Executive Function skills are more important for school readiness than are IQ or entry-level reading or math.

(e.g., Blair, 2002; 2003; Blair & Razza, 2007; Normandeau & Guay, 1998)

Executive Functions are also important for school success.

Working memory and inhibitory control each independently predict both math and reading competence throughout the school years.

Executive functions predict academic performance in the earliest elementary grades thru university better than does IQ.

(Alloway & Alloway, 2010; Bull & Scerif, 2001; Dumontheil & Klingberg, 2012; Gathercole et al., 2004; McClelland & Cameron, 2011; Nicholson, 2007; Passolunghi et al., 2007; St Clair-Thompson & Gathercole, 2006; Savage et al., 2006; Swanson, 2014).

Executive Functions are also critical for job success.

Poor EFs lead to poor productivity and difficulty finding and keeping a job (Prince et al. 2007).

Executive Functions are also important for marital harmony.

People with poor EFs are more difficult to get along with, less dependable, and more likely to act on impulse (Eakin et al. 2004).

Executive Functions are also important for making and keeping friends, for being accepted by other children.

Children with poor EFs often respond impulsively, have trouble resisting urges, & are forgetful; they don't wait their turn, forget the rules that all agreed to, etc.

Poor EFs cause social problems such as disinhibited or criminal behavior.

The incidence of social problems reflecting poor EFs (crime, incarceration, and being unemployable) is increasing dramatically and the cost is staggering (Atkinson et al. 2005).

EFs are impaired in many mental health disorders

e.g., addictions, ADHD, OCD, depression, conduct disorder, & schizophrenia (Verdejo-García et al. 2006; Penadés et al. 2007; Diamond 2005; Lui and Tannock 2007; Taylor-Tavares *et al.*2007; Barch 2005).

Such disorders are increasing at alarming rates (Moffitt et al. 2010; Robinson et al. 1999) & account for more lost years of life & productivity than any other illness including cancer (Prince et al. 2007).

Poor EFs can also lead to poor physical health including obesity, over-eating, poor food choices, substance abuse, & poor sustained adherence to doctors' orders (Crescioni et al. 2011; McAuley 2011; Riggs et al. 2010).

In a large sample of >14,000, Miller et al. (2011) found that youths with poorer self-control were "exponentially more likely" to suffer from 9 of the 10 adverse health conditions they examined.

In other words, Executive Functions are important for every aspect of life – success in school and in the workplace, making & keeping friends, marital harmony, and avoiding things like unplanned pregnancy, substance abuse, or driving fatalities.

Self-control, creativity, reasoning, mental flexibility, discipline and perseverance are really important – they are often more predictive than IQ.

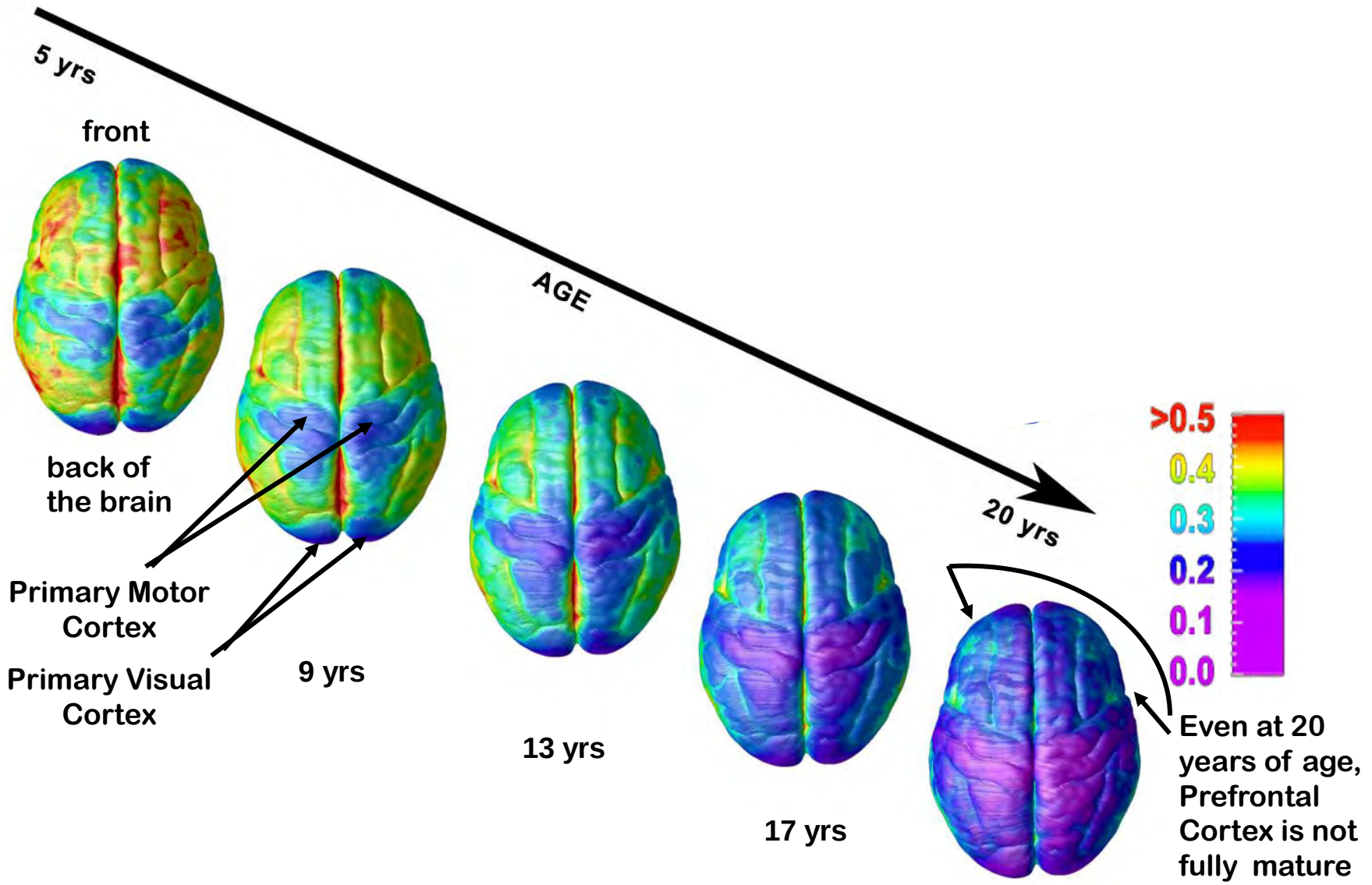
The good news is that Executive Functions can be improved.

EF skills can be improved
even in children as young as 4-5 years

without expensive, highly
technical equipment

by regular teachers
in regular classrooms

Human Brain Development



Even those who believed that EF can be improved, have doubted whether that could be done as early as preschool since EF depends on PFC, and PFC isn't fully mature until young adulthood.

(Analogy with leg length at 2 years and walking and even running at age 2.)

Just because PFC isn't fully functional, doesn't mean that it isn't functional at all.

Kovács AM, Mehler J. (2009)

Cognitive gains in 7-month-old bilingual infants.

Proceedings of the National Academy of Sciences.

vol 106, p. 6556-6560

Wass, S, Porayska-Pomsta, K, & Johnson, MH

(2011)

Training attentional control in infancy.

Current Biology, 21, p.1-5

There are 3 basic ways to improve functioning that requires EFs:

(a) work on EFs - train them, challenge them, & practice, practice, practice

(b) work on reducing things that impair EFs (stress, lack of sleep, etc.)

(c) find ways of reducing the demands on EFs (circumvent the need for EFs, in part) scaffolding

Science asked me to write a review of all interventions shown to improve EFs in young children

Diamond, A. & Lee, K.

(2011)

Interventions shown to Aid Executive Function Development in Children 4-12 Years Old

Science, vol. 333

accompanying online tables

Diamond, A. & Ling, D.

(submitted)

Psychological Bulletin

---

synopsis of that to appear

in Oxford UP: Bunting et al.

An integrative approach to cognitive and working memory training: Perspectives from psychology, neuro-science, and human development

We did NOT look at studies that…

- … were solely correlational,
- … included no comparison group,
- … looked only at acute effects (immediate effects of a single exposure), or
- … did not assess EFs.

We did NOT look at studies that…

… were solely correlational

Too often correlational studies (that find, e.g., students who exercise or play in the orchestra have better EFs than students who do not) are discussed as if they show causality (e.g., that exercise or playing in the orchestra helps produce the better EFs).

But of course it could be that students with better EFs are more likely to choose to be in the orchestra or are wise enough to exercise more.

We did NOT look at studies that…

- … were solely correlational,
- … included no comparison group,
- … looked only at acute effects (immediate effects of a single exposure), or
- … did not assess EFs.

… included no comparison group

To conclude that what individuals did inbetween Times 1 & 2 produced the improvement at Time 2, there needs to be evidence of differential improvement (a group x change interaction).

Without that we can't know if what people did between Times 1 & 2 *caused* the improvement or if the improvement would have been seen even if participants had not done that activity (e.g., practice effect from pre-testing).

Studies that show improvements from Time 1 to Time 2 among training-group participants but comparable improvements among control-group participants are also fundamental unconvincing.

E.g., Chang et al. (2013) randomly assigned children to low-intensity or high-intensity soccer exercise. Both groups improved in accuracy and speed on the flanker task, with almost identical post-test results and pre-to-post improvement. They concluded that the "exercise intervention, regardless of intensity, resulted in shorter reaction times and higher response accuracy."

But, of course, since both groups showed comparable improvement, we can't conclude that exercise played a role in the improvement. To conclude that we'd need a third group that did something else, or even nothing, and did not show comparable improvements.

(i.e., need to show differential improvement)

We did NOT look at studies that…

- … were solely correlational,
- … included no comparison group,
- … looked only at acute effects (immediate effects of a single exposure), or
- … did not assess EFs.

Diverse activities including computerized training, games, aerobics, martial arts, yoga, mindfulness, & certain school curricula all have at least a little published evidence that they improve executive functions.

Nature Reviews Neuroscience (January 2008)

"Be Smart, Exercise Your Heart:
Exercise Effects on Brain and Cognition"

Charles Hillman, Kirk Erickson & Art Kramer

The evidence shows that physical activity (especially aerobic exercise) robustly improves cognition and brain function.

In particular, the frontal lobe and the executive functions that depend on it show the largest benefit from improved fitness.

The positive effects of aerobic physical activity on cognition and brain function are evident at the molecular, cellular, systems, and behavioral level.

Exercise without a social or cognitive component (e.g., riding a stationary bike) produces little or no cognitive benefit.

Kamijo et al.

(2011)

Sternberg task

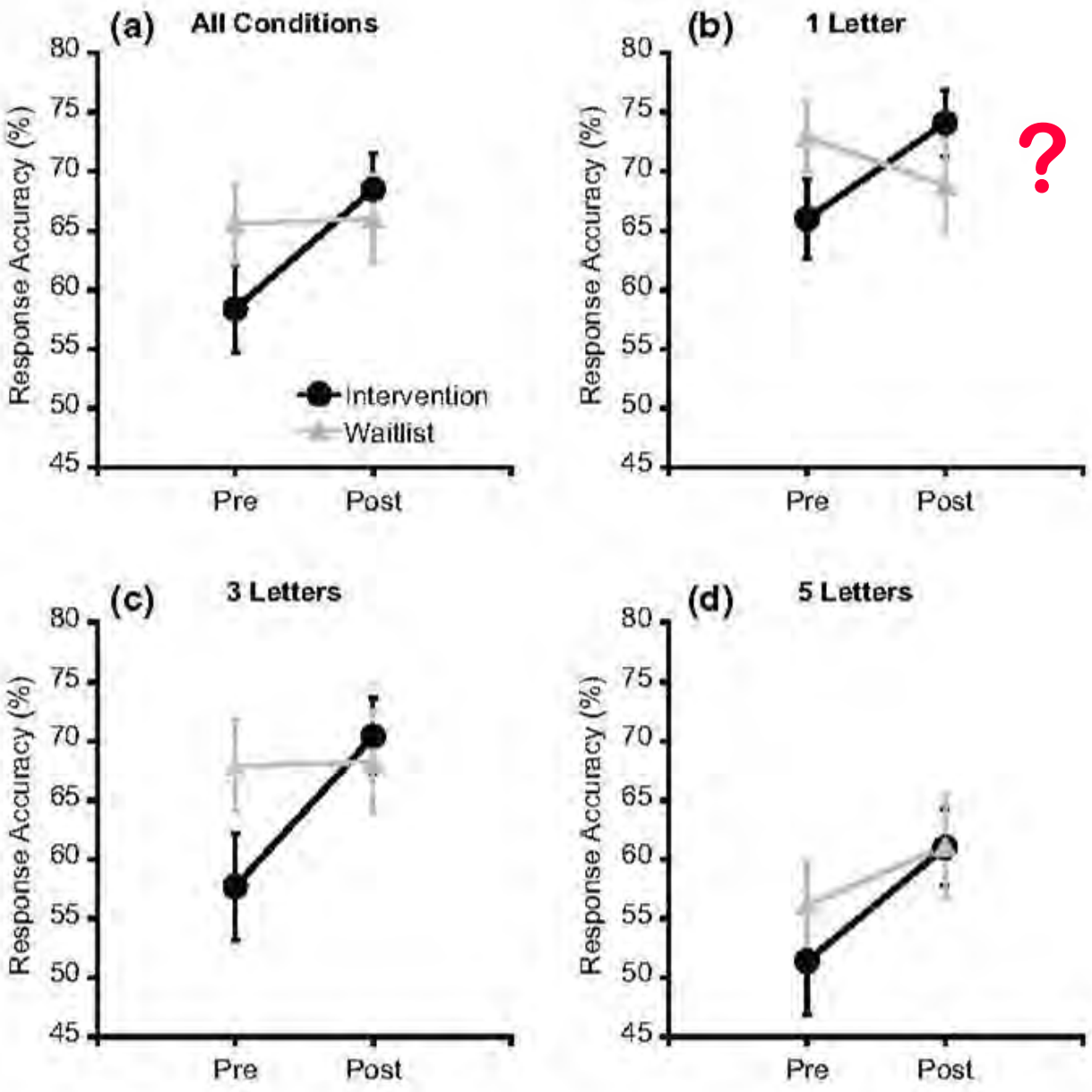
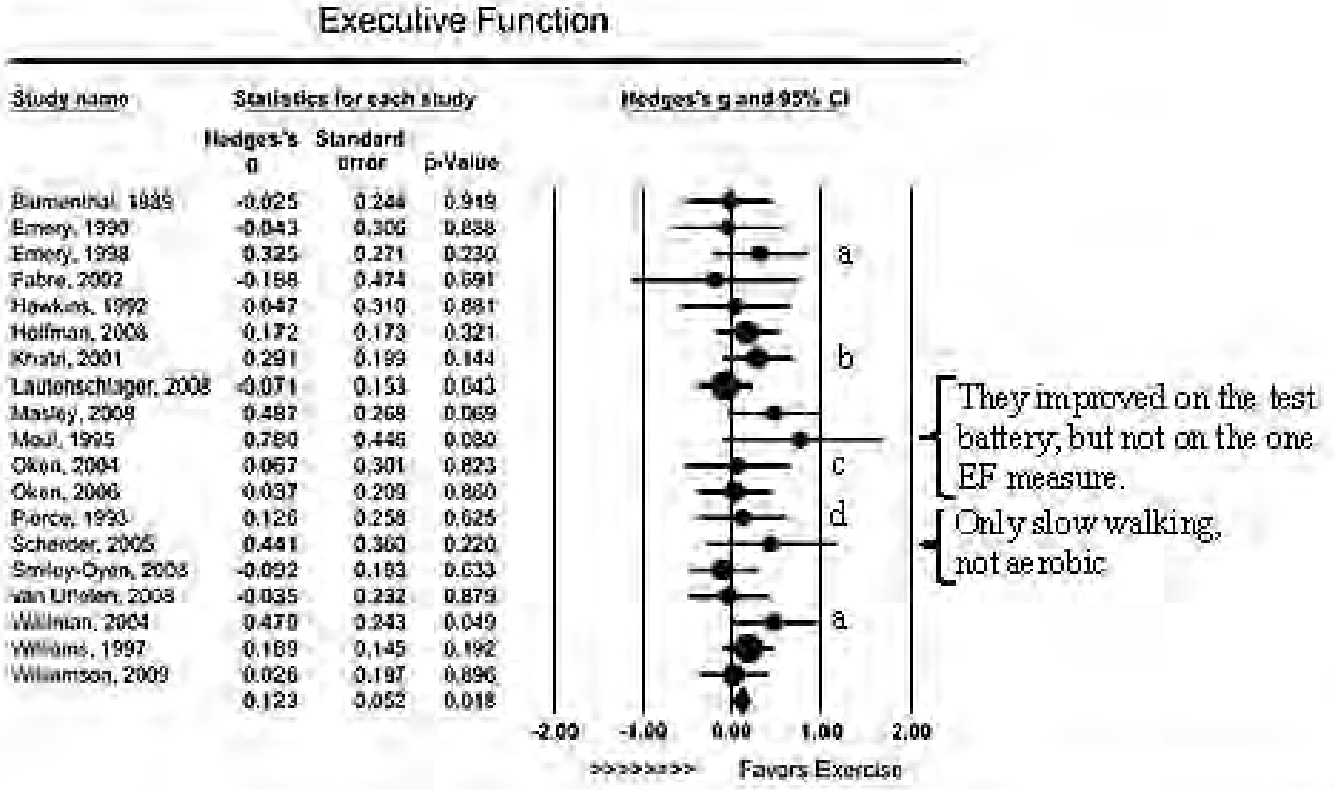


Figure 2 *Mean response accuracy at pre- and post-test across the physical activity intervention and waitlist control groups.*

Controls started off with somewhat better WM, & aerobic group caught up.

