

COGNITIVE INTERVENTIONS FOR ADHD: RATIONALE AND EVIDENCE

EDMUND SONUGA-BARKE

Congress of the German Society
of Child and Adolescent Psychiatry, *Essen 2011*

D

B

B L

THE RATIONAL

THE TRANSLATIONAL LOGIC

All we have to do is identify the **causes** of a disorder to **identify new targets** for novel treatments.

While not sufficient (or indeed necessary) for innovation it does provide a rational basis and represents the ultimate purpose of the science of psychopathology.

THE TRANSLATIONAL LOGIC

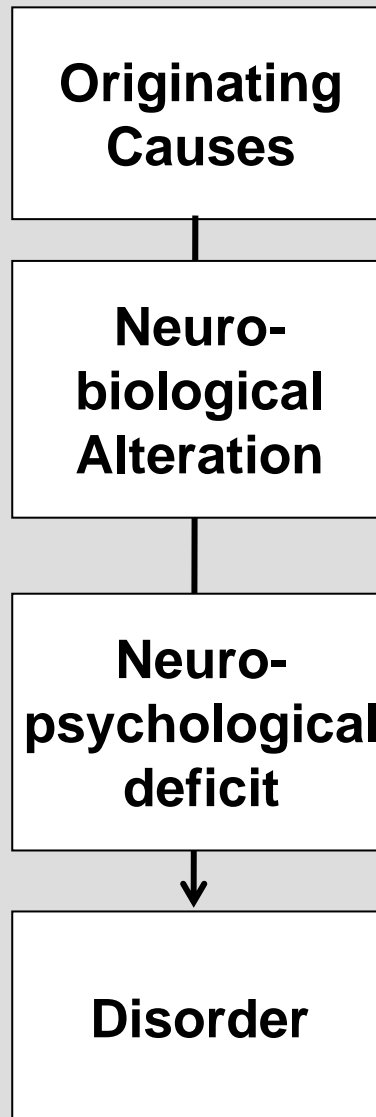
All we have to do is identify the **causes** of a disorder to **identify new targets** for novel treatments.

While not sufficient (or indeed necessary) for innovation it does provide a rational basis and represents the ultimate purpose of the science of psychopathology.

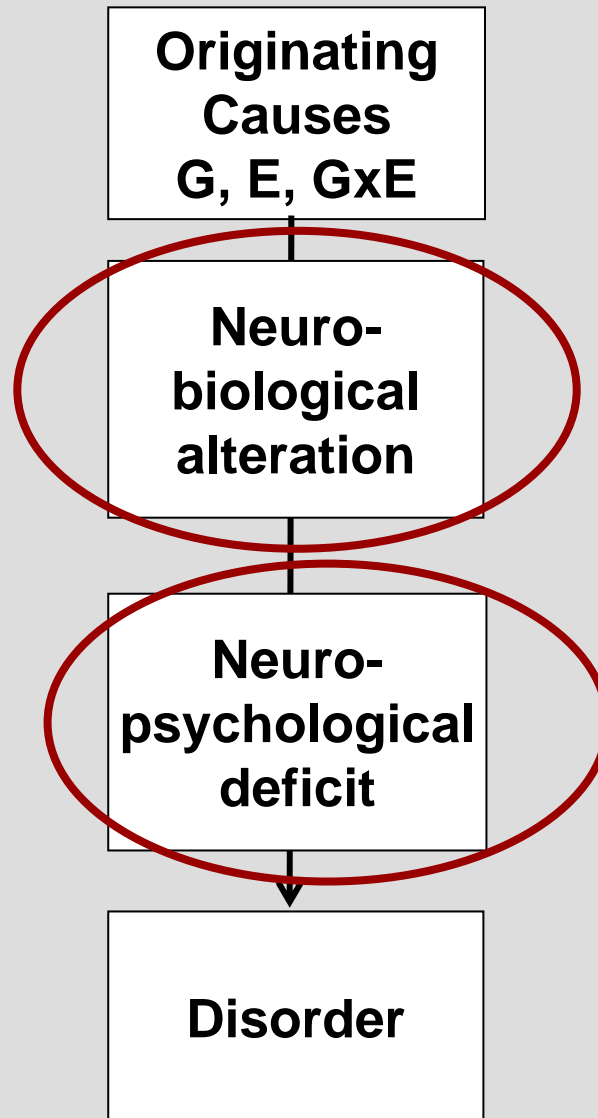
THE THERAPEUTIC PROMISE

If we can achieve this we should be able to fundamentally alter the mechanisms of the disorder to bring about fundamental, context independent and sustainable therapeutic change.

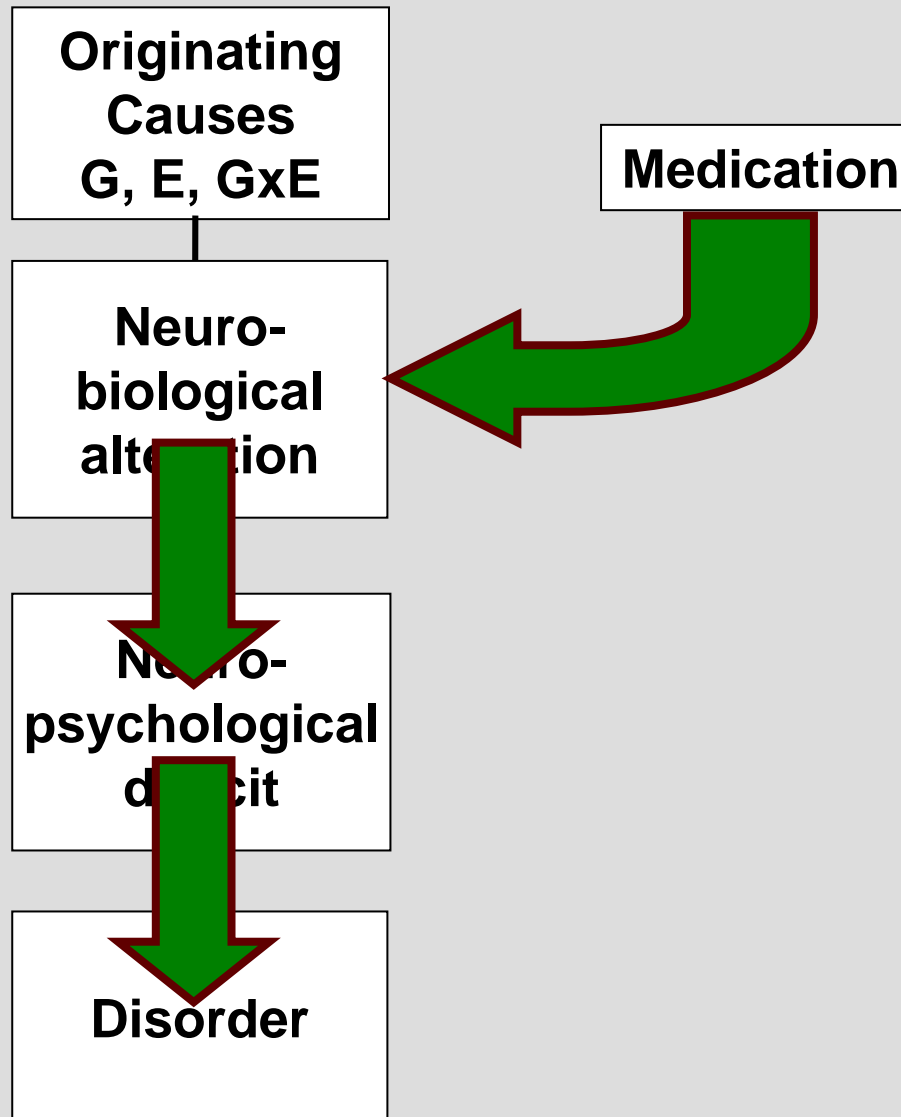
WHICH LEVEL OF CAUSE TO TARGET?



