

Theory of Mind

Interconnectedness of ToM and intellectual achievements – Part 1 Executive function and IQ

Dr Penny Tok

Today

- Recap
- What is executive functioning
- What is IQ
- Links between EF, IQ and ToM

Consider these two statements:

“Humans are thinking beings that feel”

“Humans are feeling beings that think”

Acquisition of false belief understanding coincides with significant changes in EXECUTIVE FUNCTIONING

IN BRIEF
Executive Function:
Skills for Life and Learning

Contributions to ToM: Executive functions

Executive functions: collection of higher order mental processes involved in future goal oriented behaviours.

- Cognitive flexibility
- Inhibition
- Working memory
- Planning
- Generativity



Necessary for the completion of complex tasks

Necessary for conscious **THOUGHT and ACTION**



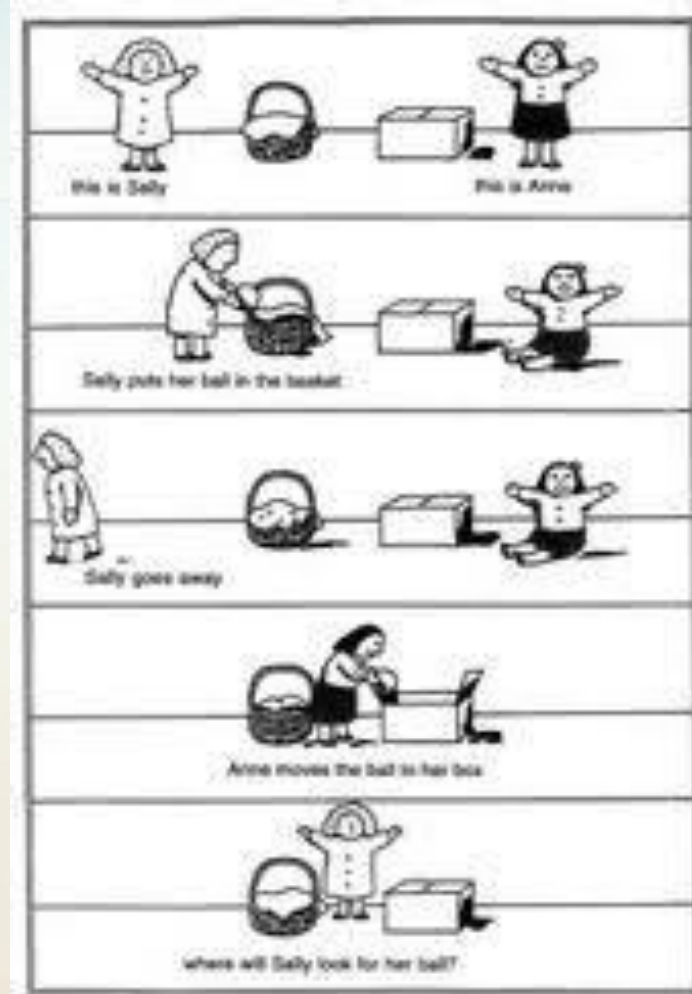
EF as the Conductor of the Brain's Orchestra



Creates the impression of a central control center or a singular control capacity
(from McCloskey)

What executive function does the child need?

