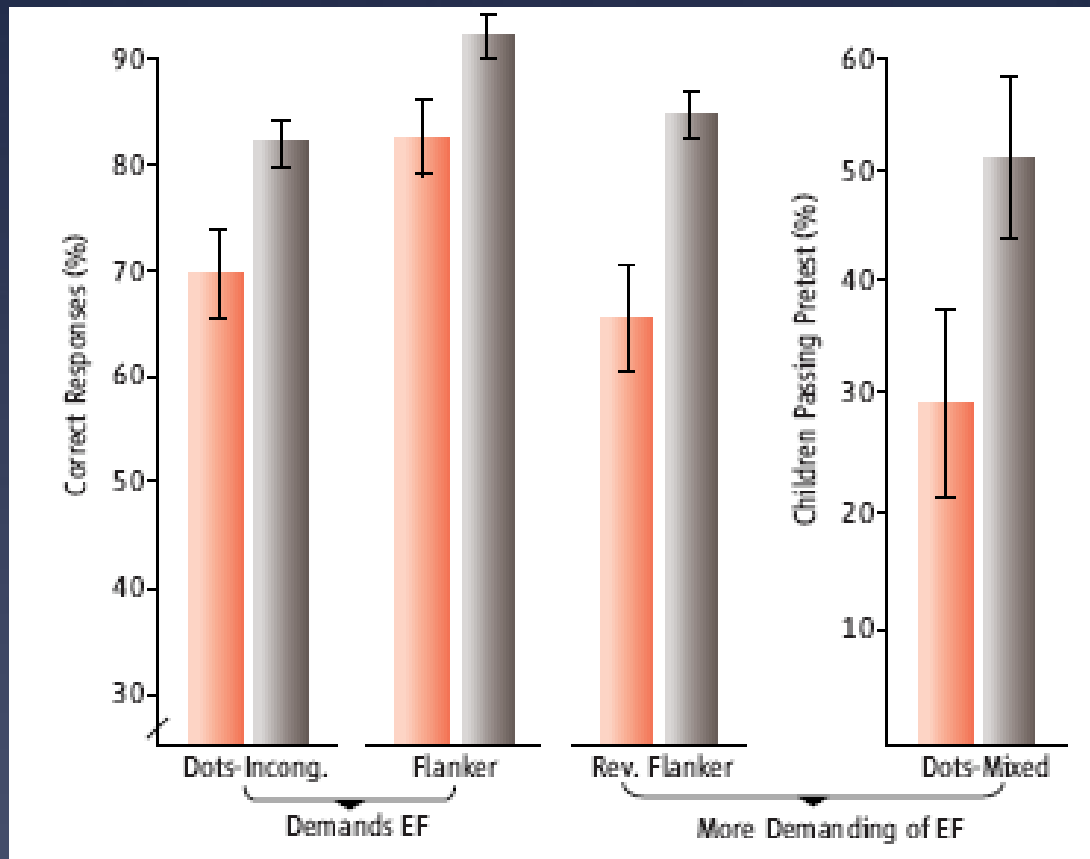
Results for 12-year-olds. Students in the Montessori program wrote more sophisticated and creative stories and showed a more developed sense of community and social skills. Scores were converted to average z scores (18).

THE EARLY YEARS

Preschool Program Improves Cognitive Control

Cognitive control skills important for success in school and life are amenable to improvement in at-risk preschoolers without costly interventions.

Adele Diamond,^{1*} W. Steven Barnett,² Jessica Thomas,² Sarah Munro¹



Fostering School Ability

- * Early childhood education as a process through which children acquire effective learning skills not simply as an input-output system
- * Build early childhood education on scientific knowledge of self-regulation, of how children develop effective and meaningful ways of acquiring and using information
- * Conduct experiments to understand what works best and how it works

Collaborators and Funders

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