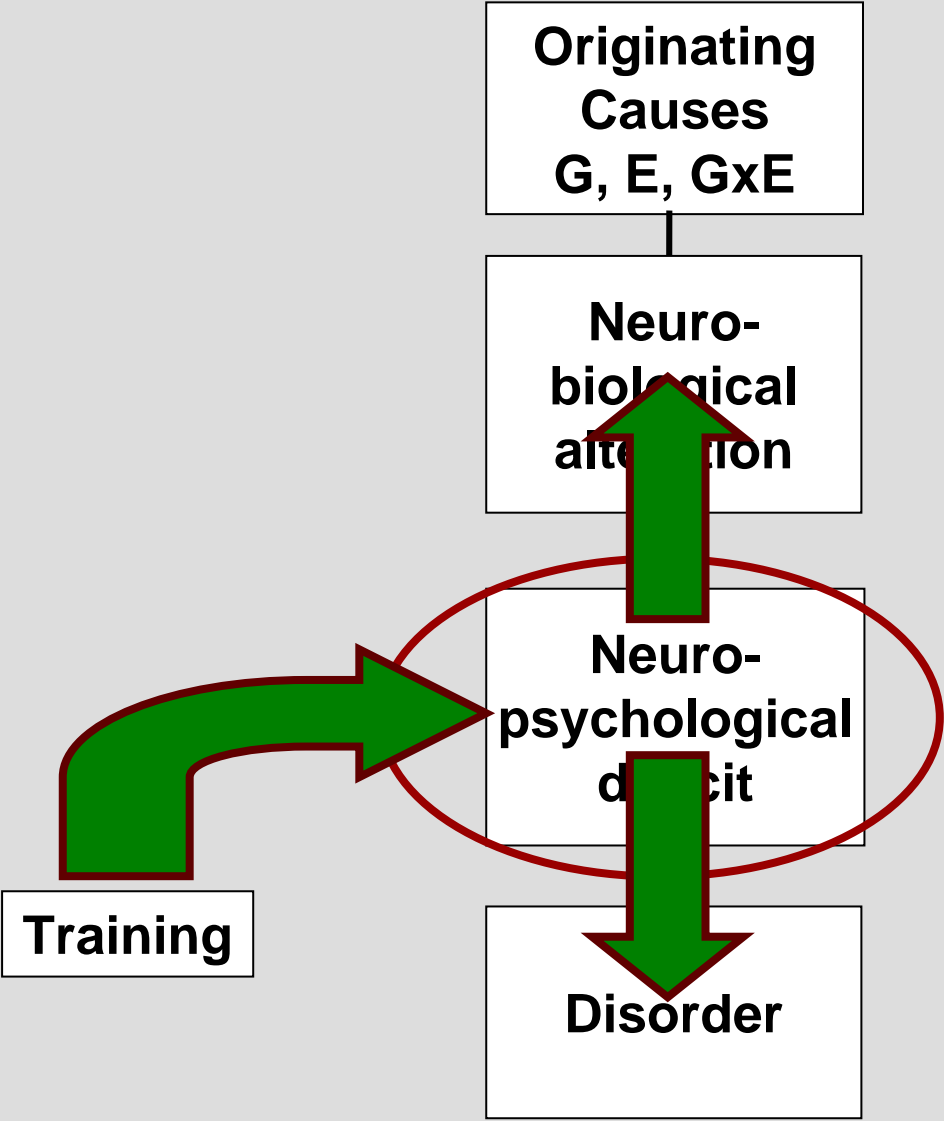
NEURO-BIOLOGICAL & PSYCHOLOGICAL MEDIATORS OFFER PROMISING TARGETS



DIRECTLY ON THE NEUROBIOLOGICAL LEVEL



THE NEUROPSYCHOLOGICAL LEVEL



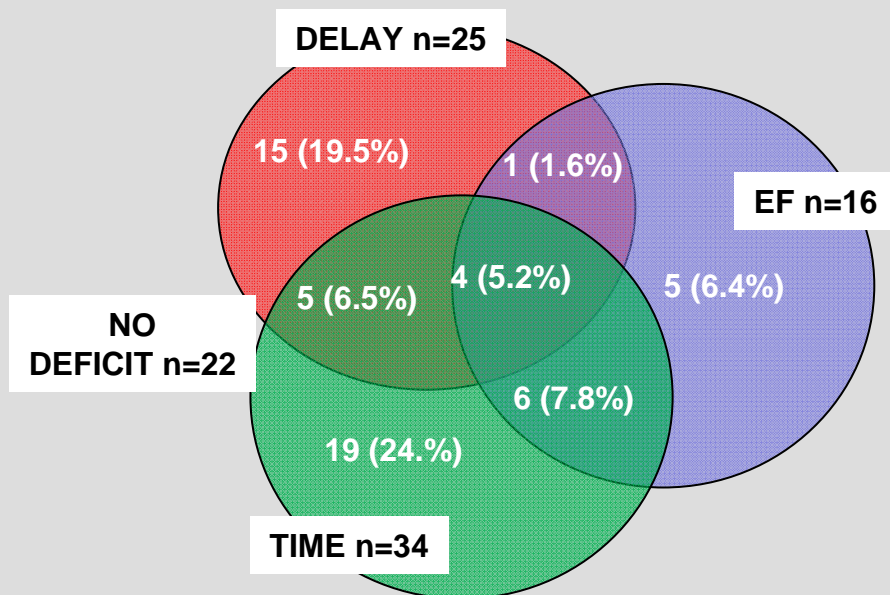
**“NEUROCOGNITIVE ENHANCING
INTERVENTIONS”
REPRESENT ONE OF THE MOST
EXCITING AND POTENTIALLY
IMPORTANT AREAS OF SCIENCE
DRIVEN INNOVATION IN ADHD
THERAPEUTICS. BUT.....**

“.....THE FINDINGS, ALTHOUGH ENCOURAGING, DO NOT AT PRESENT PROVIDE CONCLUSIVE EVIDENCE FOR THE EFFICACY OF PROCESS-SPECIFIC TRAINING AS AN INTERVENTION FOR ADHD.”