The significant effect is due to an inexplicable difference at N = 1.

Effect of aerobic exercise on executive function (n = 19).



from Smith, P.J. et al. (2010). Aerobic exercise and neurocognitive performance: A meta-analytic review of randomized controlled trials. *Psychosomatic medicine, 72*, 239-252.

a Subjects had chronic obstructive pulmonary disease
b Subjects had depression
c Subjects had multiple sclerosis
d Subjects had hypertension

To the extent that exercise alone improves EFs, that might be due to…

…exercise improving the quantity &/or quality of sleep

&/or

…exercise improving mood

Exercise alone appears not to be as effective in improving EFs as exercise-plus-character-development (traditional martial arts) exercise-plus-mindfulness (yoga) and other exercise that requires thought (soccer).

Lakes & Hoyt (2004) randomly assigned children in grades K thru 5 (roughly 5-11 years-old) by homeroom class to Tae-Kwon-Do martial arts (N = 105) or standard physical education (N = 102).

Children assigned to Tae-Kwon-Do showed greater gains than children in standard phys. ed. on all dimensions of EFs studied (e.g., cognitive [focused vs. distractible] and affective [persevere vs. quit] and emotion regulation). This generalized to multiple contexts and was found on multiple measures.

Traditional martial arts emphasize self-control, discipline (inhibitory control), and character development.

In a study with adolescent juvenile delinquents (Trulson, 1986), one group was assigned to traditional Tae-Kwon-Do (emphasizing qualities such as respect, humility, responsibility, perseverance, honor as well as physical conditioning). Another group was assigned to modern martial arts (martial arts as a competitive sport).

Those in traditional Tae-Kwon-Do showed less aggression and anxiety and improved in social ability and self-esteem.

Those in modern martial arts showed *more* juvenile delinquency and aggressiveness, and decreased self-esteem and social ability.

Whether EF gains are seen depends on the way an activity is done.

Computerized training of WM or reasoning (e.g., CogMed) *clearly* improve WM or reasoning.

But computerized training of inhibitory control in young children (ages 4-6 years) has failed despite multiple attempts.

Other approaches (e.g., school curricula and programs) *have* improved inhibition in 4-6 year-olds, so it can be done.

Computerized training may not be optimal for training inhibition in children so young or the optimal computerized approaches have yet to be tried.

CogMed and Mentoring

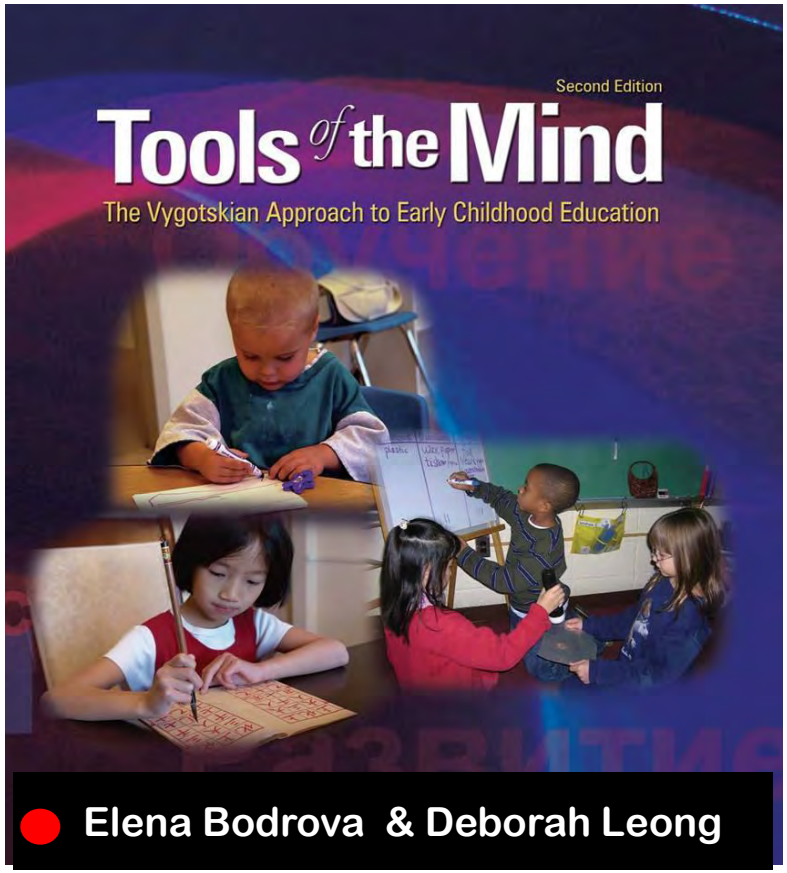
Sometimes the reason something works is different from what anyone expected: Although most studies of *CogMed*® do not mention the mentoring component,

to be certified to administer *CogMed*® adults must get trained in, & commit to, mentoring those doing *CogMed*®.

de Jong found that the mentoring seemed to account for the benefits of *CogMed®* even more than the computerized training.

de Jong, P. (May 20, 2014). *Effects of training working memory in adolescents with a below average IQ.* Workshop on Enhancing Executive Functions in Education in Nijmegen, NL.

School curricula empirically shown to improve EFs share several features in common.



Montessori

By looking at what Montessori & Tools of the Mind have in common, perhaps we can learn something about what elements might be most important in early education.

Both programs:

- challenge children to improve; challenge EFs
- scaffold, never embarrass
- hands on learning makes possible:
    - giving each child individual attention - Listen
    - dynamic assessment - carefully Observe
    - individual pacing; individualized instruction
- make it clear they expect each child will succeed
- foster community & consideration for others
- have children teaching & helping one another
- no external rewards
- joyful - less stress - more relaxed
- strong emphasis on oral language

There are LOTS of unanswered questions including…

…optimal approaches for different individuals & groups (ages, gender, background, etc.)

…optimal doses, frequencies, &/or durations for different methods, individuals, & groups

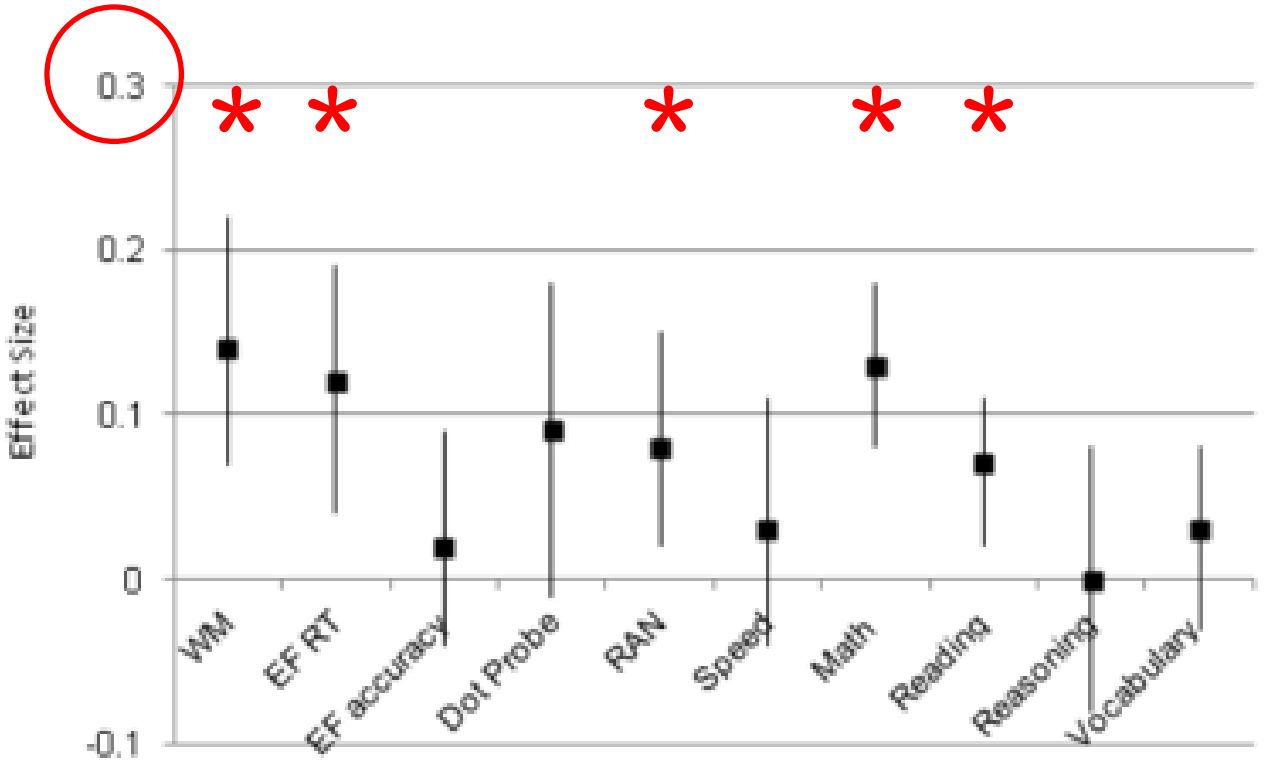
…how to help benefits last (e.g., whether & when to provide booster training sessions, embed challenges to the trained skills in daily activities, &/or address social, emotional & physical needs that impact cognition)

Regardless of the program to improve EFs, a few principles hold:

1. Those with initially poorest EFs gain the most.

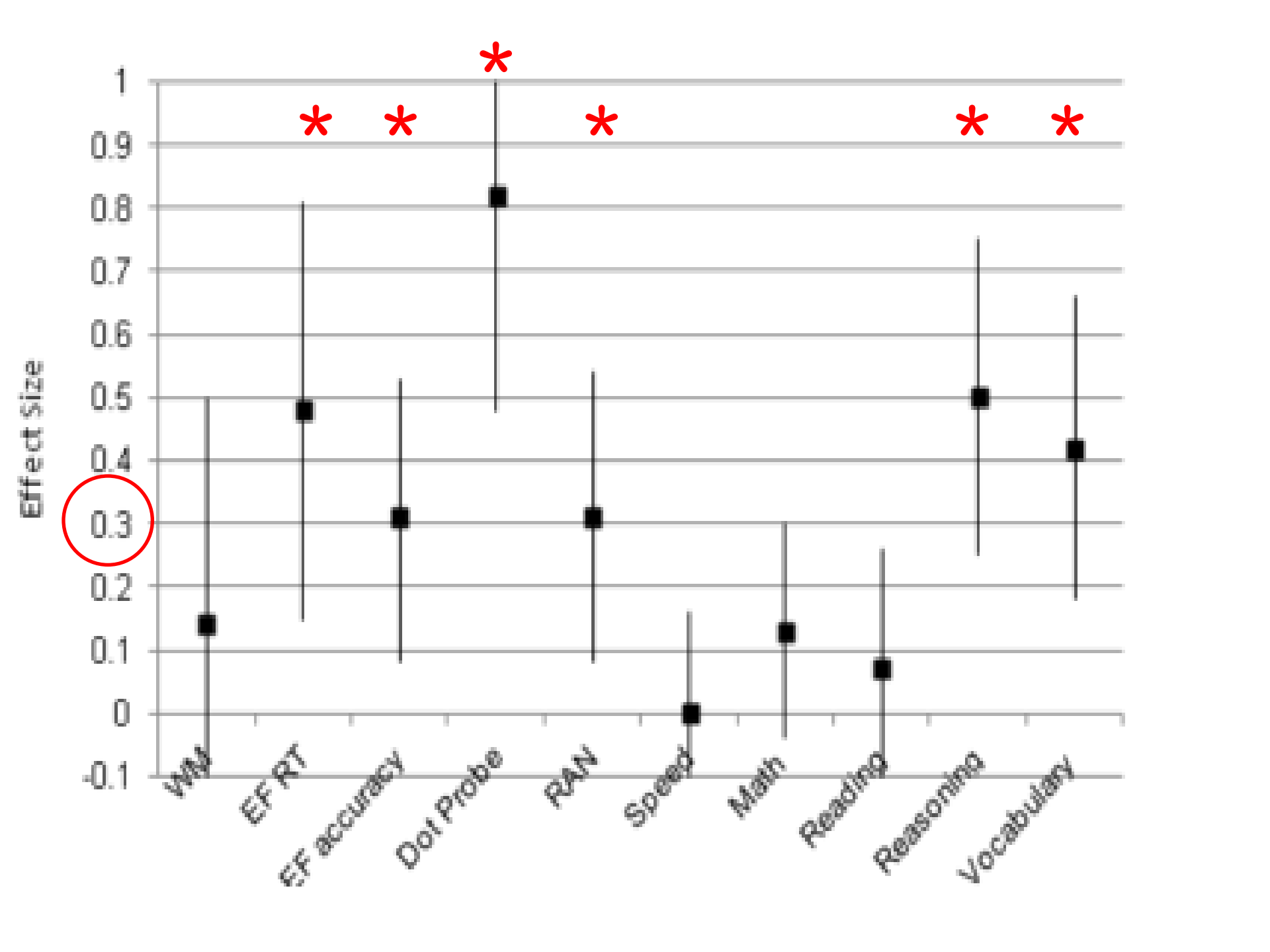
e.g., lower-income, lower WM span, or ADHD children

consistently show the most EF improvement from any program



Clancy Blair & Cybele Raver

Closing the Achievement Gap through Modification of Neurocognitive & Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten. to appear in PLOS ONE.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Reading
Reasoning
Vocabulary

Children at-risk start school with worse EFs than more economically advantaged children and fall progressively farther behind each school year

(O'Shaughnessy et al. 2003).

Small differences at the beginning can lead to bigger and bigger differences over time.

Why?

Feedback Loops

Consider negative feedback loops beginning with poor initial EFs:

Poor EFs lead to problems paying attention in class, completing assignments, and inhibiting impulsive behaviors.

School is less fun…
the teacher is always getting annoyed with you
& compliance w/ school demands is very hard.

Teachers come to expect poor self-regulation and poor work, and the children come to expect themselves to be poor students.

On the other hand, children who have better EFs are likely to be praised for good behavior, enjoy school more and want to spend more time at their lessons. Their teachers expect them to do well and the children come to expect they'll succeed -- a self-reinforcing positive feedback loop is created.

No wonder children at-risk fall progressively farther behind other children over the school years.

That widening achievement gap may result from 2 feedback loops going in opposite directions.

Improving EFs early might nip that in the bud.

Thus early EF training might be an excellent candidate for reducing inequality (because it should improve the EFs of the most needy children most) -- thus heading off gaps in achievement and health between more- and less-advantaged children.

2. EF training appears to transfer, but the transfer is not wide.

   For ex., computerized working memory training improves working memory but not self-control, creativity, or flexibility.

Commercial computerized training programs are claiming widespread cognitive benefits but beware:

Wide transfer does not occur

(on the rare occasions where it has been found, those findings have not been replicated).

People improve on the skills they practice & that transfers to other contexts where those same skills are needed -- but people *only* improve on what they practice – improvement does not transfer to other skills.

To see widespread benefits, diverse skills must be practiced.

Because of that, real world activities such as martial arts & certain school curricula (that train diverse executive-function abilities) have shown more widespread cognitive benefits than targeted computerized training.

3. EFs need to be continually challenged to see improvements - not just used, but challenged.

Consistent with: what Ericsson reports is key for being truly excellent at anything -- need to keep trying to master what is just beyond your current level of competence and comfort

(working in what Vygotsky would call the 'zone of proximal development')

Groups assigned to the same program, but without difficulty increasing, do not show EF gains.

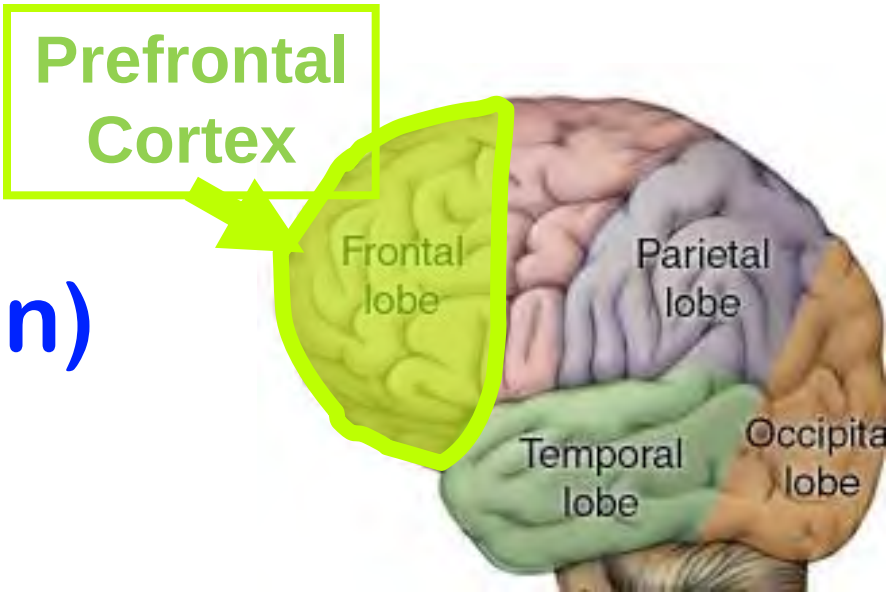
Setting aside a time to work on EFs is less effective than working on EFs as part & parcel of everything you do.

The Importance of Repeated Practice

Whether EF gains are seen depends on the amount of time spent practicing, working on these skills, pushing oneself to improve.