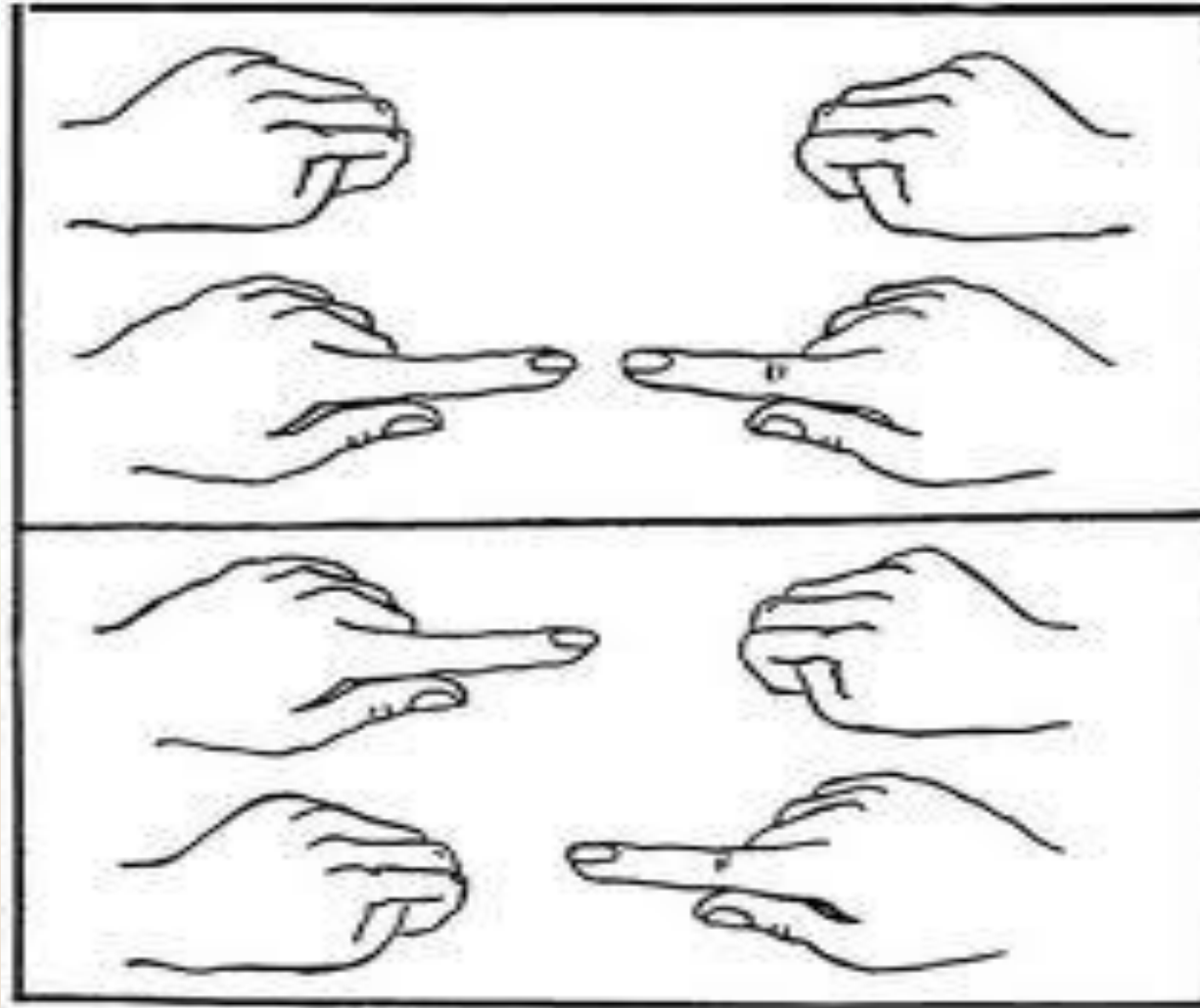
INHIBITION
OF REALITY
(WHAT THE CHILD
KNOWS)