Markomicali et al, 2009

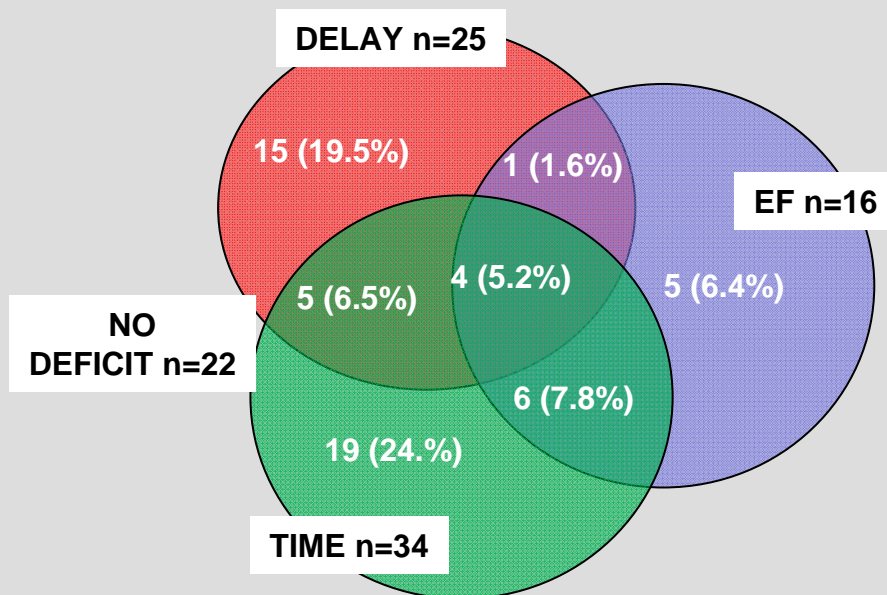
**ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS
CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A
DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND
MOTIVATIONAL DEFICITS**

ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND MOTIVATIONAL DEFICITS



Sonuga-Barke, Bitsakou, Thompson (2010)

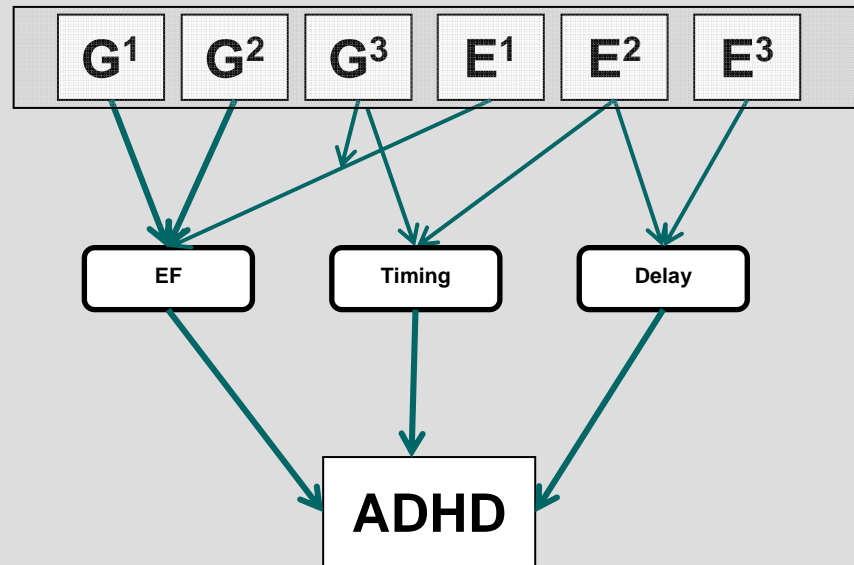
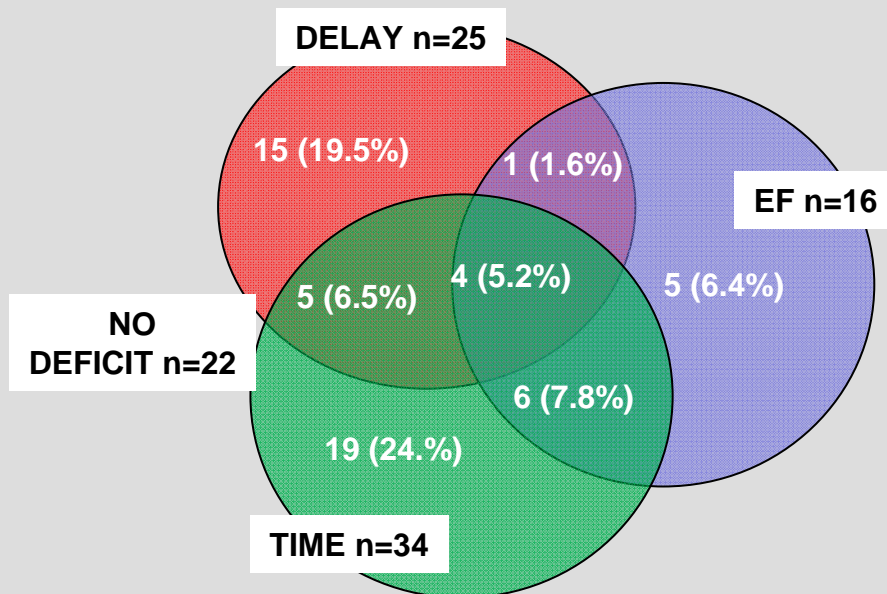
**ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS
CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A
DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND
MOTIVATIONAL DEFICITS**



Sonuga-Barke, Bitsakou, Thompson (2010)

**INTERVENTIONS WILL BE MORE SUCCESSFUL IF THEY TARGET
MULTIPLE DEFICITS**

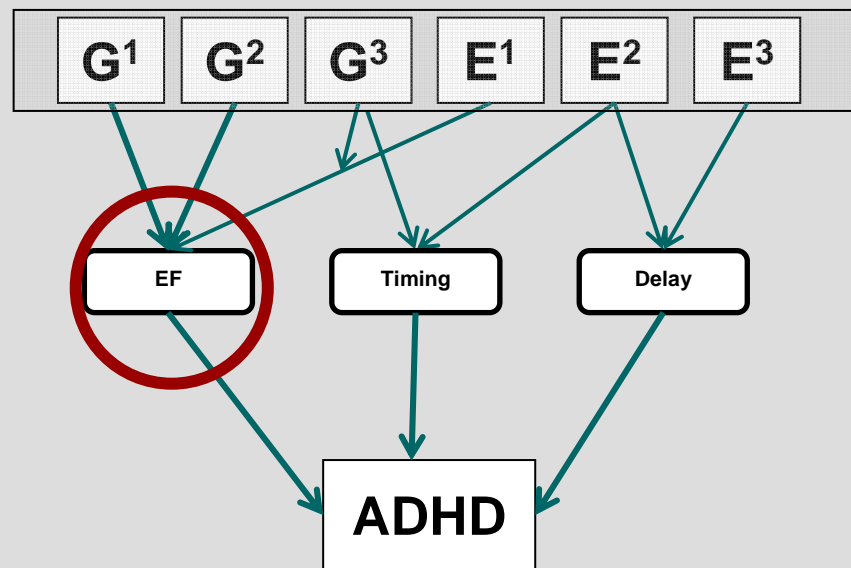
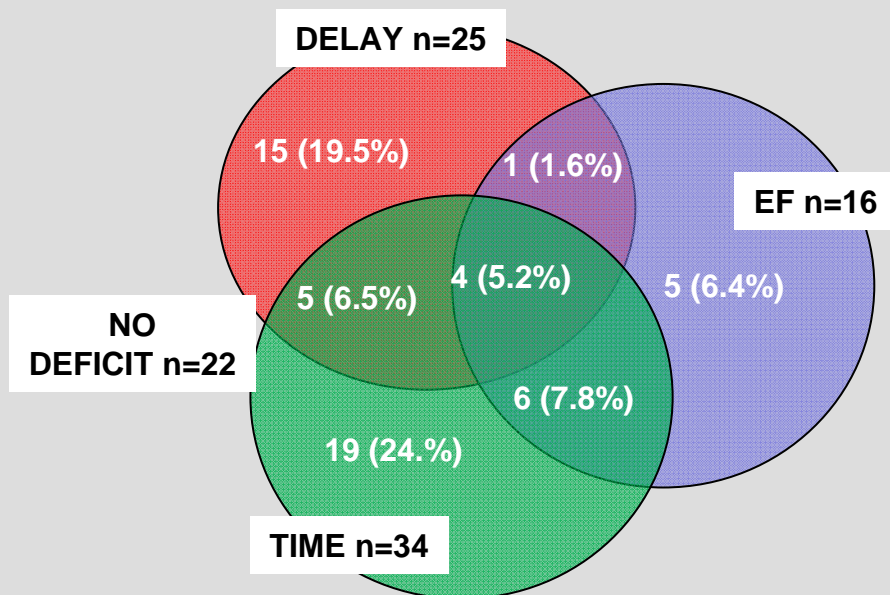
**ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS
CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A
DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND
MOTIVATIONAL DEFICITS**