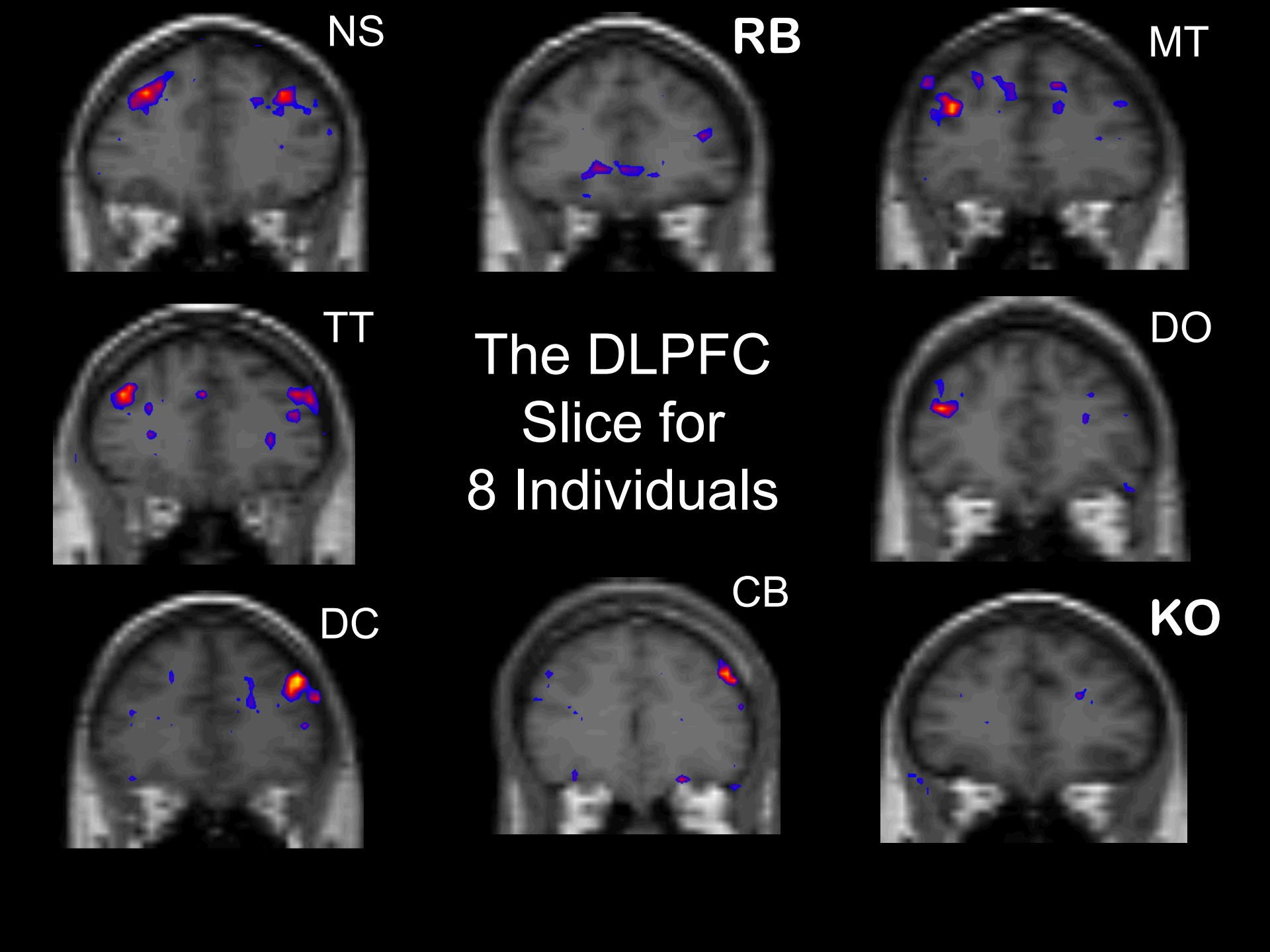
Executive Functions depend on Prefrontal Cortex and the other neural regions with which it is interconnected.

Prefrontal cortex
(what I specialize in)
is over-rated.



To learn something new, we need prefrontal cortex.

But after something is no longer new, persons who perform best often recruit prefrontal cortex *least*.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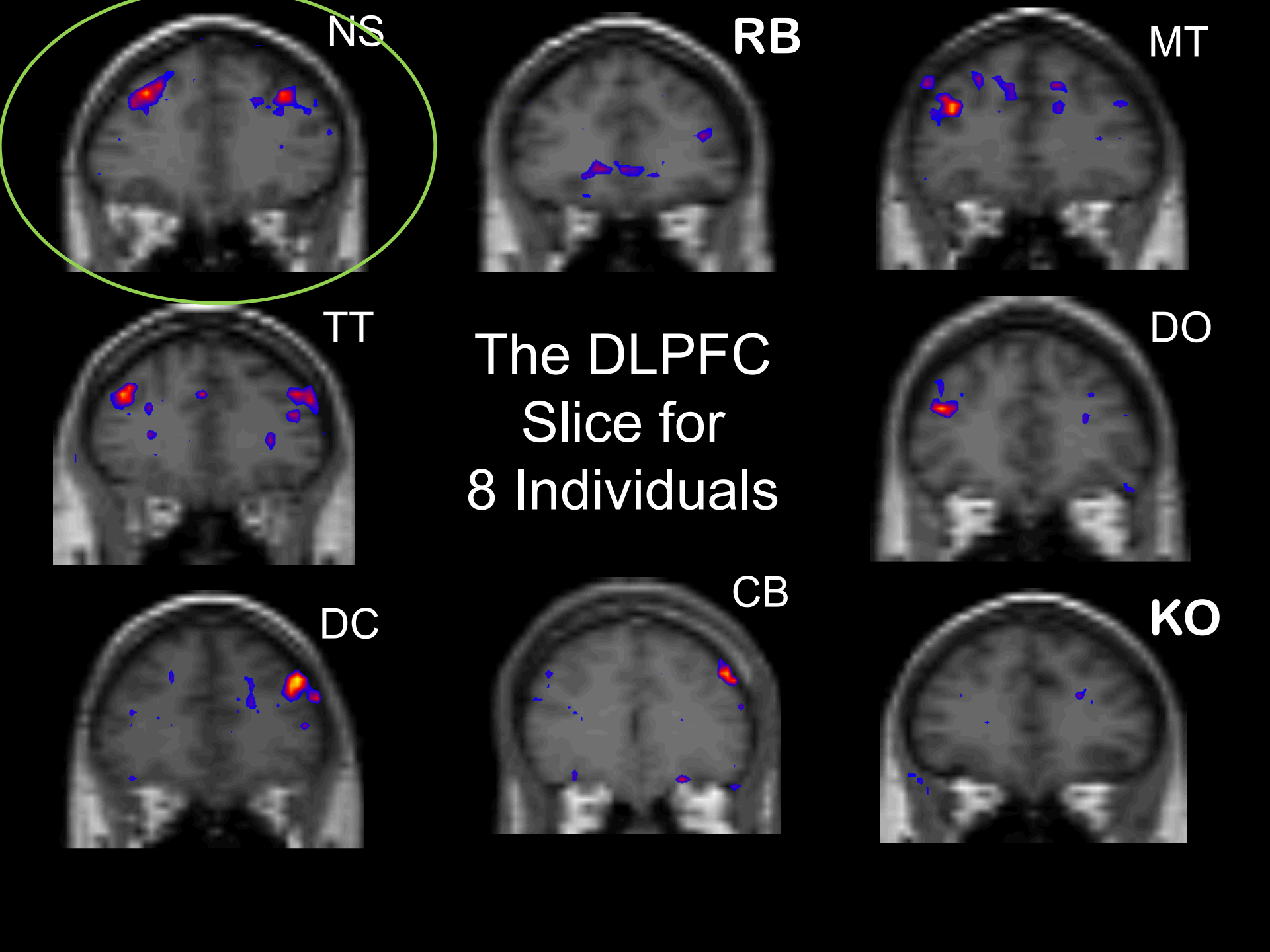
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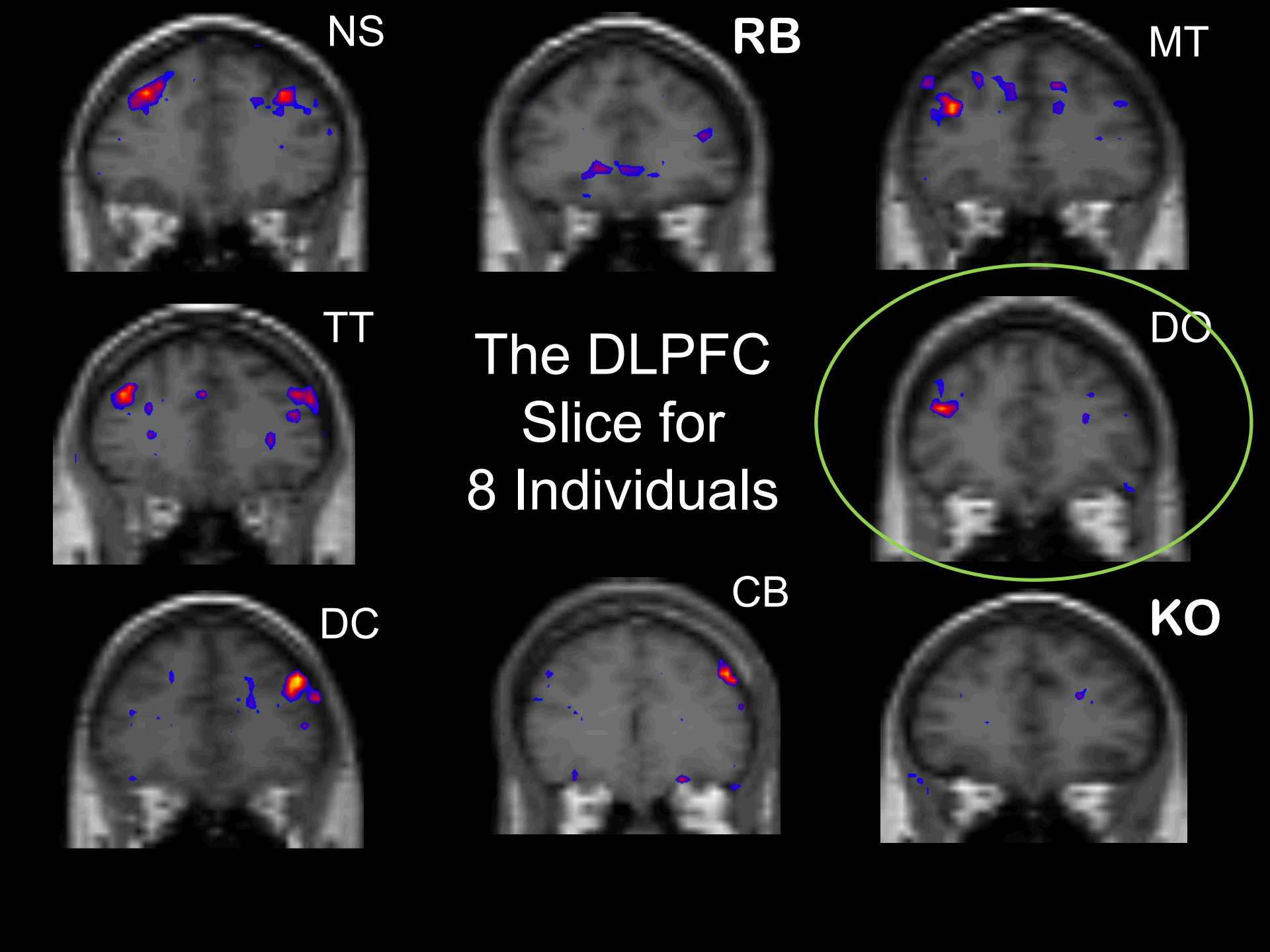
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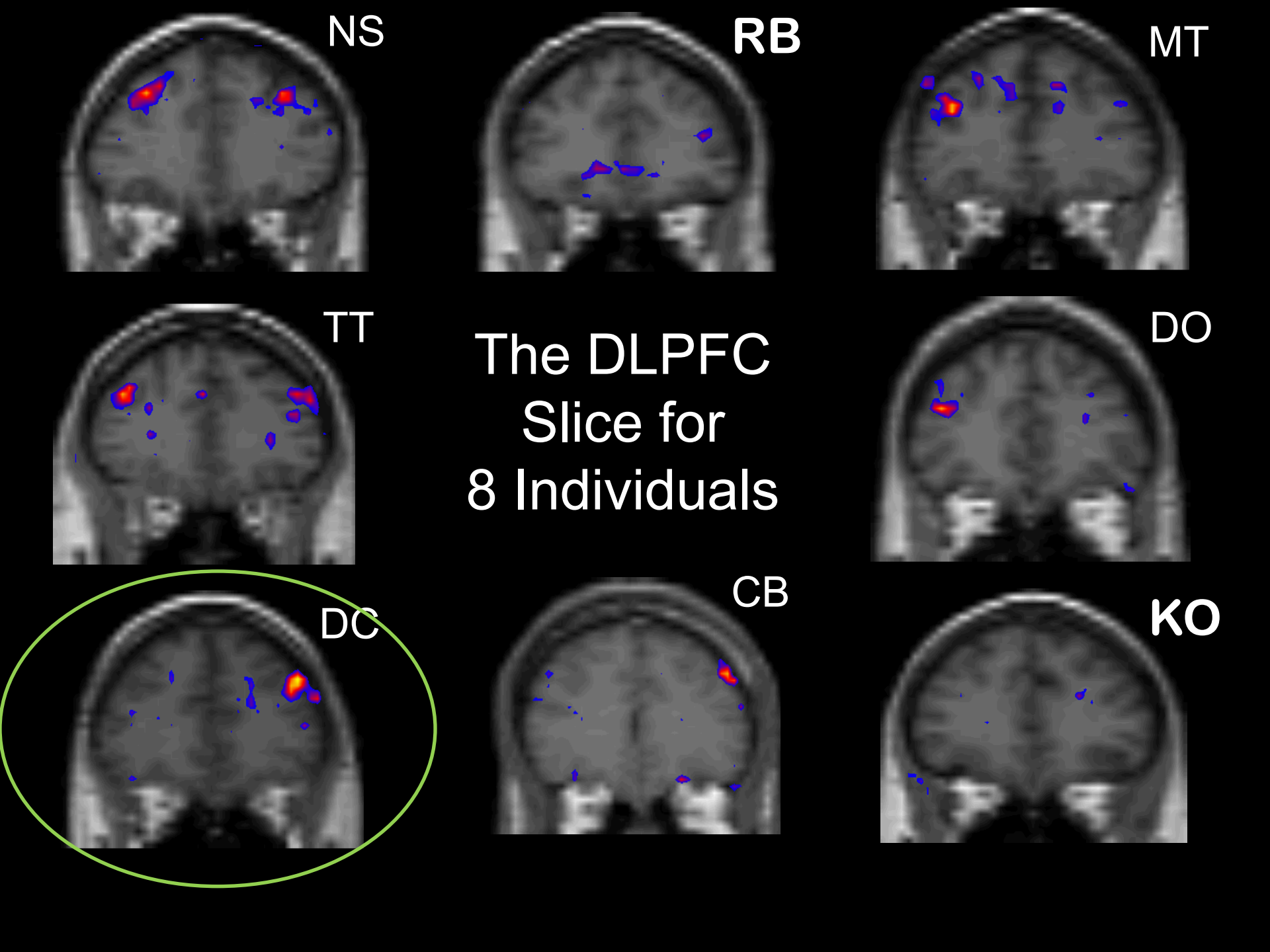
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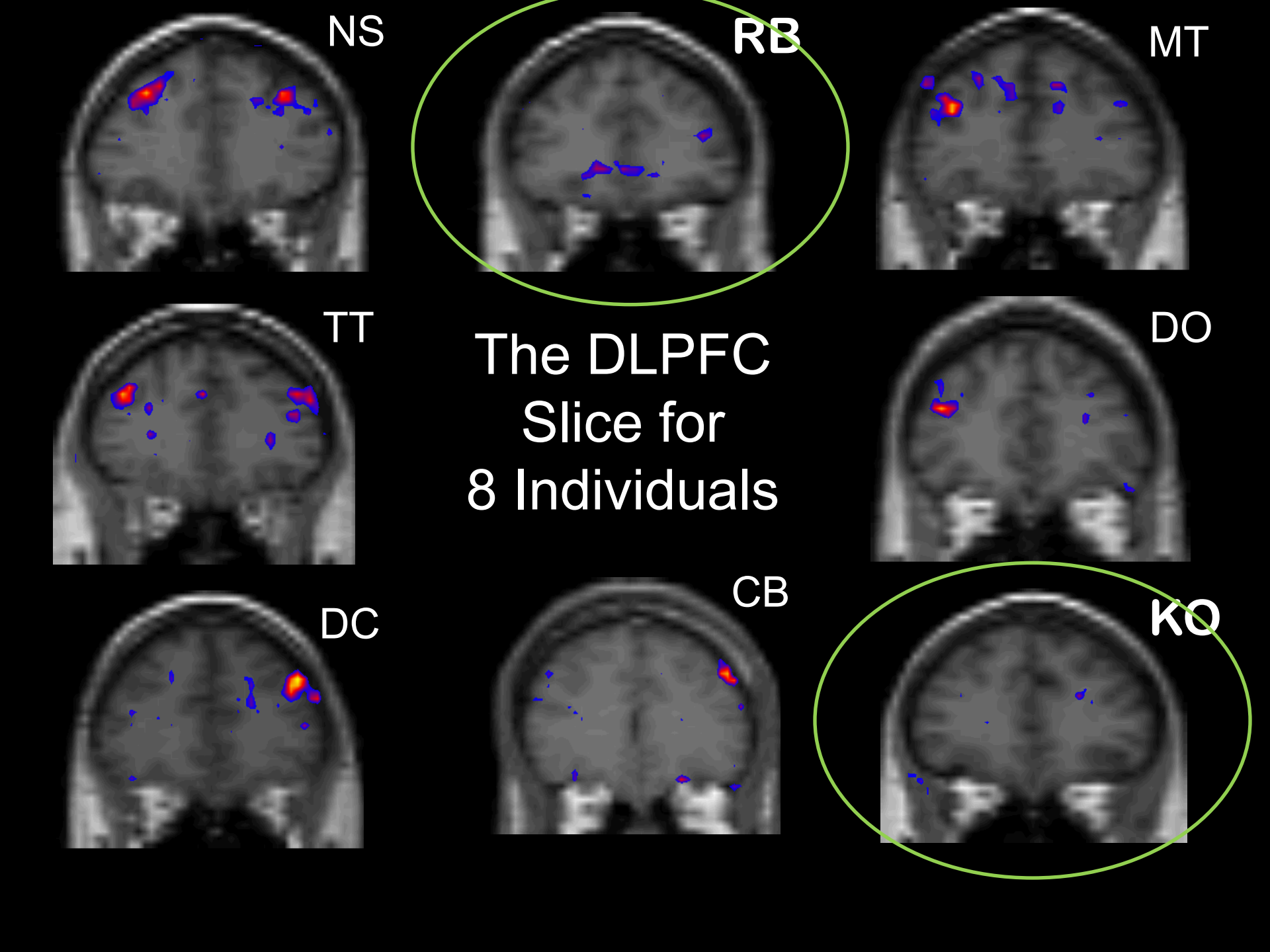
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When something is new, those who recruit PFC most, usually perform best.

