

# EF workshop for teachers

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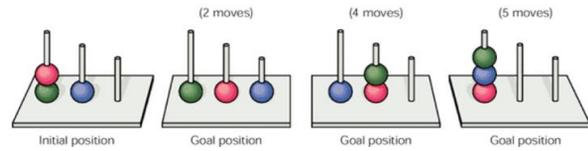
If you are interested in our work most of my papers and chapters are here:

<http://www.staff.city.ac.uk/g.morgan/>

Always interested to hear from you about any thing overlapping. Drop me an email here:

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# The Tower of London



- requires the child to move disks from a starting position to a different goal and involves planning, inhibition and working memory. Many classroom activities involve these same components. I will go through what we found out in the research and then what we did in a training study involving musical games. The main conclusions we arrived at were that language predicted executive Functions and that training improves EFs . A summary is here [http://www.staff.city.ac.uk/g.morgan/DCAL\\_research\\_briefing\\_on\\_executive\\_functioning.pdf](http://www.staff.city.ac.uk/g.morgan/DCAL_research_briefing_on_executive_functioning.pdf)

## Executive Functions

Control of cognitive processes:

- Planning
- Working memory
- Attention
- Problem solving
- Inhibition
- Mental flexibility/switching
- Multitasking
- Initiating and monitoring actions

Prefrontal cortex



# The big three EFs

## 1. Working memory

- ability to update information which is stored in memory

## 2. Inhibition

- ability to suppress automatized or predominant responses

## 3. Shifting

- ability to switch between cognitive sets or tasks

Short term memory and Selective Attention are precursor skills (develop in first year)

More complex EFs: Planning and Fluency (integration of WM and inhibition)



# Odd one out test- visual working memory



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## Measuring EFs – parent checklist (BRIEF)

Never

Sometimes

Often

- Tries the same approach to a problem over and over even when it does not work - flexibility
- Acts wilder or sillier than others in groups (birthday parties, break) -inhibition
- Overreacts to small problems - regulation
- Is not a self-starter - initiation
- When given three things to do, remembers only the first or last – working memory
- Does not bring home homework, assignment sheets, materials, etc. – planning
- Does not check work for mistakes – monitoring
- Has trouble waiting for turn - inhibition

## EF development

- Initially may be a common EF factor
- After age 4 years EFs become increasingly more differentiated with age
- EFs might have specific importance for academic success e.g. solving mathematical problems relies on working memory – retrieval and storage of partial results and processing of information while it is stored
- Mediation of other behaviours
- EFs also might have a general involvement in classroom learning – facilitate behaviour regulation and less disruption, pay attention to instruction and ignore distraction, allows you to maximally profit from learning opportunities

Morgan, G. & Dye, M. (forthcoming). Executive Functions and Access to Language: The Importance of Intersubjectivity. In M. Marcshark & H. Knoors (eds). The Oxford Handbook of Deaf Studies in Learning and Cognition.

Social Interaction



# The Intersubjectivity model

Intersubjectivity Scaffolding Hypothesis



Theory of Mind



Language development

Language Scaffolding Hypothesis



EF development

‘Have you found your brick? That’s a good brick, isn’t he? Are you building the house? Which brick goes there? Ah! Is it wobbling? Shall we put some more bricks here? That is a big house!, **House**, yes it’s a house made of bricks’



Adult is **responsive** to the child’s focus - **contingency**

Child and adult are in **coordinated joint attention**

Adult is talking with him about what the shared attention is.

Child will learn something about how these words are used (**form and function/meaning**).

The child’s language is minimal the adult **expands** on it and builds a **scaffold** around the child’s language

There is a lot of repetition but the **child is leading** the parent

## Scaffolding



Mothers of CI-implanted children use less complex utterances, suggesting a reduced language environment (Moeller & Tomblin, 2015).

## Paternal responsiveness

Mothers report anxiety and feelings of incompetence in how to interact with a deaf child. Possible cause for interruptions in maternal responsiveness

Moeller MP, Tomblin JB. An Introduction to the Outcomes of Children with Hearing Loss Study. *Ear and hearing*. 2015;36(01):45-135

## Contingent talk

- Fagan et al. (2014) found that mothers of CI-implanted children use more directives (e.g., let go, come here) and prohibitions (e.g., no, don't touch) than mothers of age-matched hearing children before and 7 months after CI implantation demonstrating continuity in an impaired foundation.
- Directive style means less participation and initiation from the children. Consequently the children were less able to interpret their mothers' intentions

Fagan MK, Bergeson TR, Morris KJ. Synchrony, Complexity and Directiveness in Mothers' Interactions with Infants Pre- and Post-Cochlear Implantation. *Infant behavior & development*. 2014;37(3):249-257.