Sonuga-Barke, Bitsakou, Thompson (2010)

**INTERVENTIONS WILL BE MORE SUCCESSFUL IF THEY TARGET
MULTIPLE DEFICITS**

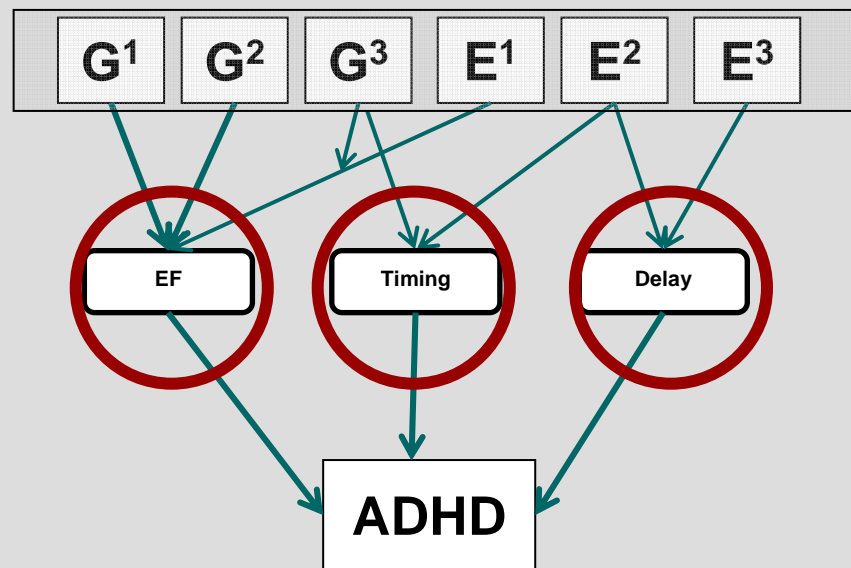
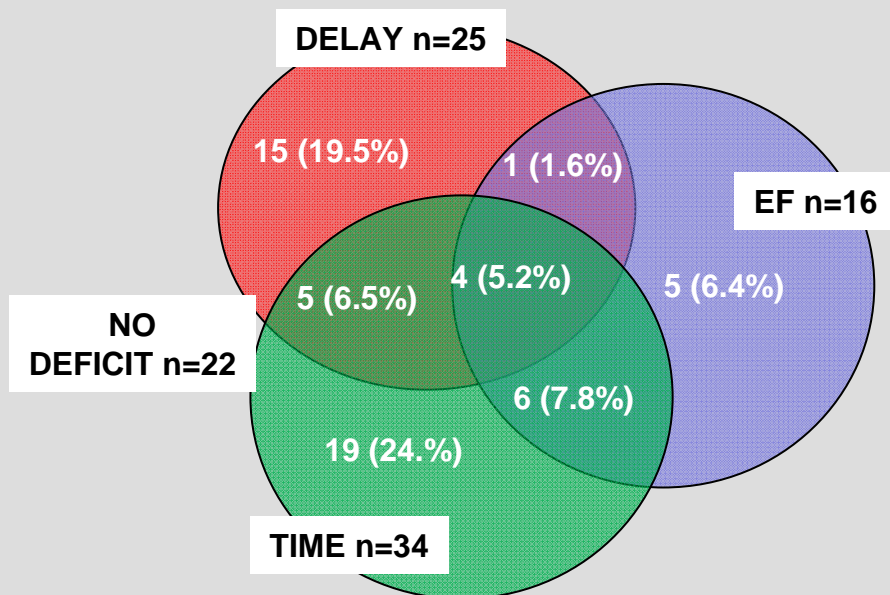
**ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS
CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A
DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND
MOTIVATIONAL DEFICITS**



Sonuga-Barke, Bitsakou, Thompson (2010)

**INTERVENTIONS WILL BE MORE SUCCESSFUL IF THEY TARGET
MULTIPLE DEFICITS**

**ADHD IS A NEUROPSYCHOLOGICALLY HETEROGENEOUS
CONDITION WITH DIFFERENT PATIENTS AFFECTED TO A
DIFFERENT DEGREE BY A RANGE OF DISTINCT COGNITIVE AND
MOTIVATIONAL DEFICITS**



Sonuga-Barke, Bitsakou, Thompson (2010)

**INTERVENTIONS WILL BE MORE SUCCESSFUL IF THEY TARGET
MULTIPLE DEFICITS**

THE EVIDENCE

WORKING MEMORY IS A SENSIBLE TARGET

“A mental workbench” (Klingberg, 2009)

“Dynamic brain processes that helps us create and maintain, for a brief period of time (seconds), internal representations of information.” (Tannock, 2010)

Crucial for so many areas of functioning

Listening, comprehension and social interaction, mental addition and future academic achievement; Driving and operating equipment.