(Duncan & Owen 2000, Poldrack et al. 2005)

But when you are really good at it, you are NOT using PFC as much.

(Chein & Schneider 2005, Garavan et al. 2000, Landau et al. 2007, Milham et al. 2003, Miller et al. 2003)

Want to be able to use PFC whenever you…

.. are presented with the unexpected,

.. need to think outside the box,

.. need to concentrate particularly hard,

.. need to adapt to change…

BUT

Want most tasks to be so familiar and well learned that PFC is NOT needed.

Want those tasks to be handed off to subcortical regions that have had 100,000s of more years of evolutionary time to perfect their functioning and can subserve task performance ever so much more efficiently than can PFC.

(re: *Zen and the Art of Archery*)

A child may know intellectually (at the level of PFC) that he should not hit another, but in the heat of the moment if that knowledge has not become automatic (passed on from PFC to older brain regions) the child will hit another (though if asked, he knows he shouldn't do that).

knowing what one should do

vs.

2nd nature (automatic)

(i.e., NOT dependent on PFC)

The only way something becomes automatic (becomes passed off from PFC) is through action, repeated action.

Nothing else will do.

"We are what we repeatedly do.
Excellence, then, is not an act, but a habit.

We don't act rightly because we have virtue or excellence, but we rather have these because we have acted rightly; these virtues are formed in a person by doing the actions;
we are what we repeatedly do."

Aristotle, *Ethica Nicomachea*, 4th century BC

"Our virtues are habits as much as our vices. Our nervous systems have grown to the way in which they have been exercised, just as a sheet of paper or a coat, once creased or folded, tends to fall forever afterward into the same identical folds.

No matter how good one's sentiments may be, if one has not taken advantage of every concrete opportunity to act, one's character [will] remain entirely unaffected…A tendency to act only becomes effectively ingrained in us in proportion to the… frequency with which the actions actually occur."

- William James

How can someone practice a skill he or she is not yet capable of performing on his or her own unaided?

The answer: Scaffolds

Scaffolds enable children to practice skills they would not otherwise be able to practice.

Buddy Reading

Non-verbal signs and symbols aid comprehension and memory.

The Importance of

…Action for Learning

…Learn through Doing

at any age, but especially for young children

a Chinese proverb:

I hear, and I forget.

I see, and I remember.

I do, and I understand.

If information is not relevant for action, we don't pay attention in the same way (hence the difference in route memory for the driver, versus the passenger, of a car).

Hands-on Learning

We evolved to be able to learn to help us act, to help us do what we needed to do.

If information is not relevant for action, we don't pay attention in the same way (hence the difference in route memory for the driver, versus the passenger, of a car).

You learn something when you NEED it for something you want to DO.

(My son teaching me to program the VCR)

The same is true when we teach children in school. They need opportunities to concretely apply what they are taught.

This is important because little kids are not built to sit still for any length of time listening to verbal instruction,
esp. little boys.
Trying to force young children do that will cause many children to dread school &
to form long-lasting perceptions of themselves as stupid & unable to learn.

Young children are not smaller college students.
It is not developmentally appropriate to try to make them sit for 20 minutes listening to a lesson.
Young children's learning needs to be active and hands on.

Many concepts can, and should, be introduced visually and tactilely before they are introduced using language. It helps a great deal to give children experiences with concepts first before attaching verbal labels to them.

For example, by playing with the pegboards you see below, children learn about the concepts of height & diameter without those words ever being used.

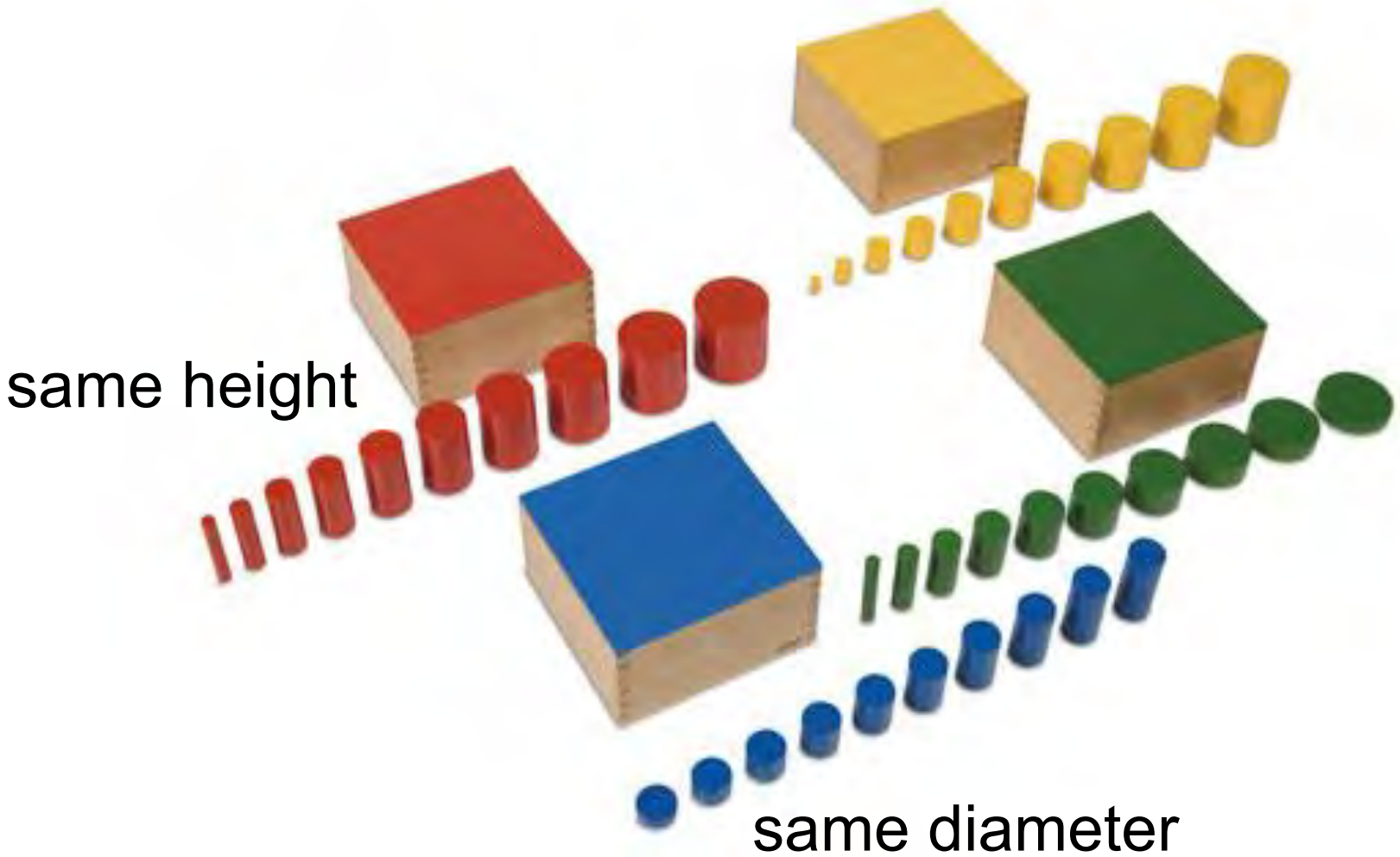
By the time those words are introduced, children have a deep understanding of the concepts.

same height

differ only in diameter

same diameter

differ only in height


same height
same diameter

Dangerous Fallacies:

The earlier you start teaching academic subjects, the better children will be at academic subjects.

If we don't start academics early, your children will never catch up.

(academics is DIFFERENT from early education)

Children need early EDUCATION

(at ages 3-5)

active, hands-on learning, play

They do NOT need early

ACADEMIC INSTRUCTION

at ages 3-5

It is NOT true that children need basic literacy skills to be ready for school.

Children need basic

language skills

-- ORAL LANGUAGE --

to be ready for school.

The difference in the number of words that middle-income & low-income children HEAR in the US in the first 3 years of life is HUGE (25 million words).

By 3 years of age, children in the US whose parents are professional KNOW more than twice (2x) as many words as children whose parents are on welfare.

Vocabulary assessed at age 3 strongly predicts reading comprehension at 9-10 years of age.

Hart and Risley (1995). *Meaningful Differences*

(see also Hoff, 2002, 2003, 2013; Rowe et al., 2013; Pancsofar & Vernon-Feagans, 2010)

Oral language is the foundation of early literacy (Paris & Paris, 2003; Kirkland and Patterson, 2005; Kendeou et al., 2009).

Young children need to be exposed to A LOT of RICH ORAL LANGUAGE.

The more interaction, the more conversation between someone relating a story (thru reading or storytelling) & the children, the more actively engaged the children are, the more their vocabulary improves.

The conversation that takes place in the context of reading seems to have more benefit than the reading itself.

Over the course of evolution our brains became adapted to acquire oral language. We are biologically predisposed to acquire oral language.

But reading is too new; we have no biological predisposition for that.

Some children can easily learn to read at an early age. But critically, for others it is beyond their ability at that young age.

We don't want children thinking they are failures

We want children to LOVE learning & enjoy school, not to feel that they can't learn & hate school.

Finland -- Children don't start school or begin to read until they are 7. Yet Finnish children score the best of any children in the entire world in PISA testing in Grade 4.

Children drilled in reading in K will test better on reading at the end of K than children steeped in oral language in K (who haven't received the same instruction in reading),

but by the end of 2nd grade, I predict that those steeped in oral language in K will probably be the better readers.

Very often what produces the best short-term outcomes is different from what produces the best long-term outcomes

Rosenbaum et al., 2001;

many papers by Robert Bjork's lab 2007-2012

When you have hands-on learning, when children are able to work on their own or in pairs or small groups then teachers can then give each child individual attention:

to observe, to listen, & to teach

(provide individual instruction)

And each child can progress at his or her own pace.

The teacher then acts as a scientist,
testing out hypotheses about

- why is a particular child having difficulty?
- what kind of assistance might be most helpful to that child?
- are any children ready for new challenges?

That's not easy. It is at least as demanding as my scientific work.
It takes training.

But anyone can be trained.

The Director of the International Montessori Assoc. has been working in a Displaced Persons Camp in Kenya, training the mothers to be the Montessori teachers for their children.

These women were illiterate.

They had no fancy materials. They were taught to make all the teaching materials from scratch from what they could find in the camp.

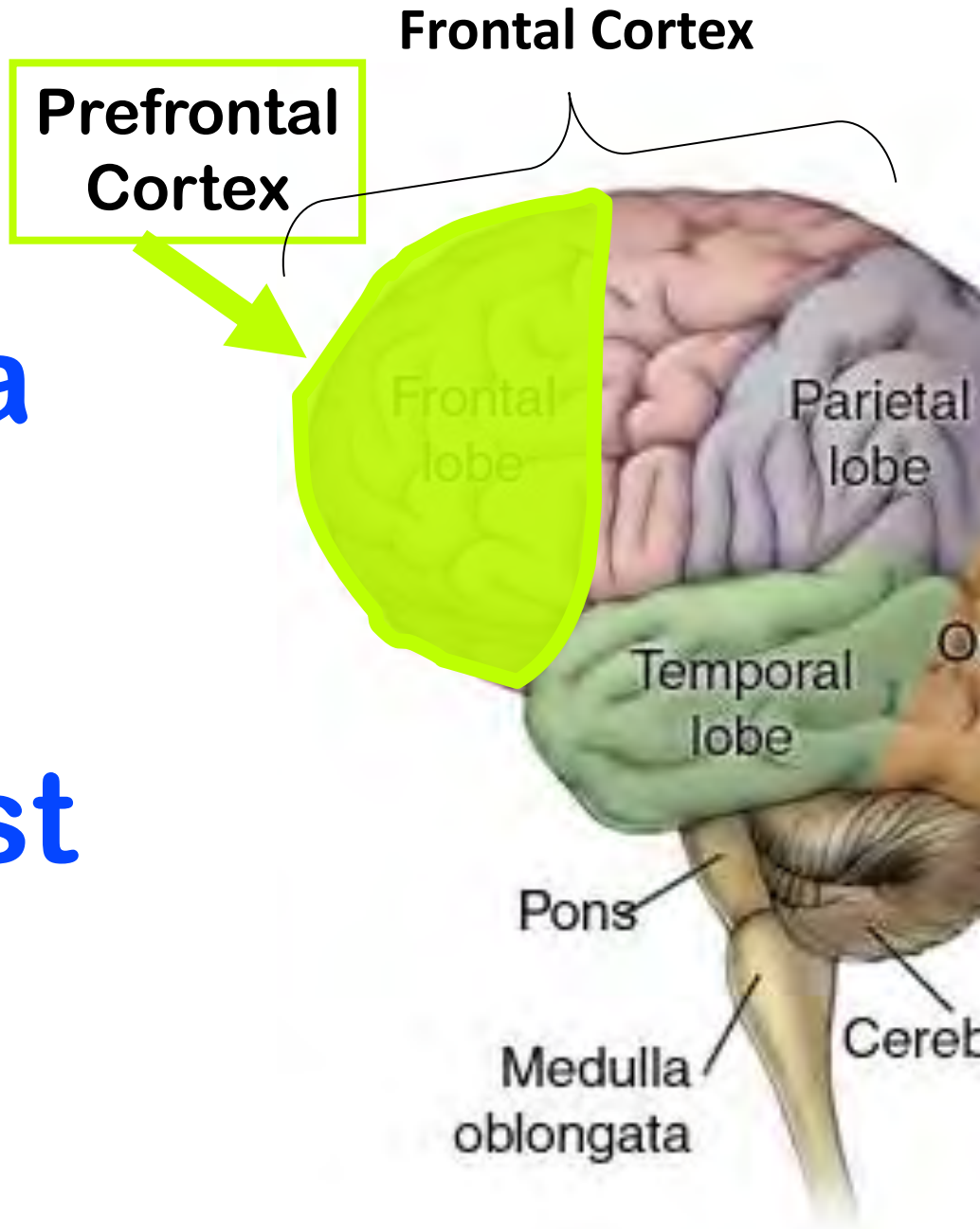
Almost any activity can be the way in, can be the means for disciplining the mind and enhancing resilience.

MANY activities not yet studied might well improve EFs.

I predict that the activities that will *most successfully* improve EFs will not only work on training and improving EFs but will also *indirectly support* EFs by lessening things that impair EFs and enhancing things that support EFs.

What things impair and what things support EFs?

PFC is the newest area of the brain and the most vulnerable.



Nowhere is the importance of social, emotional, and physical health for cognitive health more evident than with PFC & EFs.

PFC & EFs are the first to suffer, & suffer most, if we are

- sad or stressed
- lonely
- or not physically fit

Conversely, we show better EFs when we're happy, feel socially supported, & we're physically fit.

To show the EFs they are capable of, to achieve the academic outcomes of which they are capable, children need to

- feel joyful and relaxed (not stressed)
- feel they are in a supportive community they can count on, and
- their bodies need to be fit and healthy.

Our brains work better when we are not in a stressed emotional state.

Amy Arnsten, 1998
The biology of being frazzled
Science

This is *particularly* true for PFC & EFs.