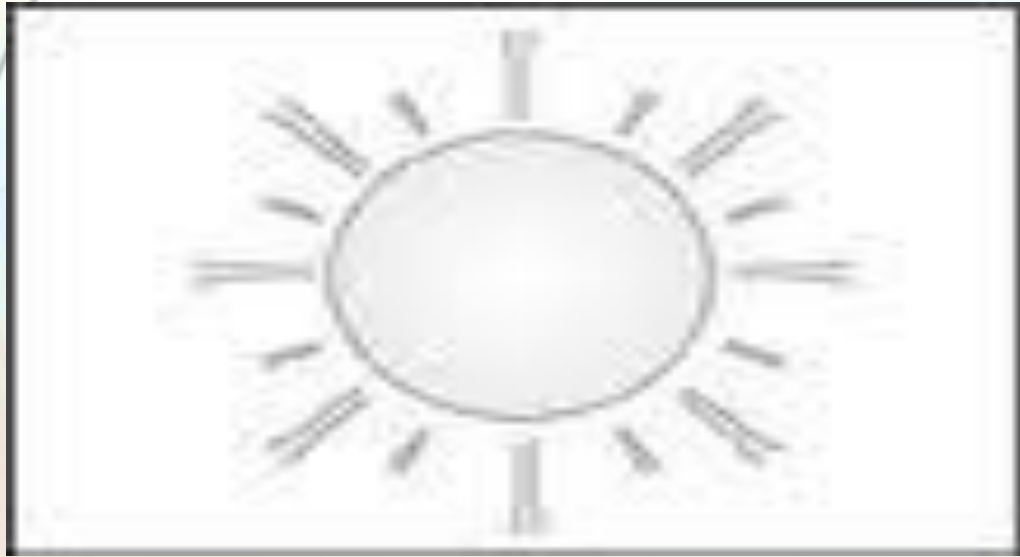


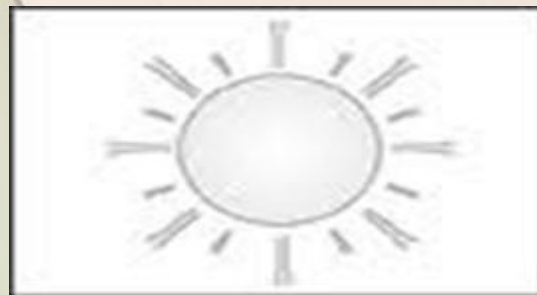
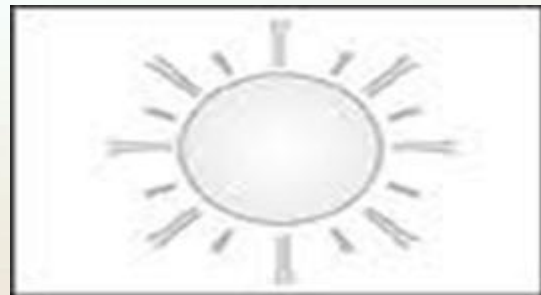
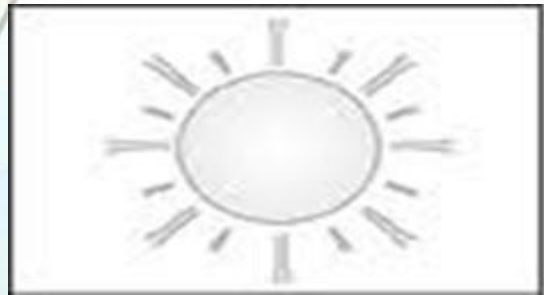
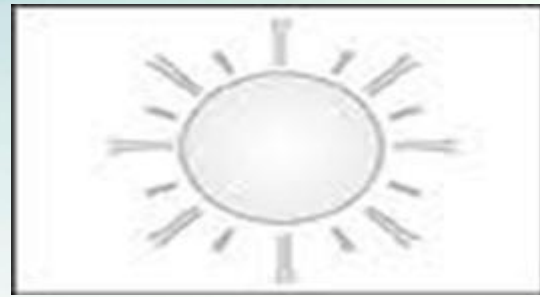
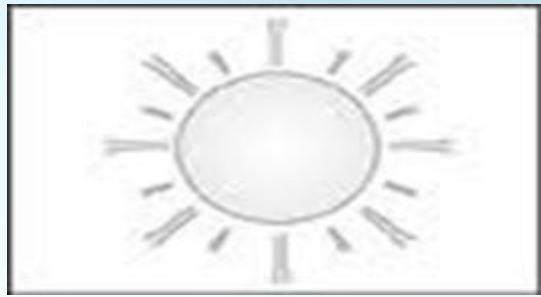
What is inhibition?

Luria's Hand game

Inhibition:







YELLOW

BLUE

GREEN

RED

PINK

WHITE

BLACK

PURPLE

BLUE

RED

ORANGE

GREY

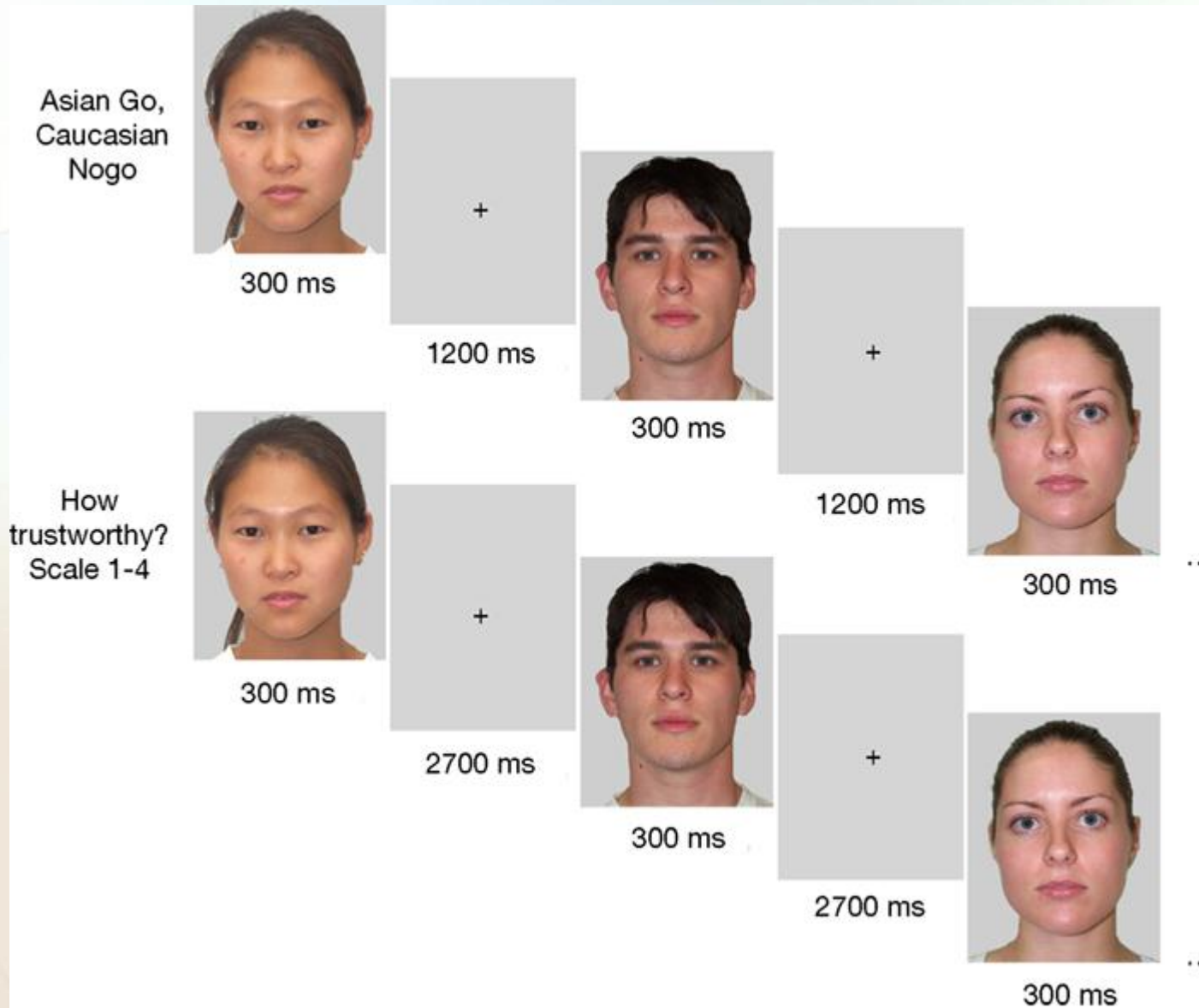
BROWN

PINK

WHITE

Response inhibition is linked to emotional devaluation: behavioural and electrophysiological evidence