Impaired in ADHD

CHILDREN AND ADOLESCENTS (Willcutt et al. 2005)

Verbal Working Memory: $d = .55$ (55% of studies)

Spatial Working Memory: $d = .63$ (75% of studies)

STRATEGIES FOR IMPROVING WM

Intense Computerized Training of Working Memory (Robomemory by Cogmed)



- 40 min training / day
- 5 days/week, 5 weeks
- Adaptive algorithm
- Internet based feedback

WM TRAINING CAN IMPROVE WM IN THOSE WITH WM DEFICITS AND WITH ADHD

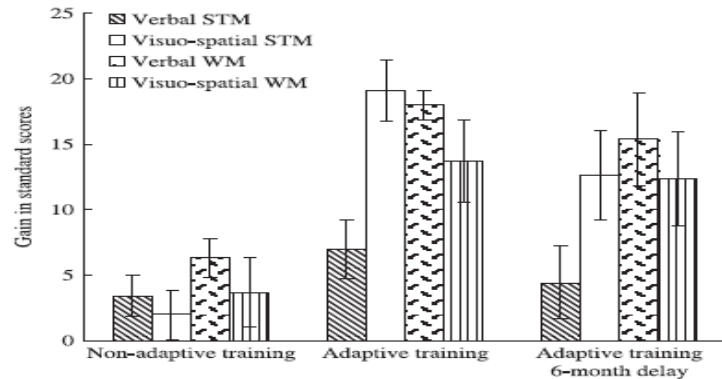
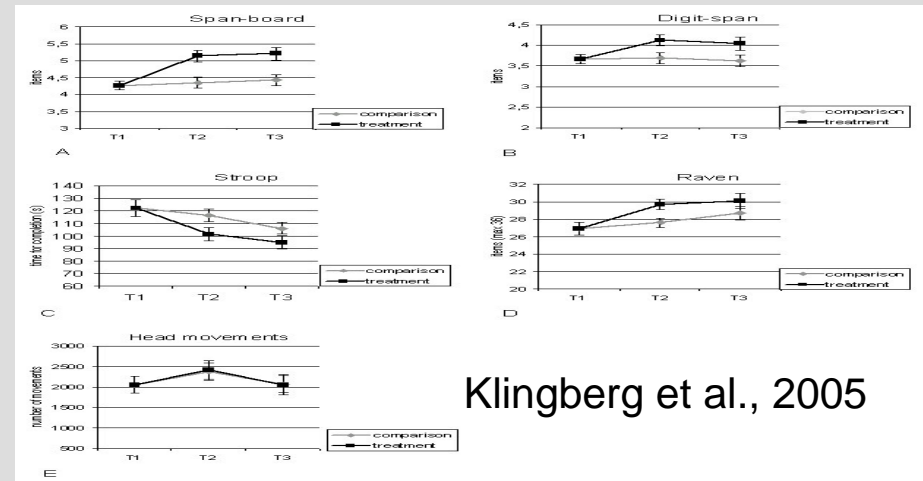


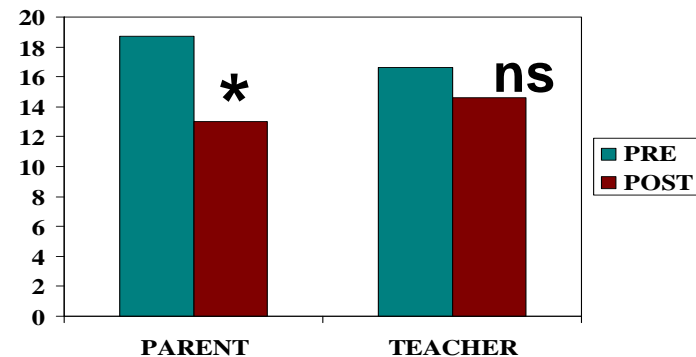
Figure 1 Impact of training on working memory.
Holmes et al., 2009



Klingberg et al., 2005

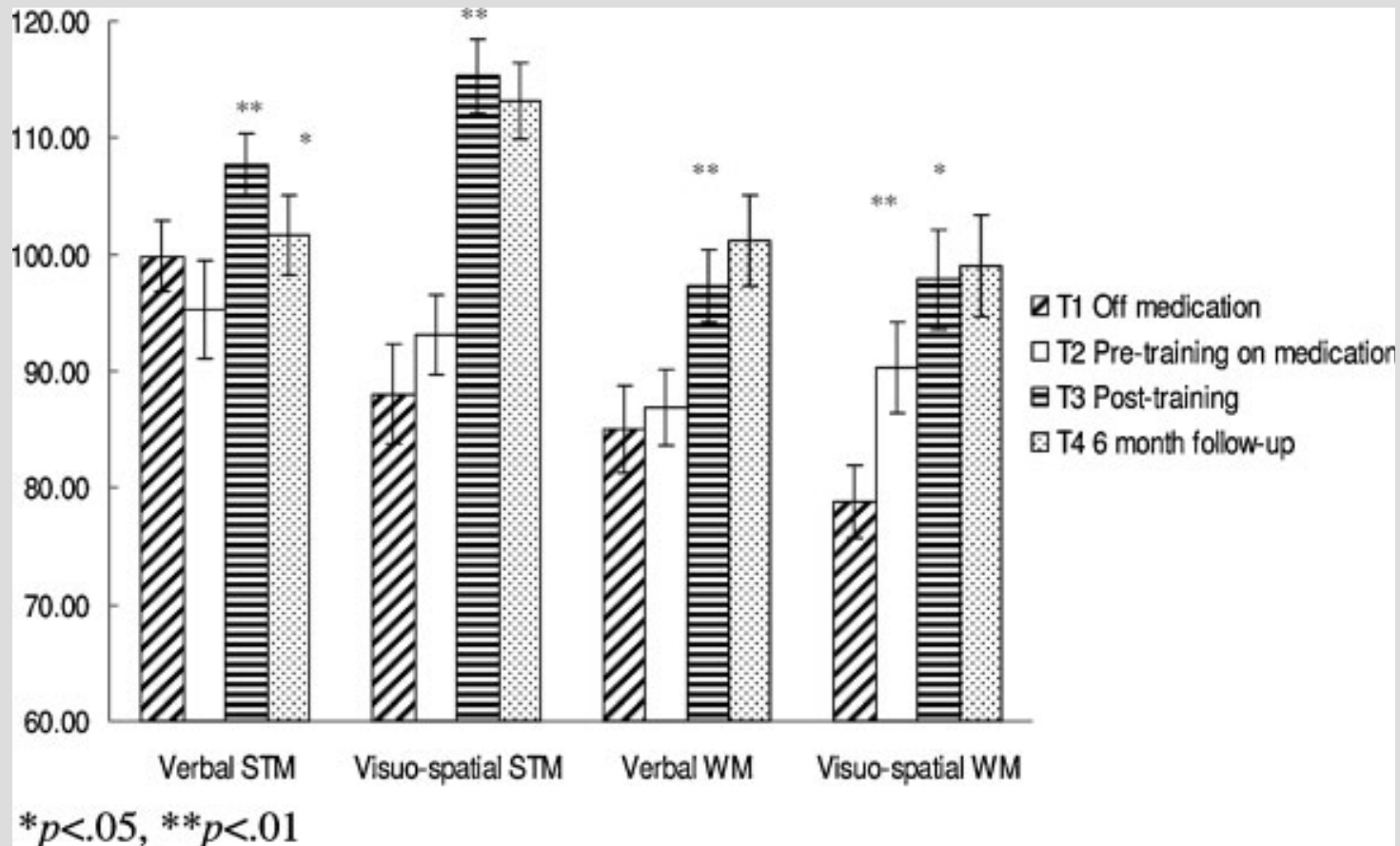
BUT MANY REMAIN TO BE CONVINCED THAT IT HAS EFFICACY AS A TREATMENT FOR ADHD?