## Study 1 (Botting et al, 2016 *Child Development*)

Deaf, N = 108

Hearing, N = 125

Group	Simon task <sup>1</sup>	ToL (extra moves)	Design Fluency <sup>2</sup>	Odd one out <sup>2</sup>	Backward span <sup>2</sup>	Colour trails (secs) <sup>3</sup>
Hearing	-11.07 (15.43)	25.78 (15.03)	20.96 (6.35)	10.39 (4.46)	6.06 (1.95)	29.75 (16.9)
Deaf	-17.02 (16.83)	30.77 (18.16)	19.59 (7.72)	7.99 (4.03)	4.9 (2.11)	38.22 (20.60)
T-test	$p < .001$	$p = .025$	$p = .14$	$p < .001$	$p < .001$	$p = .002$
ANCOVA	$p = .003$	$p = .188$	$p = .67$	$p = .021$	$p = .010$	$p = .132$

<sup>1</sup> interference score

<sup>2</sup> total score

<sup>3</sup> additional time

Botting, N., Jones, A., Marshall, C., Denmark, T., Atkinson, J., & Morgan, G. (2016). [Non-verbal executive function is mediated by language: A study of deaf and hearing children](#). *Child Development*

## Main Findings of Study 2 (Jones, et al, 2019)

- Over 18 months all deaf and hearing children improve both their EF and language!
- Over 18 months deaf children catch up with hearing group on some EFs but continue to lag behind their hearing peers in other tasks and language **but gap does not widen**
- Previously we found language mediated EF scores at time 1. Language at T1 predicted later EF (and not vice versa)

Jones, A., Marshall, C., Botting, N., St Clair, M., Atkinson, J. and Morgan, G. (2019). [Expressive vocabulary predicts non-verbal executive function: a 2-year longitudinal study of deaf and hearing children](#). *Child Development*.

# Can we train EF skills in deaf children?

Katherine Mason thesis

EF training study with deaf primary school children



## Curriculum-based

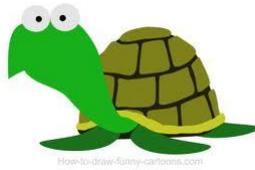


### ***Turtle technique***

**STOP** (stop & calm down)

**THINK** (generate a plan)  
(solutions/behaviours/outcomes)

**GIVE IT A TRY!** (try my plan) (learn from  
the outcomes)



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## Music-based Interventions



## Music playing involves:

- Selective attention
- Inhibition
- Planning
- Working Memory
- Monitoring skills
- Multitasking
- Flexibility/switching

Musicians better on EF tasks than non-musicians (e.g. Bialystok & Depape, 2009)

## Example activities



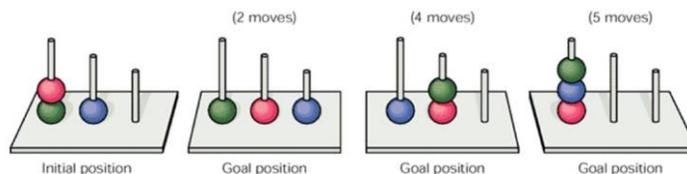
EF Measures – red indicates significant improvement after intervention

- Tower of London – *Planning*
- Sun/Apple task - *Inhibition*
- Odd one out test - *working memory*
- Spatial span (Corsi) - *working memory*
- Symbol Search – *flexibility, attention*
- Colour trails test – *cognitive switching*
- Design - *fluency*
- Semantic - *fluency*

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## Self-reflection during learning

1. Notice challenges
2. Pause
3. Consider the options
4. Put things into context prior to responding
5. Monitor progress towards a goal



Zelazo, P.D., Forston, J.L., Masten, A.S., & Carlson, S.M. (2018). Mindfulness plus reflection training: effects on executive function in early childhood. *Frontiers in Psychology*, 9, 208.

## Summary and questions

- What is EF?
  - Why is it important?
  - Why a weak area for most DHH children?
  - Can we improve EF?
- 
- What other things do we need to do to work on EF in the school?