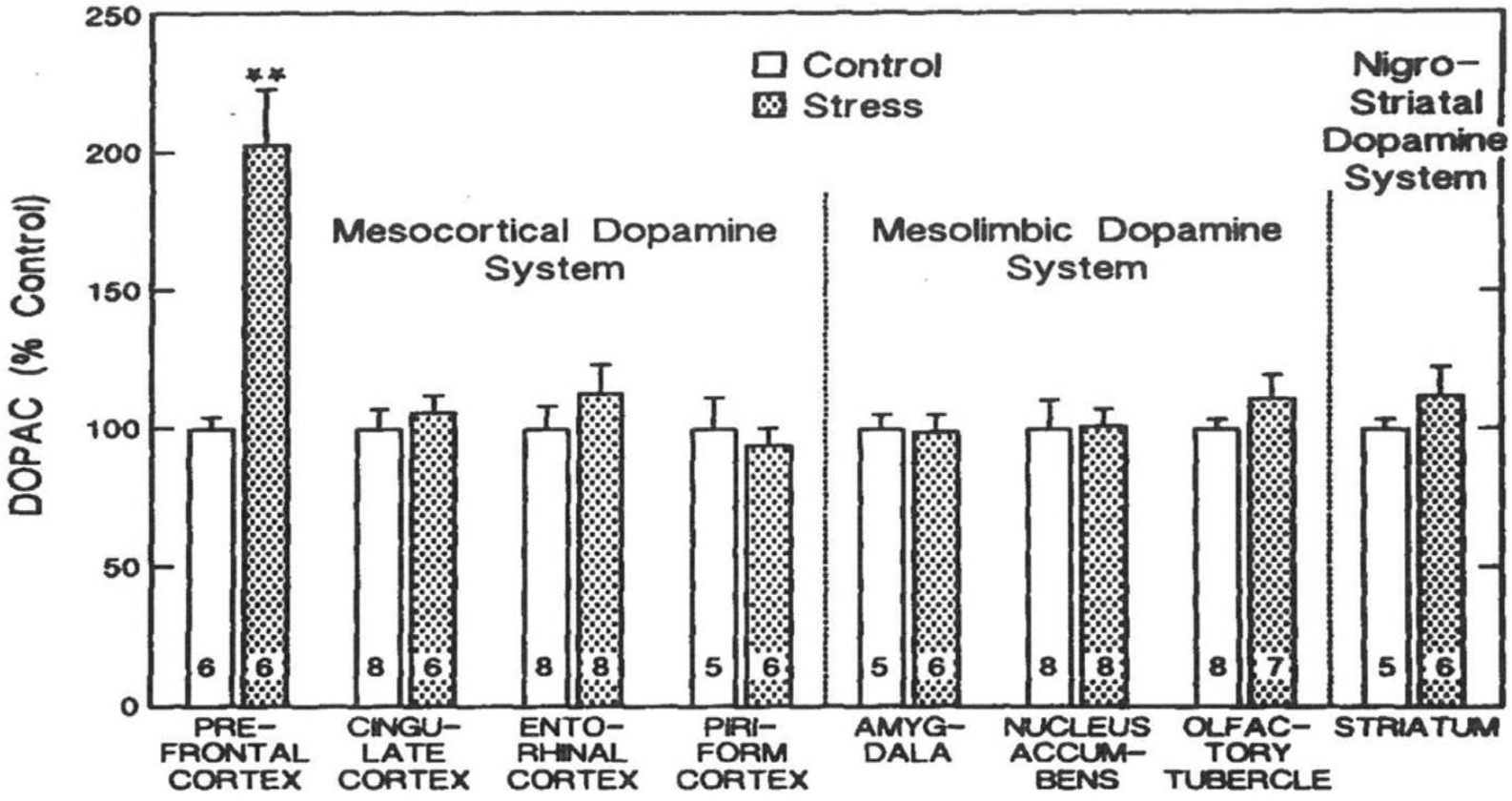
Stress impairs Executive Functions and can cause anyone to look as if he or she has an EF impairment (like ADHD) when that's not the case. (You may have noticed that when stressed you cannot think as clearly or exercise as good self-control.)

Dopamine is a critically important neurotransmitter in prefrontal cortex and in the striatum.

One way neurons communicate with one another is by one neuron releasing dopamine and the other neuron taking it up with dopamine receptors.

Stress and Prefrontal Cortex

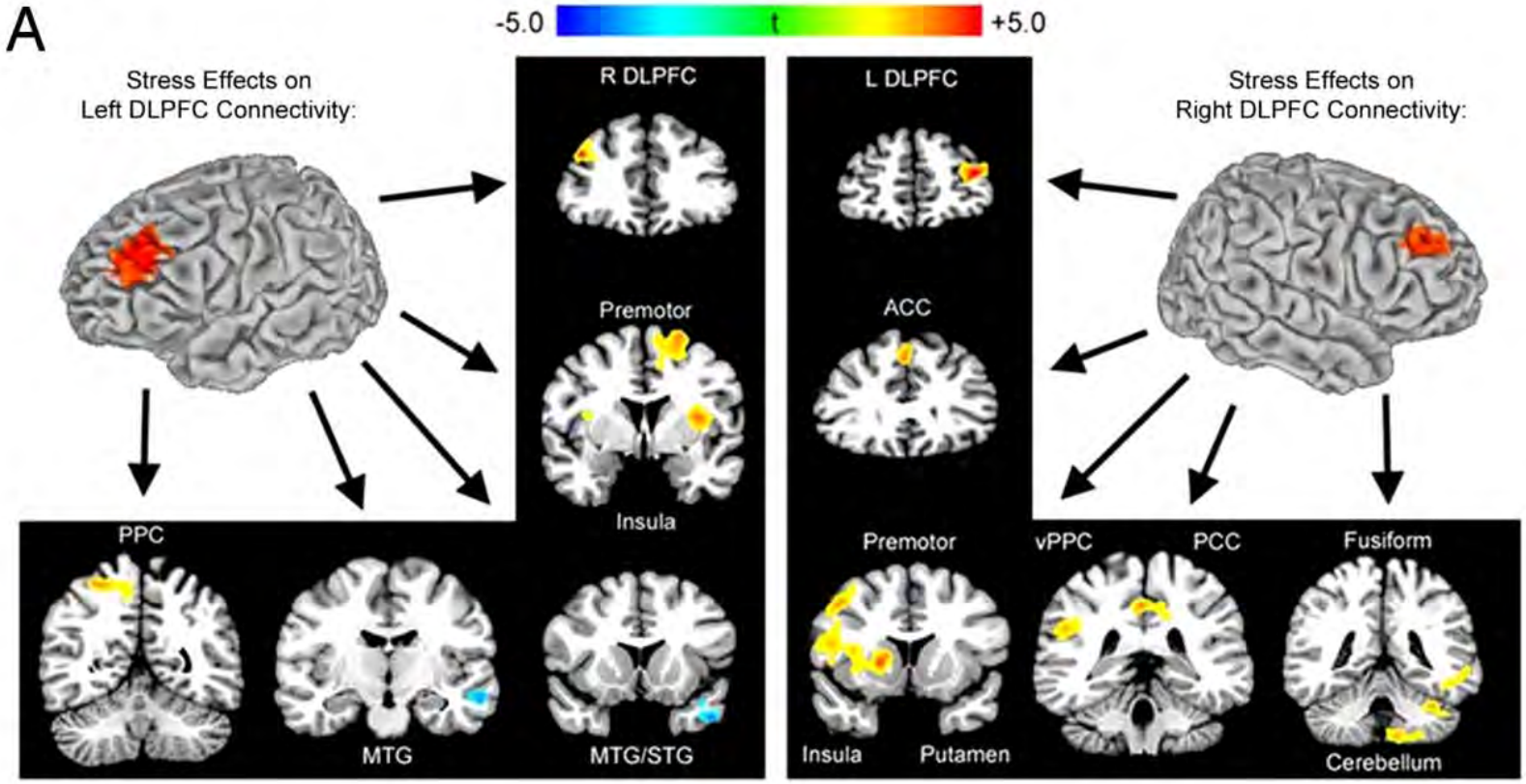
Even mild stress increases DA release in PFC but not elsewhere in the brain



(Roth et al., 1988)

In humans (& primates in general) there are more glucocorticoid receptors in PFC than in the hippocampus (the reverse of what's true in rodents).

Sánchez MM, Young LJ, Plotsky PM, Insel TR (2000)
Distribution of Corticosteroid Receptors in the Rhesus Brain.
J Neurosci, 20, 4657-4568.



In college students, one month of stress in preparation for a major exam disrupts prefrontal cortex functional connectivity.

Stress decreases coupling between left DL-PFC and right DL-PFC, and between DL-PFC and premotor cortex, the ACC, the insula, posterior parietal cortex (PPC), and the cerebellum.

Liston et al. (2009) *PNAS*

When we are sad we're worse at filtering out irrelevant information (i.e., worse at selective attention).

Desseilles et al., 2009
von Hecker & Meiser, 2005

When we are happy we are better at selective attention.

Gable & Harmon-Jones, 2008

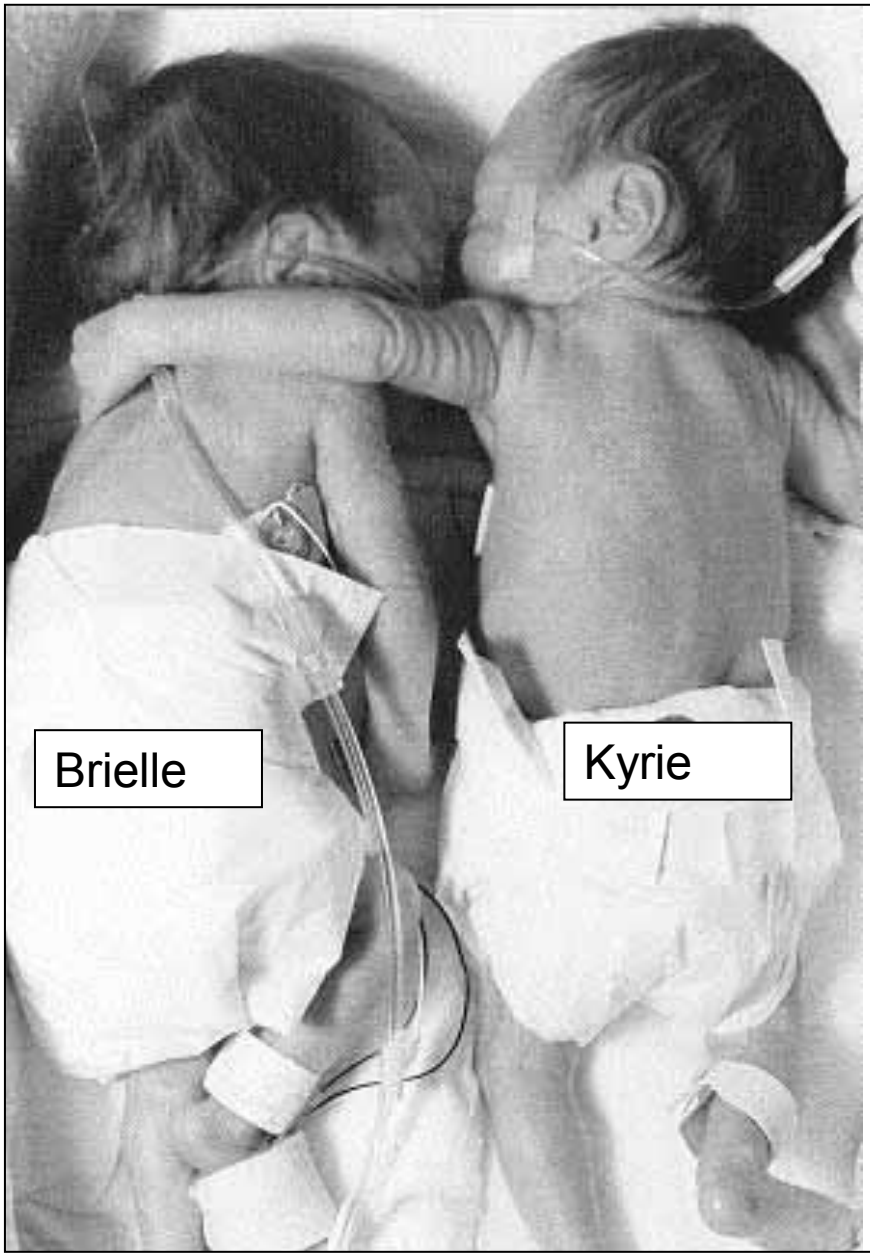
People show more creativity when they are happy

THE most heavily researched predictor of creativity in social psychology is mood.

The most robust finding is that a happy mood leads to greater creativity (Ashby et al. 1999). It enables people to work more flexibly (Murray et al. 1990) & to see potential relatedness among unusual & atypical members of categories (Isen et al. 1985, 1987).

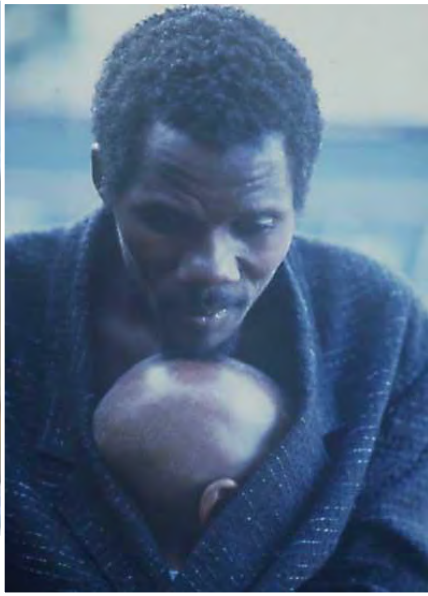
Hirt et al. 2008: 214

Touch relieves Stress

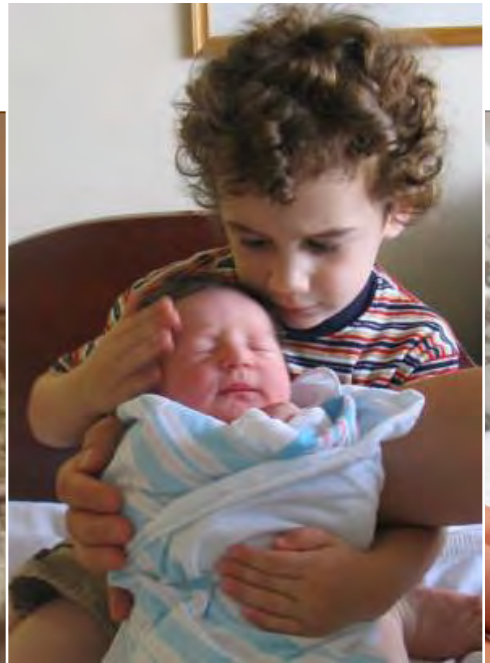


Born 12 weeks early, these twins were whisked into separate incubators. Brielle (on the left) had breathing and heart-rate problems, didn't gain weight, and fussed when anyone tried to comfort her. Finally a nurse put the two sisters together. As Brielle dozed, Kyrie wrapped her arm around her smaller sibling. With her sister nearby, Brielle began to calm down and thrive. Sooner than expected, the girls went home.

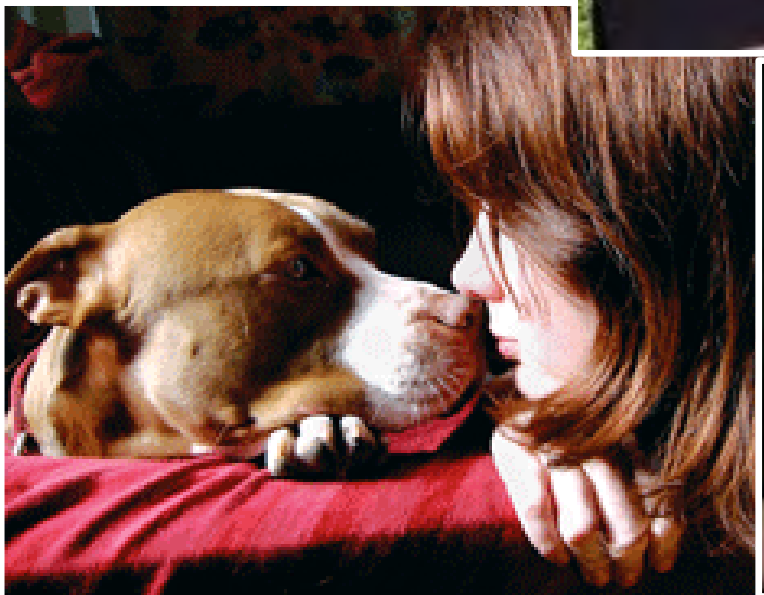
first reported in the *Worcester Telegram & Gazette* Nov. 18, 1995
picked up by *Life Magazine*, June 1996



Hugs are the best medicine.



Pets can reduce stress



Pets teach us about gentleness, patience, & never holding a grudge

The presence of a dog in the classroom reduces stress and helps children perform better.

Gee, N. R., Church, M. T., & Altobelli, C. L. (2010). Preschoolers make fewer errors on an object categorization task in the presence of a dog. *Anthrozoös, 23, 223-230.*

Gee, N. R., Crist, E. N., & Carr, D. N. (2010). Preschool children require fewer instructional prompts to perform a memory task in the presence of a dog. *Anthrozoös, 23, 173-184.*

Gee, N. R., Harris, S. L., & Johnson, K. L. (2007). The role of therapy dogs in speed and accuracy to complete motor skills tasks for preschool children. *Anthrozoös, 20, 375-386.*

Beetz, A., Julius, H., Turner, D., & Kotrschal, K. (2012). Effects of social support by a dog on stress modulation in male children with insecure attachment. *Frontiers in Psychology, 3*.

Beetz, A., Kotrschal, K., Turner, D. C., Hediger, K., Uvnäs-Moberg, K., & Julius, H. (2011). The effect of a real dog, toy dog and friendly person on insecurely attached children during a stressful task: An exploratory study. *Anthrozoös, 24, 349-368.*

Exercise Reduces Stress

Exercise in almost any form can act as a stress reliever.

Williamson et al. (2001) Mood change through physical exercise in nine- to ten-year-old children. *Perceptual Motor Skills. 93*(1):311-316.

Carmack et al. (1999). Aerobic fitness and leisure physical activity as moderators of the stress-illness relation. *Annals of Behavioral Medicine* (1999), *21*(3): 251-257

Lane & Lovejoy (2001) The effects of exercise on mood changes: the moderating effect of depressed mood. *Journal of Sports Medicine and Physical Fitness, 41*:539-545

Meditation can reduce stress.