RATINGS OF ATTENTION

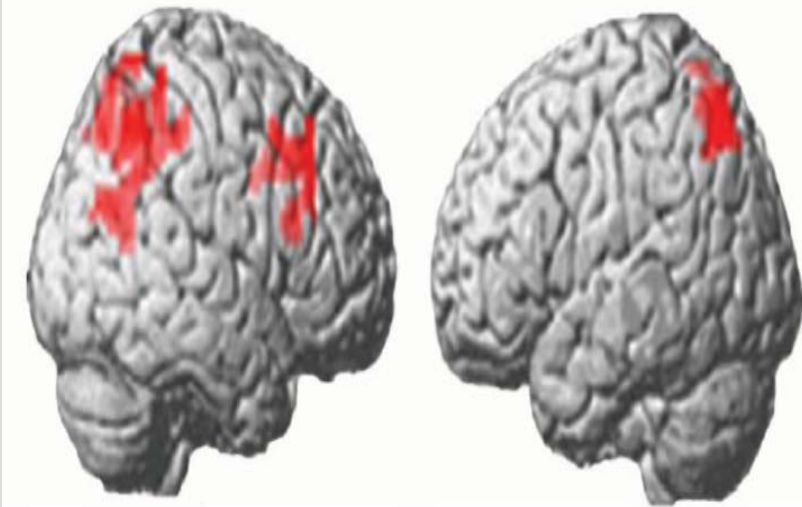
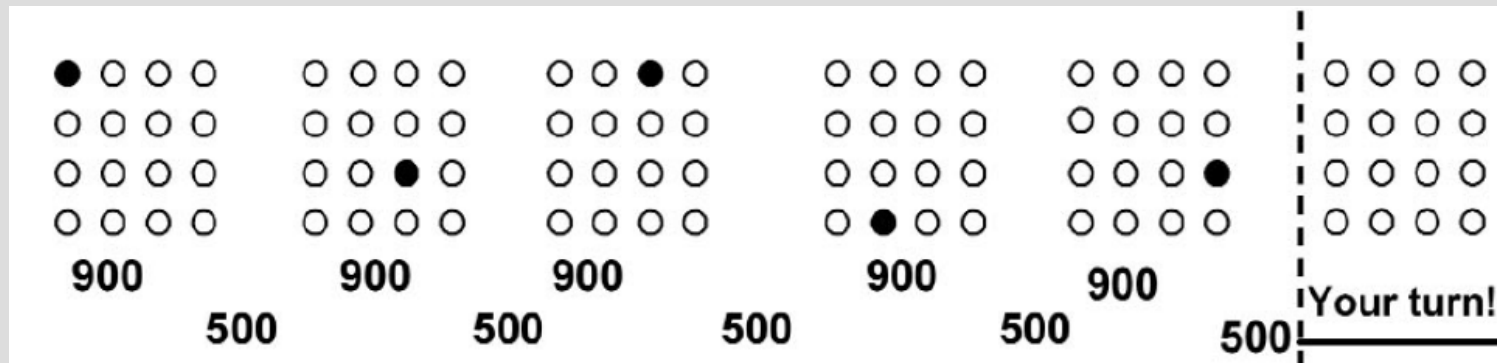


Klingberg et al., 2005

WM TRAINING CAN IMPROVE WM ABOVE THE EFFECTS OF MEDICATION HOLMES ET AL. (2010)



DOES WM TRAINING CHANGE THE BRAIN:ACTIVATION?



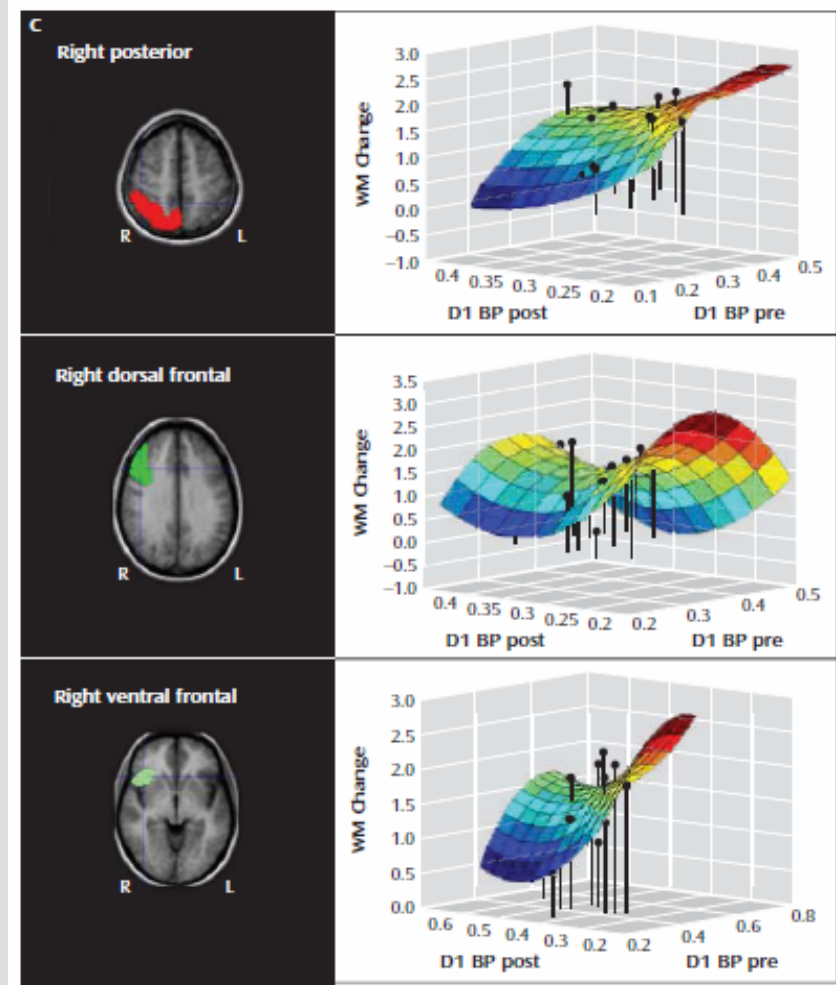
Plasticity in neural systems underlying WM

- Right middle frontal gyrus
- Right inferior parietal cortex
- Intraparietal cortex

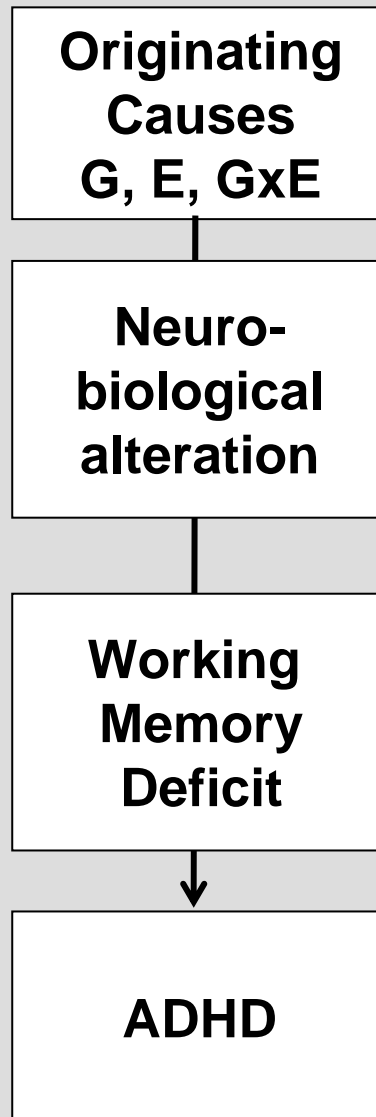
DOES WM TRAINING CHANGE THE BRAIN: NEUROCHEMISTRY?