Walking meditation is more age-appropriate for little kids than sitting meditation.

An activity from Montessori schools, that is essentially a type of walking meditation.

Everyone (even the grown-ups) gets a bell and walks in a line or circle. The goal is for no one's bell to make a sound.

If you're stressed,
you can't be the
teacher or parent you
want to be.

If you're stressed,

your children will pick on it.

It will cause them to feel stressed.

And if they're stressed, their EFs will suffer & therefore their school performance will suffer.

RELAX

You're not perfect.

You're going to make mistakes.

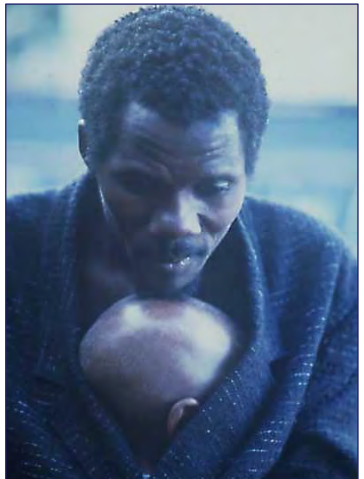
I can guarantee 100% that worrying about whether you're a good enough parent or teacher will NOT improve your parenting or teaching – it will only make it worse.

Imperfect ≠ Worthless

Even the people
you most respect
make mistakes and
have done things they regret.
EVERYONE makes mistakes.
Everyone is imperfect.
Yet each of us is wonderful in our own way – despite being imperfect.
And you can be a TERRIFIC parent even though you aren't the perfect parent.

Your humanity is more important than your knowledge or skill or doing the textbook-perfect thing.




The Spirit rather than the Technique

Who would you rather listen to….

the musician who plays from the heart or the musician with absolutely perfect technique but no heart?

You can do the textbook-perfect thing, but if it doesn't come from the right place, it will not have the desired result.

Jerome Frank conducted a study comparing many different forms of psychotherapy to.

He concluded:

Regardless of which form of psychotherapy, the most successful clinical outcomes were achieved by….

those who cared deeply about their patients and were able to communicate that caring to the patients

Jerome Frank concluded that:

"A totally untrained therapist who exercises a great capacity to love will achieve psychotherapeutic results equal to the best."

The best body of work on the relative effectiveness of different forms of psychotherapy

can be found in Bruce Wampold's 2001 book:

The Great Psychotherapy Debate: Models, Methods, and Findings

He concluded that:

the client-therapist relationship trumps technique hands down.

"Clients respond more to the quality of the therapeutic relationship than to this new technique or that.... The evidence shows that specific [techniques do not guarantee success] in and of themselves. Therapists need to realize that [clinical know-how, while necessary, is effective] only in the sense that it is a component of the healing context. Slavish adherence to a theoretical protocol [or] approach is utterly in opposition to science. Therapists need to have a healthy sense of humility with regard to the techniques they use." - Wampold

The British Medical Journal asked people what makes a good doctor:

The majority of people responded:

"A good doctor, is first and foremost, a good human being."

The same is true for parents and teachers

What matters most in Early Childhood Education?

Not the # of children

Not the caregiver: children ratio

Not having the best materials

but the caring relationship between the teacher and the children

As international studies show (e.g., Melhuish , 1990 a & b)

Save money on equipment & high tech gadgets

Spend money on teacher training & teacher salaries






Don't have much money? Can't afford the newest toys or gadgets? Relax.

Your humanity is more important than material possessions or even doing the textbook-perfect thing.

Your caring -- your openness to truly listen; being there for a child when he or she needs you - is more important than your knowledge or skill.

The most powerful way to communicate to our children that we care about them is to listen to them. Truly listen.

Give them our time and our attention.

The quality of our listening, rather than the wisdom of our words, is often what has the most impact.

“The principal form that love takes is giving of your time….being willing to listen….When something is of value to us we spend time with it. So it is when we love our children…. we give them our time. True listening, total concentration on the other, is always a manifestation of love.”

Scott Peck

"Perhaps the most important thing we ever give each other is our attention. And especially if it's given from the heart..."

"Listening is the oldest and perhaps the most powerful tool of healing."

-- Dr. Rachel Naomi Remen

Fire

What makes a fire burn
is space between the logs,
a breathing space.
Too much of a good thing,
too many logs
packed in too tight
can douse the flames
almost as surely
as a pail of water would.

So building fires
requires attention
to the spaces in between,
as much as to the wood.

When we are able to build
open spaces
in the same way
we have learned
to pile on the logs,
then we can come to see how
it is fuel, and absence of the fuel
together, that make fire possible.

We only need to lay a log
lightly from time to time.
A fire
grows
simply because the space is there,
with openings
in which the flame
that knows just how it wants to burn
can find its way.

- Judy Brown

Mindful Listening means staying fully in the present moment, giving a child your *full*, undivided attention.

That's not so easy.

To do that you need to set aside your own worries and preoccupations, thinking about what you need to do next, even trying to anticipate where your child's train of thought is going or whether you are sufficiently in tune with your child.

Listening with your heart as well as your head -- listening not just to the words but to what's unspoken.

But it is *so* worth it:

"The greatest gift
I can conceive of
having
from anyone
is
to be seen by them,
heard by them,
to be understood."

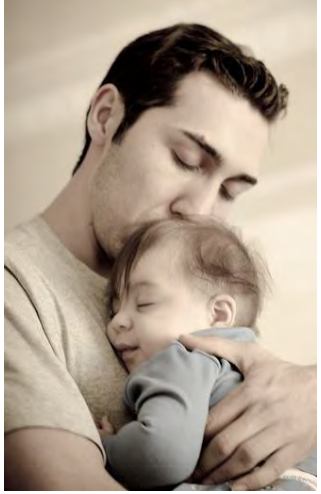
-- Virginia Satir

It's so powerful is to be heard / understood –
and to be liked anyway.

Children need to feel heard –
feel seen and accepted
for who they are.

We bring with us issues from our own past that can impair our ability to listen. Experiences that are not fully processed may create unresolved and leftover issues that influence how we react to our children. These issues can easily get triggered in the parent-child relationship.
At these times, we're not acting like the parent we want to be and are often left wondering why parenting sometimes seems to "bring out the worst in us.

Siegel & Hartzell (2004)



Attachment is what we call the love between a baby and a caregiver.

Before the term ‘attachment’ existed, **ERIK ERIKSON** called this

BASIC TRUST, which he defined as

- knowing beyond any shadow of a doubt that you are loved
- feeling the world is basically a good, safe, trustworthy place
  - where you’ll be helped if you need it
  - where things make sense and are predictable.

He considered this ‘the cornerstone of a healthy personality.’

The major insight of Mary Main et al. (1985): the direct intergenerational transmission of relationship patterns, while relatively common, is NOT inevitable.

Some parents who experienced abusive or rejecting relationships growing up have children who are securely attached to them.

What distinguished that group of parents, from other parents with similarly unfortunate childhoods whose own children were insecurely attached, was their ability to discuss adverse childhood experiences with emotional openness, coherence, and reflective insight. They seemed to have come to terms with what had happened to them, and had gained an understanding why their parents had behaved as they did.

The outcome can be AS GOOD for those insecurely attached IF they have organized their attachment experience into a coherent story.

Putting feelings into words reduces stress.

If you can get people to talk or write about their problems, their psychological and physical health improves.

--- James Pennebaker,
Opening Up: The Healing Power of Expressing Emotions

Writing forces some degree of structure and organization of one's thoughts. When writing, the thinking process slows down.

The act of repeatedly telling about your experience results in both an organization of the event and a summarizing of it. Over days, the description of the event is gradually shortened and summarized.

Constructing stories -- day by day, as you write, the episode takes on shape as a coherent story.

Any type of event is less overwhelming and easier to think about once it is summarized.

Once organized, events are often smaller and easier to deal with.

Painful feelings we try to ignore or suppress NEVER go away or subside as long as we keep them buried. The only way they lose their strength is by our confronting them.

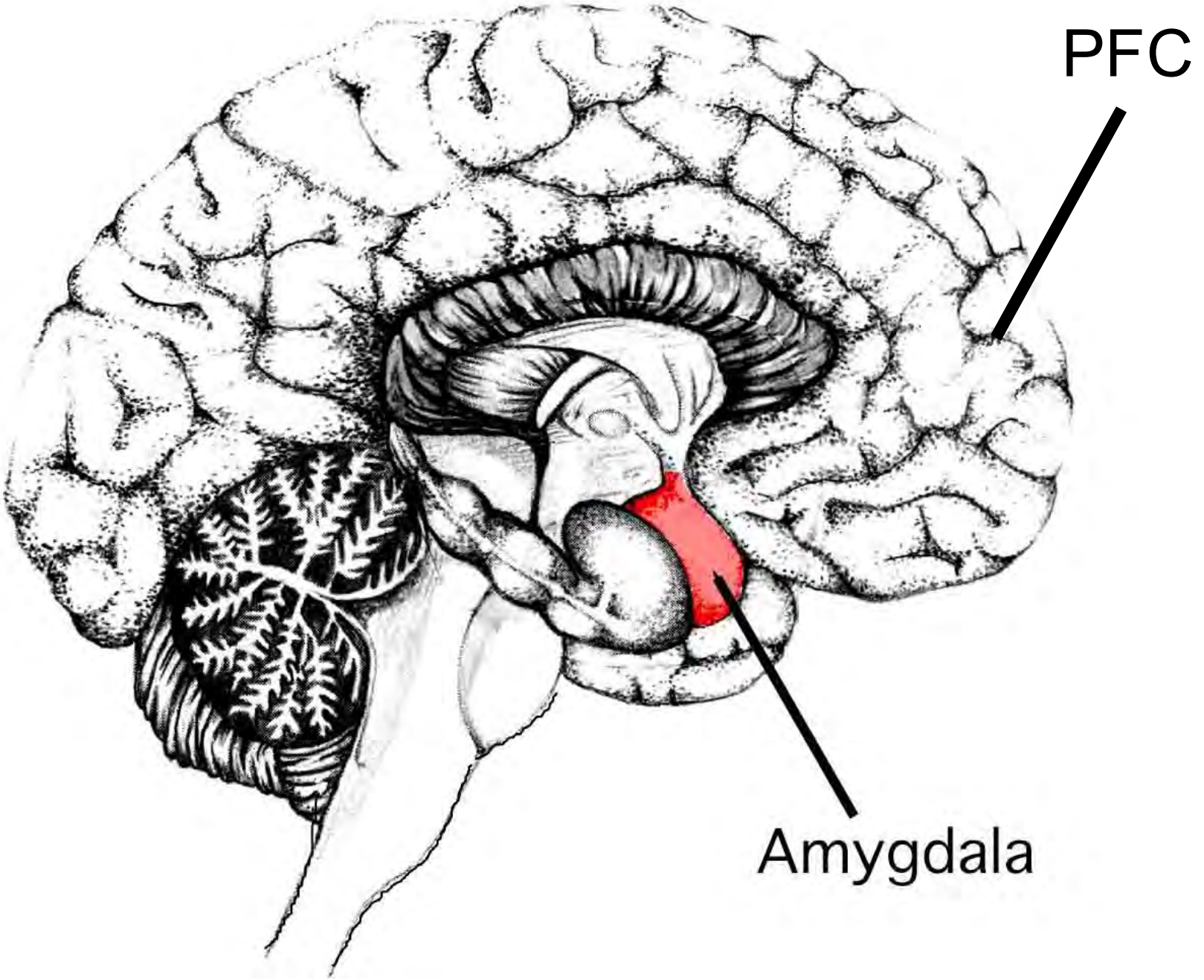
Zeigarnik Effect: the mind keeps working on things that aren't complete.

Coming to an understanding allows closure.

Zeigarnik, 1967

Putting Feelings Into Words Produces Therapeutic Effects on the Brain

When you put feelings into words, you increase activation in prefrontal cortex and that produces a reduced response in the amygdala.


PFC
Amygdala

a

Affect Label

SCARED ANGRY

b

Affect Match

c

Observe Affect

d

Gender Label

SAMUEL HELEN

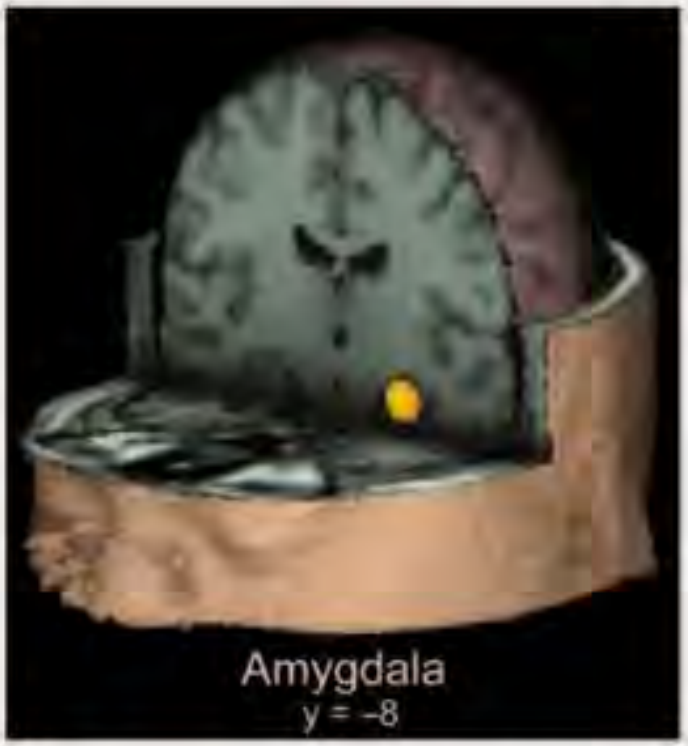
e

Gender Match

f

Shape Match

Amygdala activation went up in ALL conditions when an angry or fearful face was shown, but ONLY in the one condition (a) where subjects had to assign a verbal label to the emotion, did amygdala activation GO DOWN.



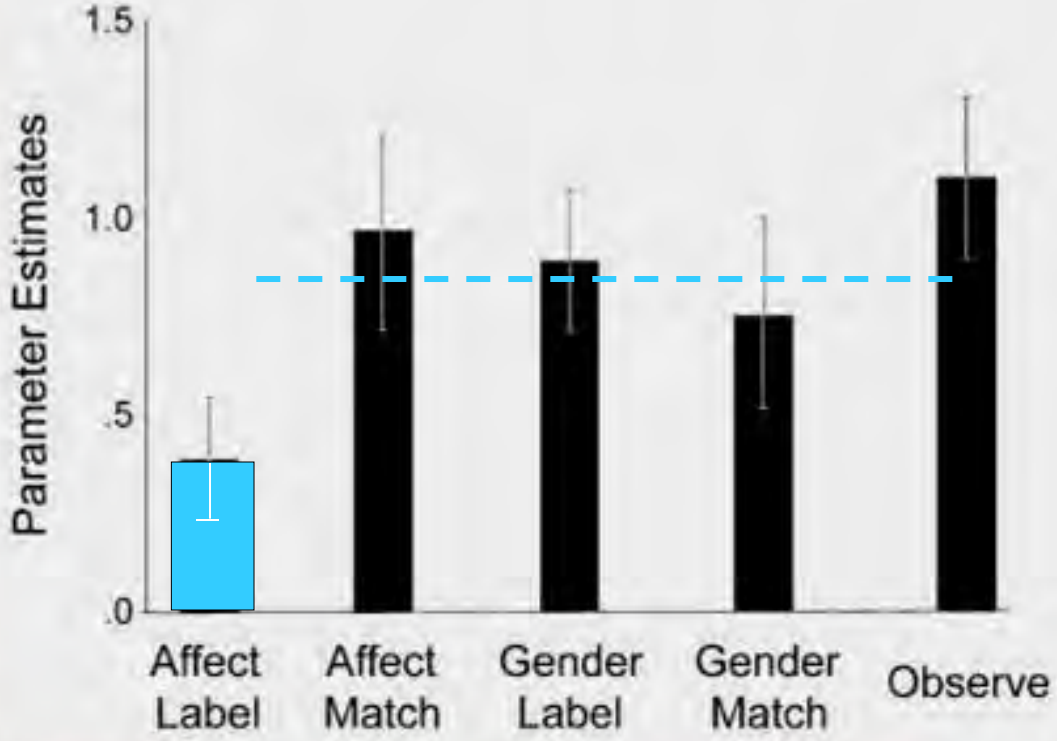
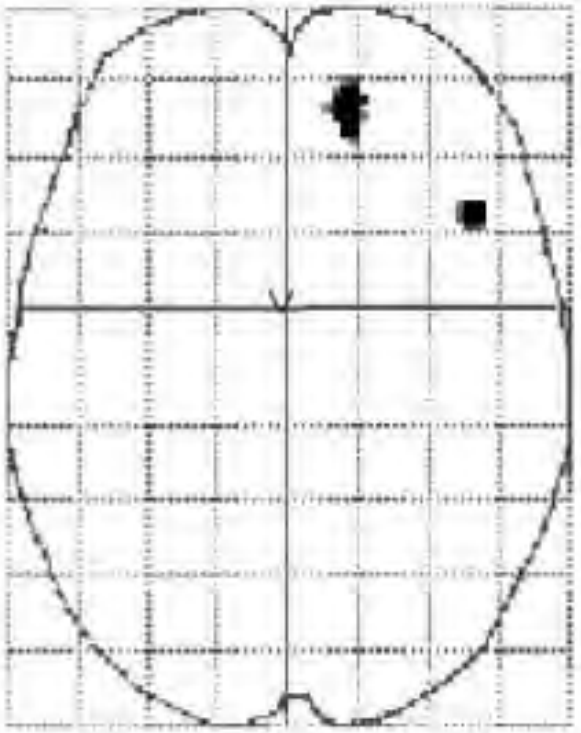