- 14 hours training,
- Improved WM
- Inverse relationship to D1 receptor BP in WM regions
- Decrease in the density of prefrontal and parietal dopamine D1 receptors
- Changes in WM correlate with changes in D1 activity/

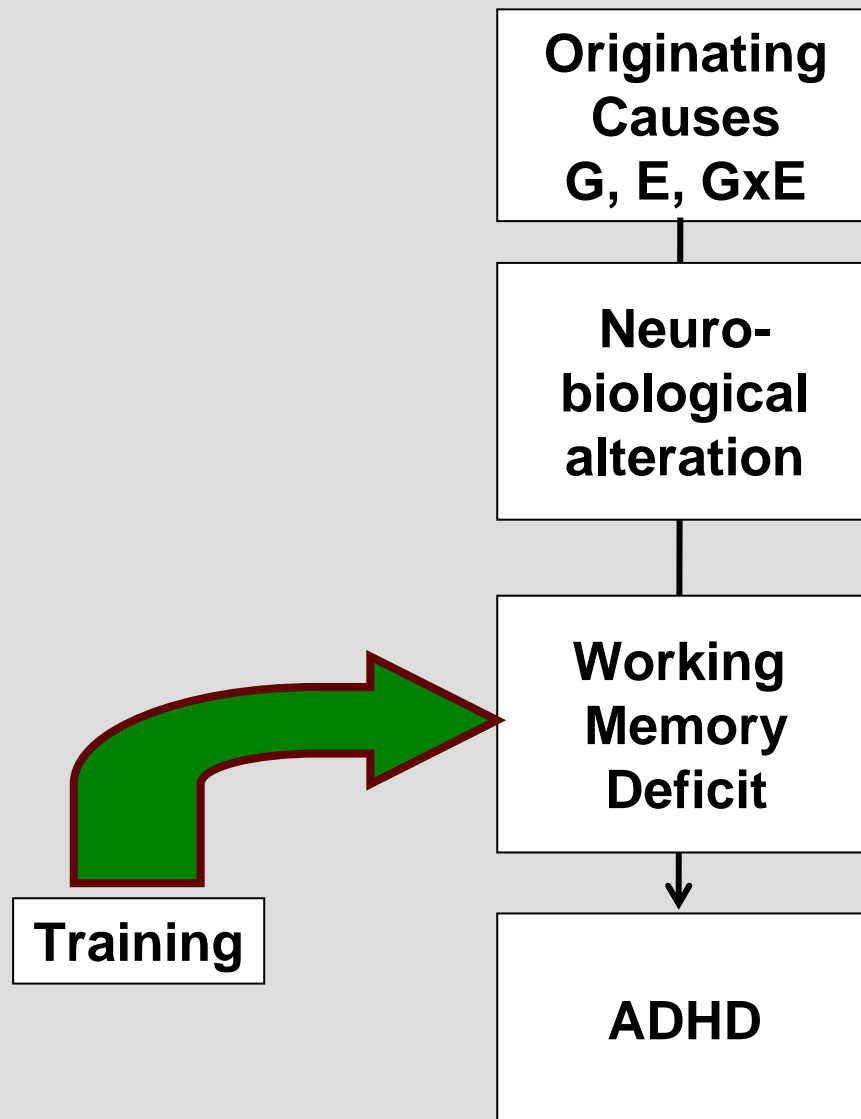
Mc Nab et al. *Science* 2009



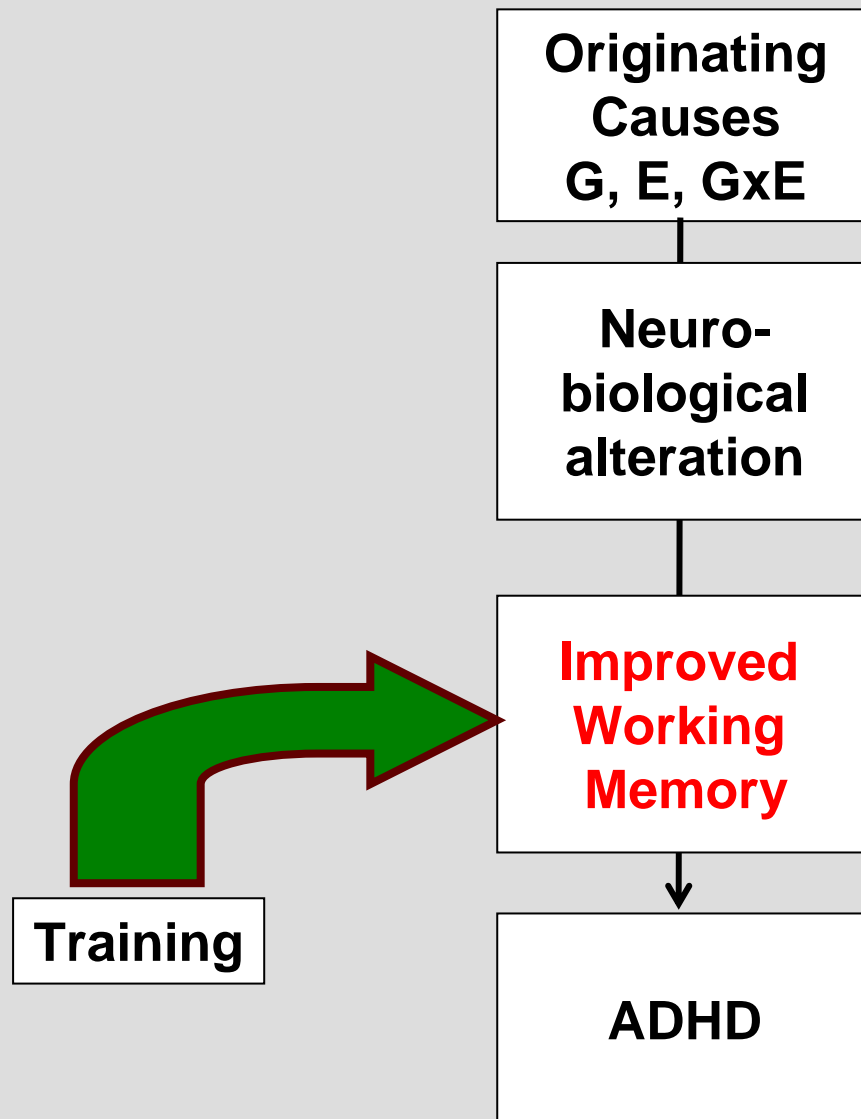
WORKING MEMORY TRAINING (STATE OF PLAY)



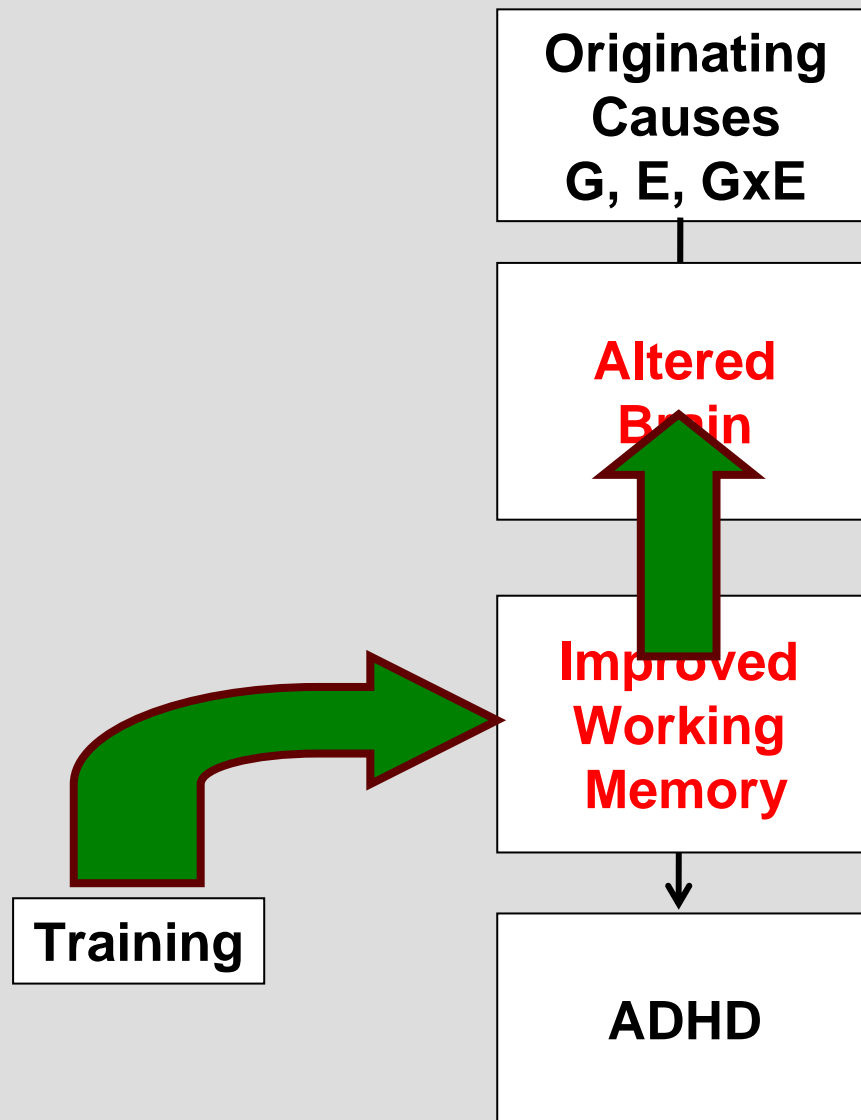
WORKING MEMORY TRAINING (STATE OF PLAY)



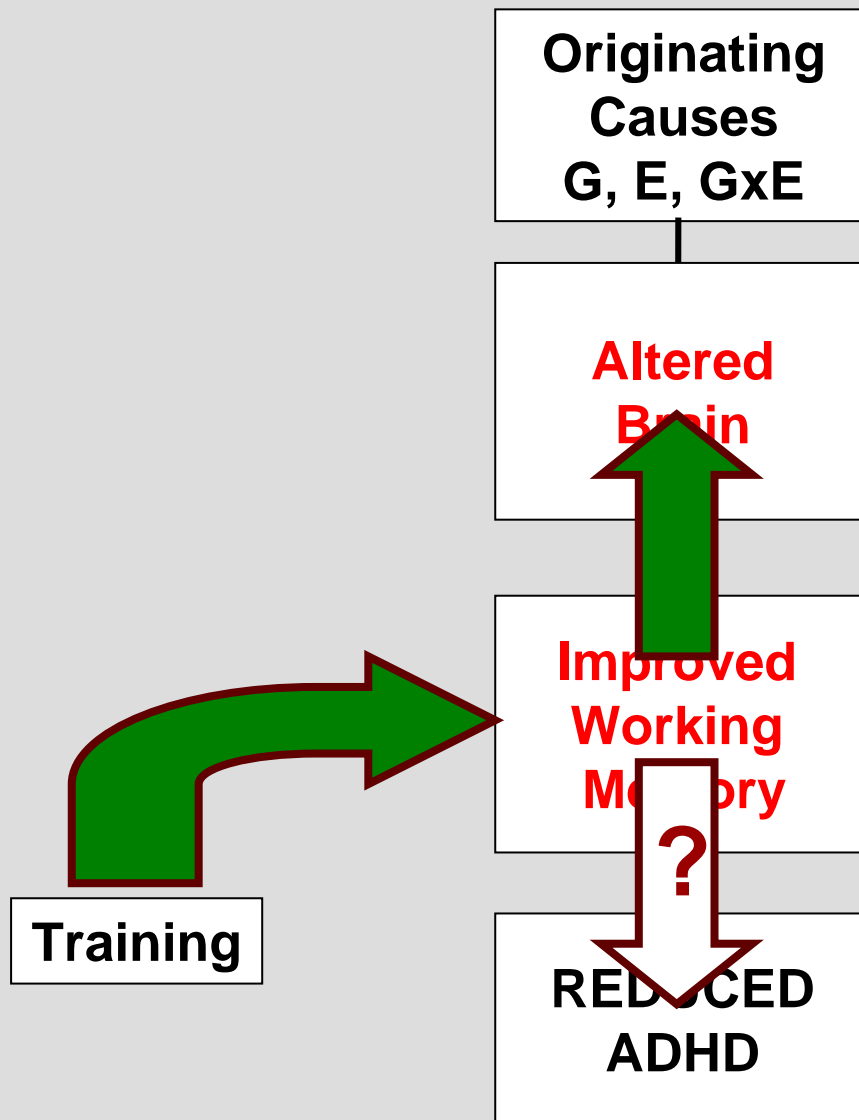
WORKING MEMORY TRAINING (STATE OF PLAY)



WORKING MEMORY TRAINING (STATE OF PLAY)



WORKING MEMORY TRAINING (STATE OF PLAY)



THE FUTURE

CAN WE OPTIMISE THE IMPACT OF COGNITIVE TRAINING IF WE....

- ..Go in earlier when the brain is more plastic?
- ..Place in the context of everyday life?
- ..Target range of processes/tailor to specific deficits?

Prototype Early Intervention Cognitive Training Approaches

Attention, Inhibition & Memory Training For Preschoolers With ADHD – *A/IM* - Tamm et al (2010).

Training Executive, Affective & Memory Skills- *TEAMS*
Halperin & Healey et al (2010).

Revised New Forest Parenting Package – *NFPP*
Thompson, et al (2001; 2010).

CONCLUSION

- Initial evidence for training effects on cognitive deficits look promising ...
....but much more research is needed before conclusions about its efficacy as an ADHD treatment.
- Ways to optimize treatment might include –
 - Early start.
 - Integrating into normal life.
 - Targeting a broad range of deficits.
 - Tailoring to specific deficit profiles.
- Large scale, well designed and coordinated RCTs are needed.