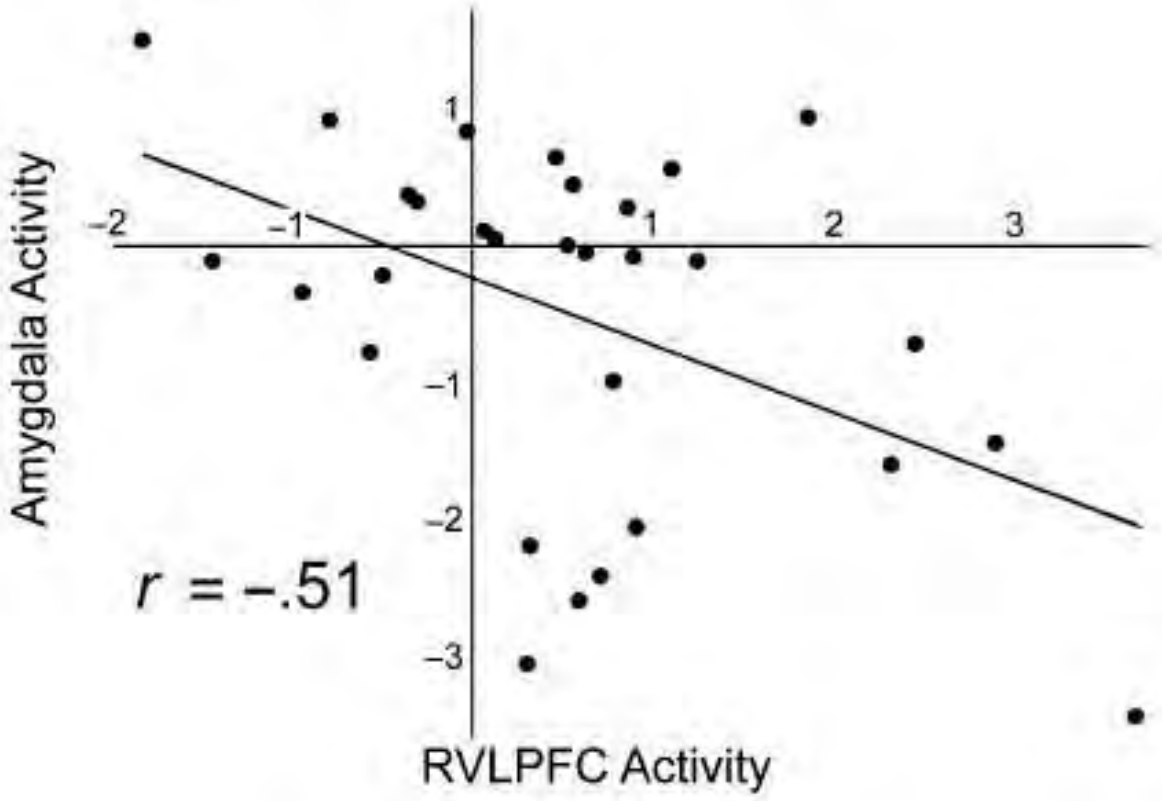
Fig. 2. Parameter estimates of activity during five conditions (relative to activity in the shape-match control condition) in an amygdala region of interest (ROI). The ROI was identified by comparing activity in the observe condition and activity in the shape-match condition. The illustration on the left shows an axial slice indicating the extent of the ROI.

Matt Lieberman et al., 2007

Inverse Relation between Activation in PFC and the Amygdala in the Lieberman et al. study

(When activation in PFC goes up, activation in the amygdala goes down.)





Translating an emotional experience into language, talking or writing about, alters the way it is represented and understood in our mind and our brain (gets prefrontal cortex more involved).

Many children are so terrified of making a mistake that they're afraid to try anything new.

Children need to feel safe

…to push the limits of what they know,

…to venture into the unknown,

…to take the risk of making a mistake or of being wrong.

The need to know it is okay to make a mistake.

It's extremely important <u>not</u> to embarrass a child.

Children can't relax if they're worried you might embarass them.

Making a mistake is not the worst thing in the world.

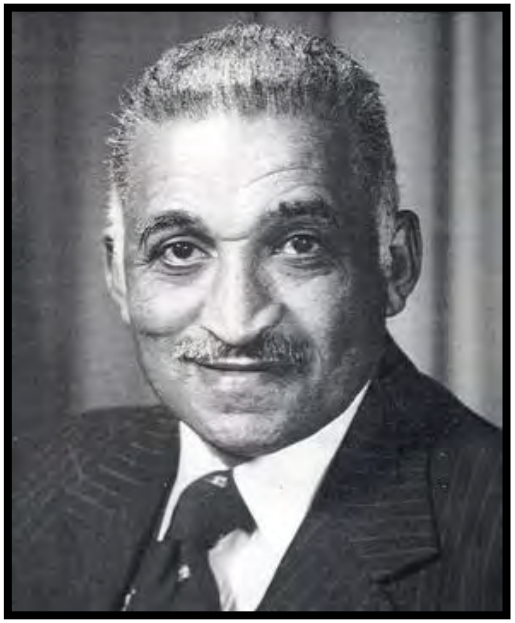
We need to let children know it's okay to make mistakes; EVERYONE makes mistakes.

The only alternative is to stay with what you already know, to stop growing.

The important thing
is how you react
after you've made a mistake
or fallen short of a goal.

You've never failed until you've tried for the last time, and you've never lost until you quit.

-- Samuel Proctor Massie



It's never over 'til it's over

Samuel Proctor Massie was born in the segregated South in the early 1900's. You *know* he encountered a lot of discrimination, setbacks, and failures. Yet he rose to become one the most highly respected and decorated chemists of the 20th century.

You haven't failed until you've stopped trying.

If children are afraid to try something new, afraid they'll be penalized for a mistake…

We need to show them they'll be rewarded for trying.

If what gets graded is what children see as important, then we need to reward them with an 'A' in a new category -- the courage to try something new, to risk being wrong.

One way programs can reduce stress & aid self-confidence is to communicate loud and clear the faith and expectation that each child will succeed.

When a toddler falls while trying to walk, we would never say ….

When a toddler falls while trying to walk, we would never say, "you get a 'D' in walking today"; it would never occur to us to say that. Instead we say, "Don't worry; I'm sure you're going to be able to do this."

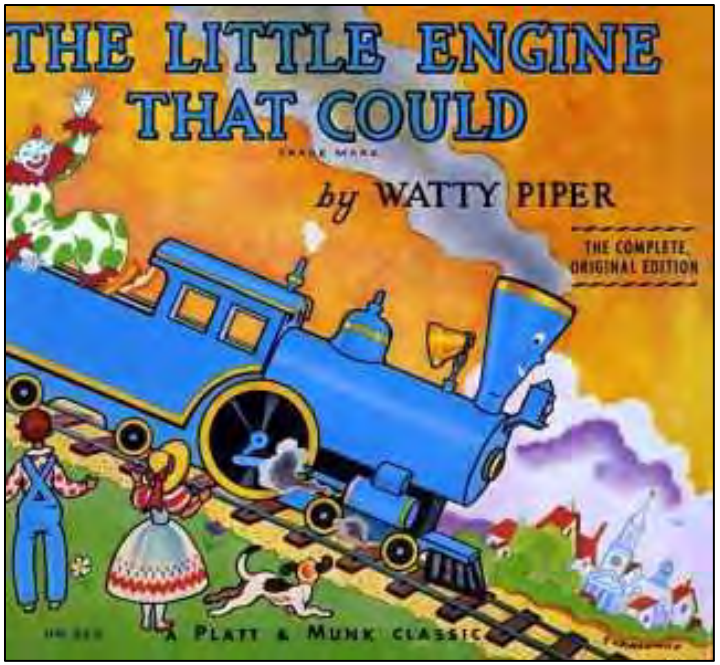
How different is that from what children hear in school. They hear: "You get a D" instead of "There's no question you are going to be able to do this. And we, together, are going to figure out a way to make that happen."

A school in BC
has as its motto:
If you can't learn the
way we teach, we will
teach the way you learn.

CHILDREN NEED TO BELIEVE IN THEMSELVES.

THEY NEED TO HAVE SELF-CONFIDENCE.

THEY NEED TO BELIEVE THEY CAN SUCCEED.



Two routes to that:

- They need to feel you believe in them - that you fully expect them to succeed.

&

- They need do-able challenges. They need opportunities to do things that enable them to see for themselves that they are capable.

Powerful Role of Expectations (by others AND yourself) and Attitude

Pygmalion in the Classroom -- powerful role of expectations Robert Rosenthal

Stereotype threat - female performance on math exams Claude Steele

Juggling

by those with physical handicaps

“Treat people as if they were what they ought to be and you help them become what they are capable of being.”

– Johann W. van Goethe

Powerful Role of Expectations (by others AND yourself) and Attitude

Pygmalion in the Classroom -- powerful role of expectations Robert Rosenthal

Stereotype threat - female performance on math exams Claude Steele

For ex., there's a stereotype in our culture that men are better in math than women.

And sure enough when a group of researchers went to a univ. & gave a standardized math test, **As a group,** the male students scored higher than the female students.

Then the researchers tested another group of entirely comparable university students on exactly the same test
– the ONLY difference was they **added** one sentence before giving the exam.

They said, "This particular test has been designed to be gender-neutral; on this particular test women score as well as men."

And what happened? The women scored as well as the men.

It was the **SAME** test as the first group got.

The only difference was whether the women expected themselves to do well or not.

Our expectations for ourselves often become self-fulfilling prophecies

Children need opportunities to do things that enable them *to see for themselves* that they are capable: do-able challenges.

(research studies by Duckworth, 2010; Lewis & Goldberg, 1969; White, 1960)

Pride and self-confidence (and joy) come from seeing yourself succeed at something that you know is not easy -- even in the youngest infants.

Another way to show children we believe in them and have faith in them is to give them an important responsibility.

the ‘Coca Cola’ study

We are not just intellects,

we have emotions

we have social needs

& we have bodies

Our brains work better when we are not feeling lonely or socially isolated.

Loneliness: Human Nature and the Need for Social Connection
2008
a book by John Cacioppo & William Patrick

This is *particularly* true for PFC & EFs.

Roy Baumeister et al. (2002, *Journal of Personality and Social Psychology*)
told a group of subjects that they'd have close relationships throughout their lives;

- they told another group the opposite; &

- told a third group unrelated bad news.

On simple memorization questions (that don't require EFs) the groups were comparable.

On logical reasoning (that requires EFs), those told to expect that they'll be lonely performed worse.

Other researchers haven't tried to manipulate this, but simply give subjects a survey when they come into the lab

& that includes questions like 'Do you feel socially supported? Do they feel lonely?'

One research group (Campbell et al., 2006) found that prefrontal cortex functioned less efficiently in those who felt lonely or isolated.

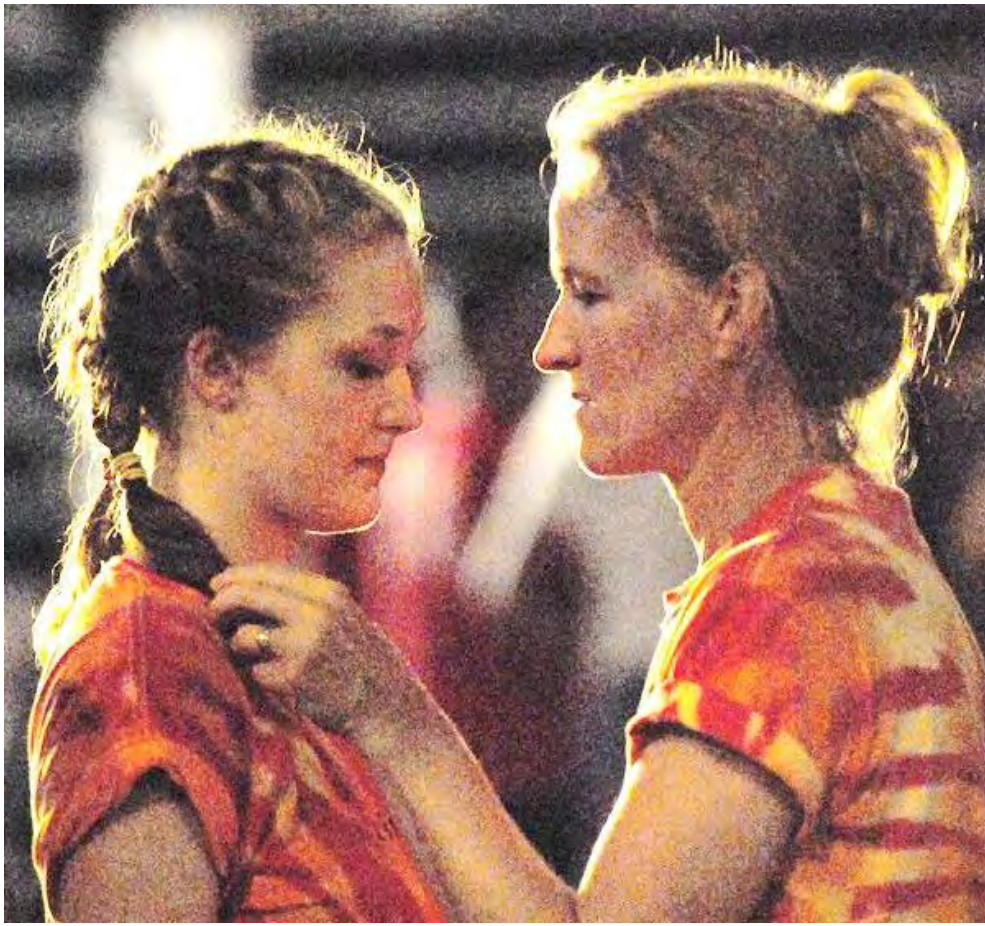
We are fundamentally social.

We need to belong.

We need to fit in & be liked.

Children who are lonely or ostracized will have more difficulty learning.

It's not just peers; a close relationship with a caring adult can be huge.



We are not just intellects,

we have emotions

we have social needs

& we have bodies

You need your sleep.

Lack of sleep will produce deficits in EF skills, and cause someone to look as if he or she has an EF impairment, like ADHD.

It is estimated that about 25% of children diagnosed with ADHD, don't have ADHD, but have sleep apnea or other problems sleeping instead.



Attention-Deficit/Hyperactivity Disorder with Obstructive Sleep Apnea: A treatment outcome study.

Huang, Guilleminault, Li, Yang, Wu, & Chen.

Sleep Medicine 2007 vol 8: 18-30

Studied 66 school-age children with ADHD and 20 healthy controls.

Conclude: Recognition and treatment of underlying mild sleep-disordered breathing (SDB) in children with ADHD may prevent unnecessary long-term MPH use and the potential side effects associated with drug intake.

Our brains work better when our bodies are physically fit.

Nature Reviews Neuroscience (January 2008)
"Be Smart, Exercise Your Heart:
Exercise Effects on Brain and Cognition"
Charles Hillman, Kirk Erickson & Art Kramer

"There is little doubt that leading a sedentary life is bad for our cognitive health."

This is *particularly* true for PFC & EFs.

The brain doesn't recognize the same sharp division between cognitive and motor function that we impose in our thinking.

The SAME or substantially overlapping brain systems subserve BOTH cognitive and motor function.

For example, the pre-Supplementary Motor Area (SMA) is important for sequential tasks,

whether they are sequential motor tasks or

sequential numerical, verbal, or spatial cognitive tasks.

Hanakawa et al., 2002

Motor development and cognitive development appear to be fundamentally intertwined.

Diamond, A. (2000)

Close interrelation of
motor development and cognitive development
and of the cerebellum and prefrontal cortex.

Child Development, 71, 44-56

When cognitive development is perturbed,

as in a neurodevelopmental disorder,

motor development is often adversely affected as well.

For example……

At least half of all children with ADHD have poor motor coordination & fit the diagnosis for developmental coordination disorder.

At least half of all children with develop-mental coordination disorder have ADHD.

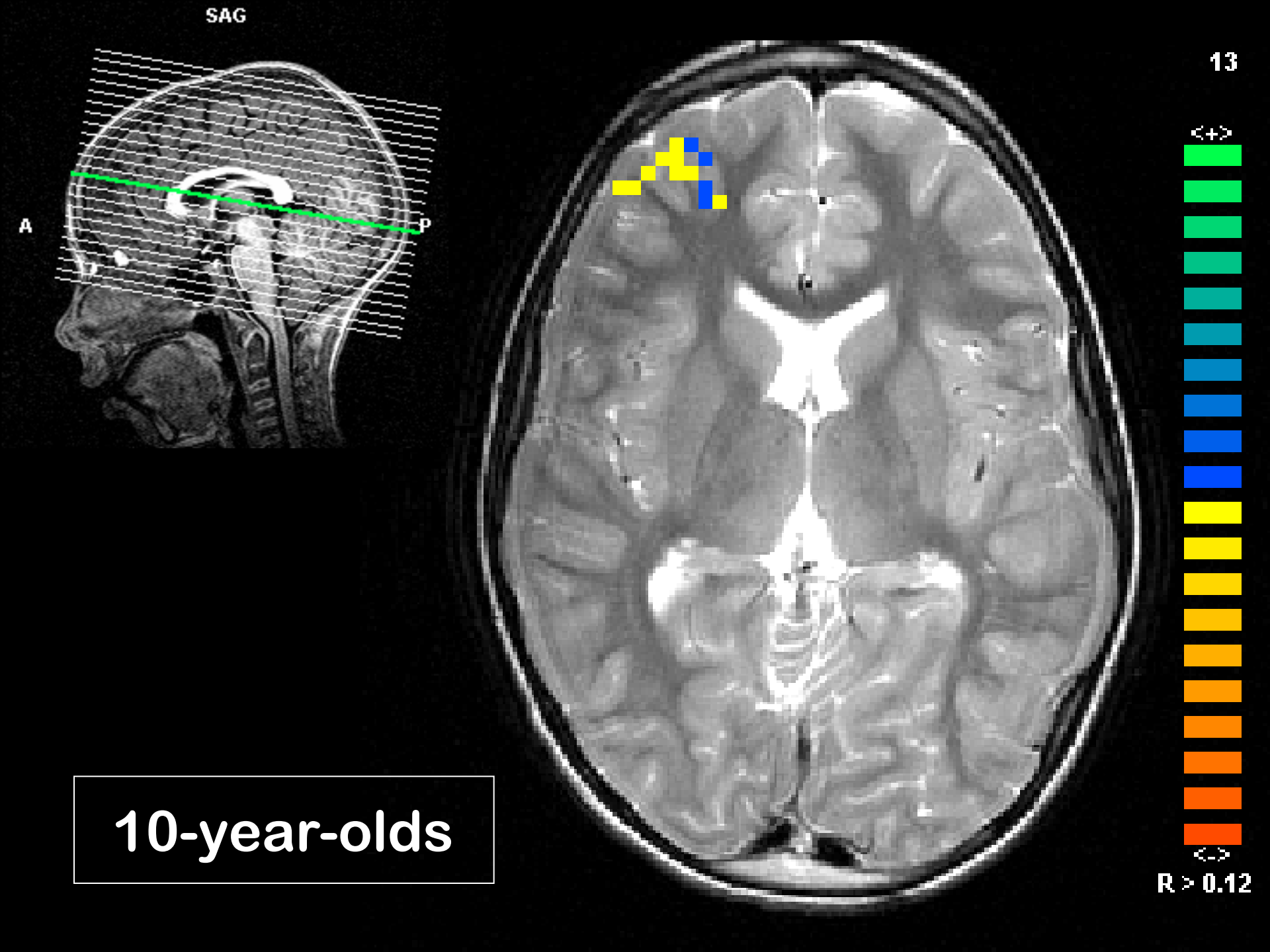
Similarly for dyslexia, autism, and other disorders.

Most cognitive tasks that activate dorsolateral prefrontal cortex also activate the cerebellum.

When dorsolateral prefrontal cortex activity increases so does activity in the contralateral cerebellum.

When dorsolateral prefrontal cortex activity decreases (e.g., when a task has been practiced and requires less concentration) so does cerebellar activation.

Activation in these two regions is strikingly correlated and closely coupled.


SAG
A
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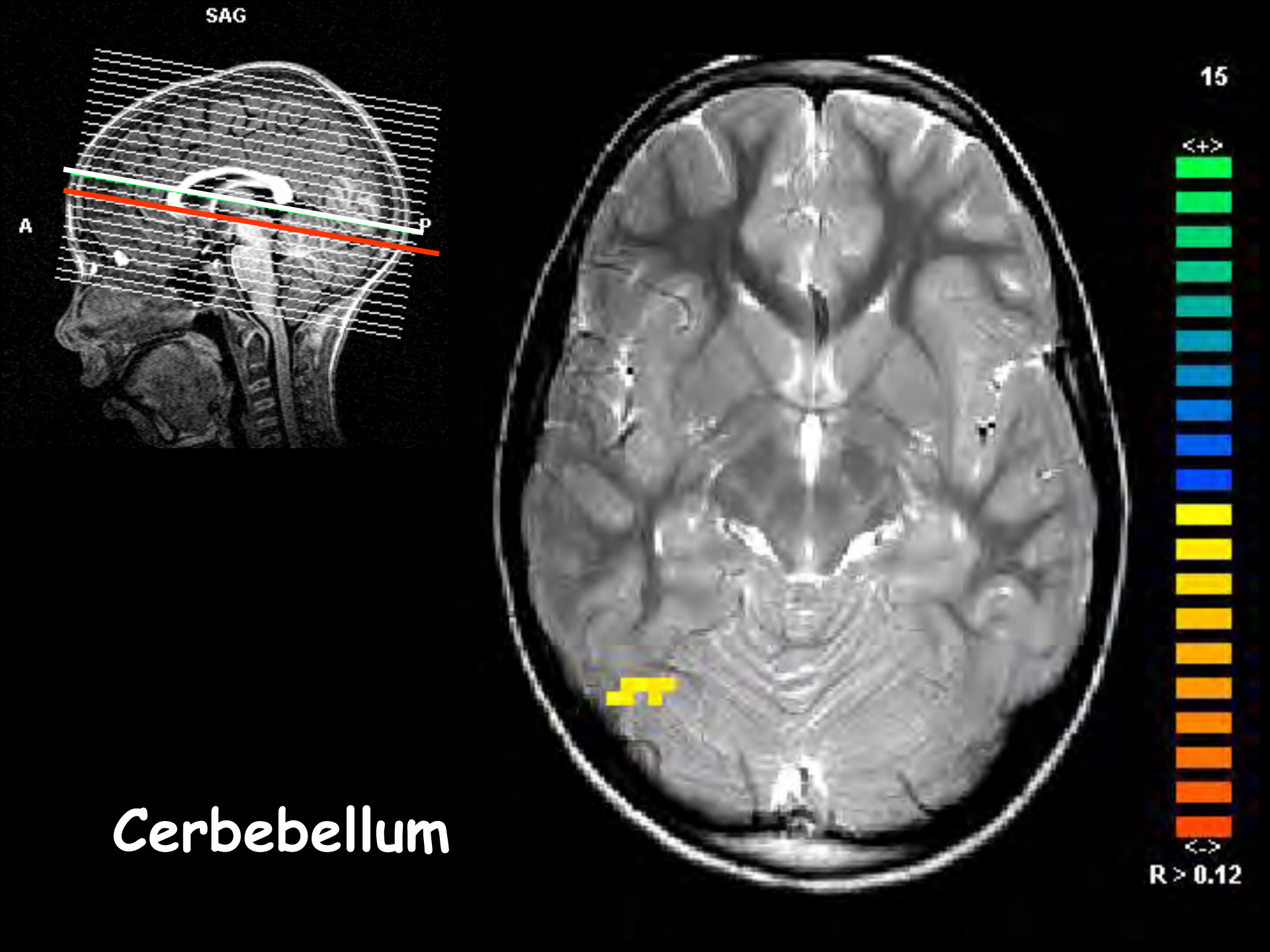
10-year-olds



Cerbebellum

The different parts of the human being are fundamentally interrelated.

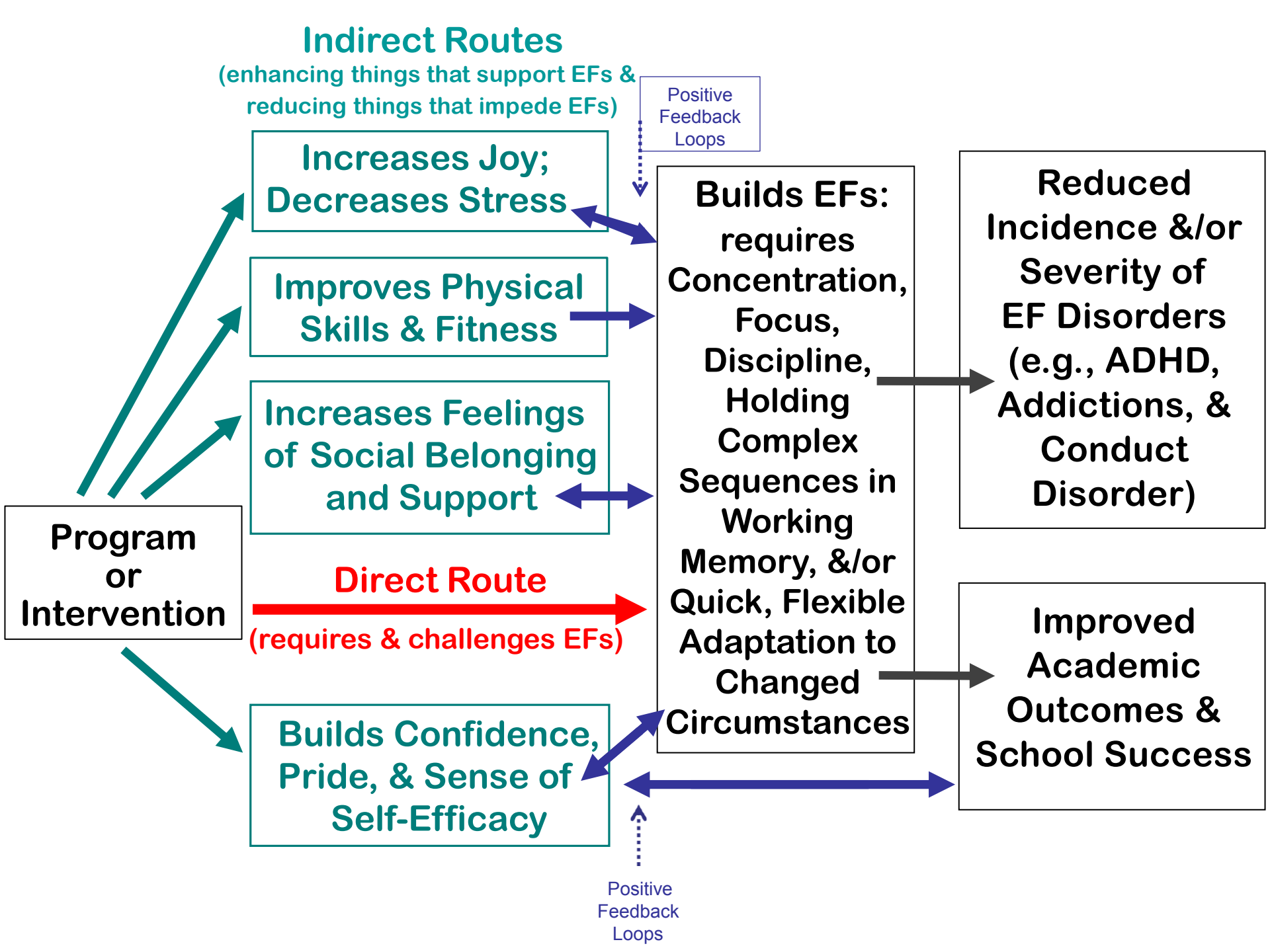
Each part (cognitive, social, emotional, & physical) is affected by, and affects, the other parts.

Diamond, 2000

Let's return to my prediction:

Those activities that most successfully improve executive functions should not only work on training and improving executive functions -- and also....

indirectly support executive functions by working to reduce things that impair executive functions and working to enhance things that support executive functions.


Indirect Routes
(enhancing things that support EFs & reducing things that impede EFs)
Positive Feedback Loops
Increases Joy; Decreases Stress
Improves Physical Skills & Fitness
Increases Feelings of Social Belonging and Support
Builds Confidence, Pride, & Sense of Self-Efficacy
Program or Intervention
Direct Route
(requires & challenges EFs)
Builds EFs: requires Concentration, Focus, Discipline, Holding Complex Sequences in Working Memory, &/or Quick, Flexible Adaptation to Changed Circumstances
Reduced Incidence &/or Severity of EF Disorders (e.g., ADHD, Addictions, & Conduct Disorder)
Improved Academic Outcomes & School Success
Positive Feedback Loops

Key is that the child keenly enjoy the activity and really want to do it, so s/he will spend a lot of time at it, pushing him- or herself to improve at it.

What activities directly train and challenge executive functions and indirectly support them by also addressing our social, emotional, and physical needs?

Traditional Activities that have been around for millennia.

For 10's of 1,000's of years, across ***all*** cultures, storytelling, dance, art, music & play have been part of the human condition.

People in ***all*** cultures made music, sang, danced, did sports, and played games. There are good reasons why those activities have lasted so long and arose everywhere.

El Sistema Orchestra

El Sistema (Venezuela's national system of Youth and Children's Orchestras) was started by José Antonio Abreu in 1975.

He envisioned classical music training as a social intervention that could transform the lives of poor kids. El Sistema is intended as a social program with music at its core. Rather than aiming to produce great musicians, it aims to create community.

Provided free. It takes *all* children (even deaf). Has reached over half a million children in 25 countries & 3 continents.


Shapes


K
TAP KIDS

The National Dance Institute (NDI) was founded by Jacques d'Amboise in 1976 to transform the lives of troubled youth .

Jacques was the best male ballet dancer in the world for 3 decades & received the National Medal of Honor. He was a high school dropout, a poor kid from a poor neighbor-hood, headed for trouble.

Since dance transformed his life, he figured it might do the same for others.

National Dance Institute

Provided free. It takes *all* children (even those in wheelchairs). Has reached over half a million children in some of the poorest areas.

Dancing Makes You Smarter

Verghese et al. (2003) examined the relation between leisure-time cognitive activity or physical activity on the incidence of dementia. At the study's outset all participants were at least 75 years and dementia-free. Five years later…..

- Reading or doing crossword puzzles was associated with 35% reduced risk of dementia.
- Almost none of the physical activities offered protection against dementia – except dance.
- Dance conferred the greatest risk reduction of any activity studied, cognitive or physical – a whopping 76% reduced risk of dementia.


UEBLA
TIGRE


SUB-10

VIDEO

Music-making, dancing, and playing sports address our

cognitive,

emotional,

social, &

physical needs.

Because they challenge EFs directly,

and indirectly support EFs by

increasing joy,

a sense of belonging, &

physical exercise,

I predict they should improve EFs.

(and we're hoping to get funding to test my prediction for El Sistema Orchestra & for social, communal dance)

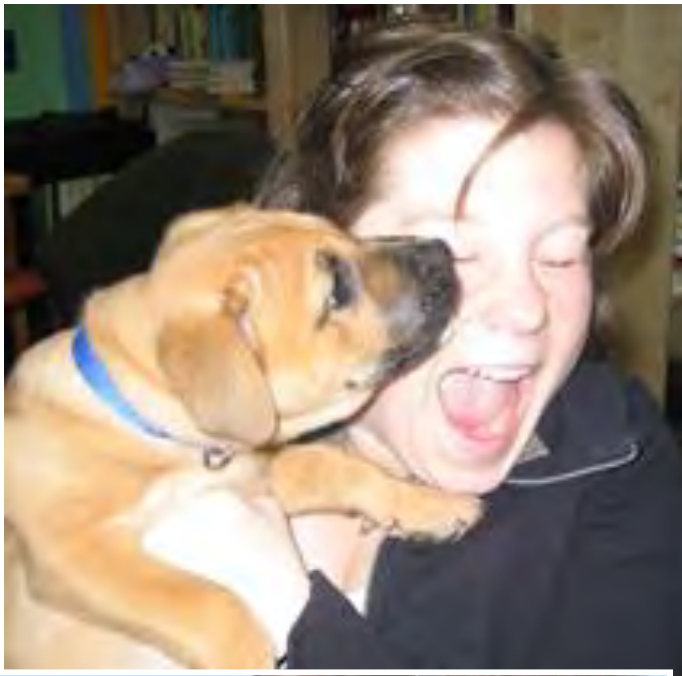
Almost any activity can be the way in, can be the means for disciplining the mind and enhancing resilience.

MANY activities not yet studied might well improve EFs.

It all depends on the way the activity is done and the amount of time that is spent doing it, pushing oneself to do better. The most important element is probably that you really want to do it, so you will spend a lot of time at it. It's the discipline, the practice, produces the benefits.

Might as well have you do things you can put their heart and soul into.

could be caring for an animal….




head
heart
hands
health


368

Could be a SERVICE ACTIVITY such as

Free the Children

Children Changing the World

More than 1.7 million youth involved in innovative education and development programs in 45 countries.

Educates, engages, and empowers young people to be confident young change-makers and lifelong active citizens.

Educators whose students are engaged in Free the Children report:

97%	of their students now believe they can make a difference in the world.	89%	confirm that their students are more confident in their goal-setting and completion.
85%	find a greater atmosphere of caring and compassion in the school.	90%	of their students have demonstrated increased leadership among their peers.

Circus Arts

Jackie Davis →

Circus

challenges one's executive functions

Have to concentrate & *stay* focused.

Have to quickly think on your feet & adapt.

Doing circus arts brings kids JOY

and builds their confidence, & sense of self-efficacy. They learn that with effort they can succeed. (fail, then succeed, iteratively)

Circus

builds community, learn to cooperate & to trust others not to let you get hurt

Develop physical skills (e.g., balance, coordination, strength, flexibility)

Last summer, I met a strong, proud African-American man. You would never guess he was born in prison, his father dead before he was born, his mother a couple of years later. At age 15 he was the oldest male in his family still alive and not in prison. He joined Circus Harmony, St. Louis's YCP, at the age of 12 and it transformed his life. Through his circus skills he has won international awards and is currently enrolled in a prestigious circus 'university' in Montreal.

If we ignore that a child is stressed, lonely, or not healthy because of poor nutrition, lack of sleep or lack of exercise those unmet needs will work against achievement of our academic goals for our children.

We need to care about the whole child (cognitive, social, emotional, spiritual & physical) if we want to improve academic achievement.

If we focus only on academics, we are less likely to succeed.

While it may seem logical that if you want to improve academic outcomes you should concentrate on academic instruction alone, not everything that seems logical is correct.

Counterintuitively, the most efficient and effective strategy for advancing academic achievement is probably not to focus only on academics.

What nourishes the human spirit may also be best for Executive Functions.

Perhaps we can learn something from the traditional practices of people across many cultures & 1,000's of years.

The arts, play, and physical activity may be critical for achieving the outcomes we all want for our children.

thanks so much for your attention

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