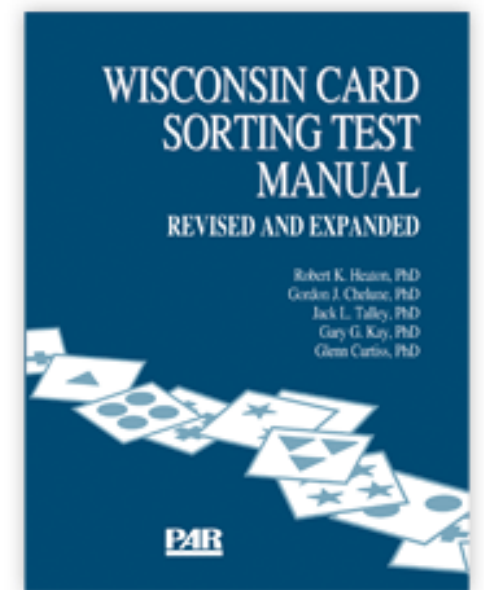
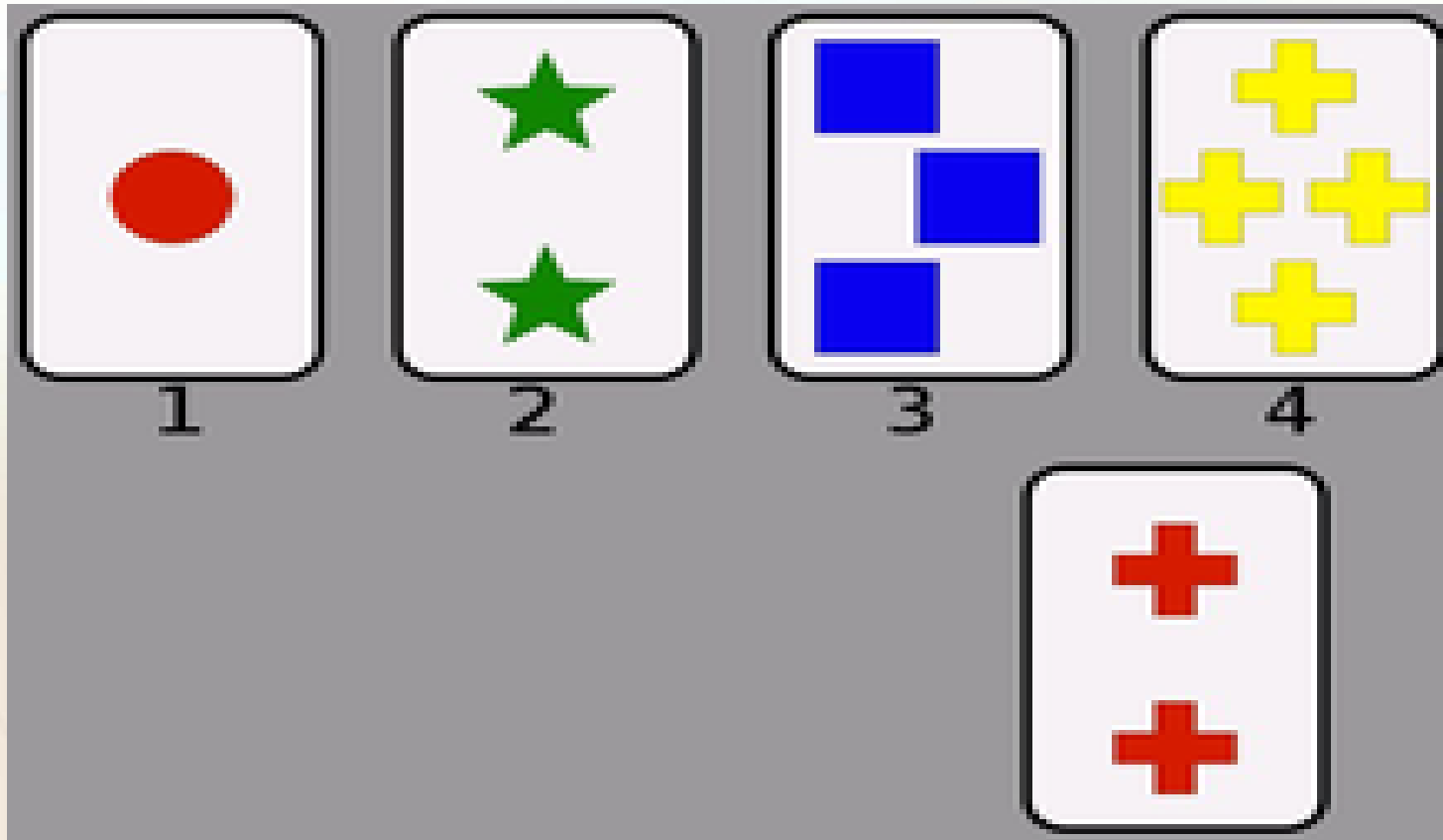
[Monika Kiss^{1,*}](#), [Jane E. Raymond²](#), [Nikki Westoby²](#), [Anna C. Nobre³](#) and [Martin Eimer¹](#)



Cognitive flexibility

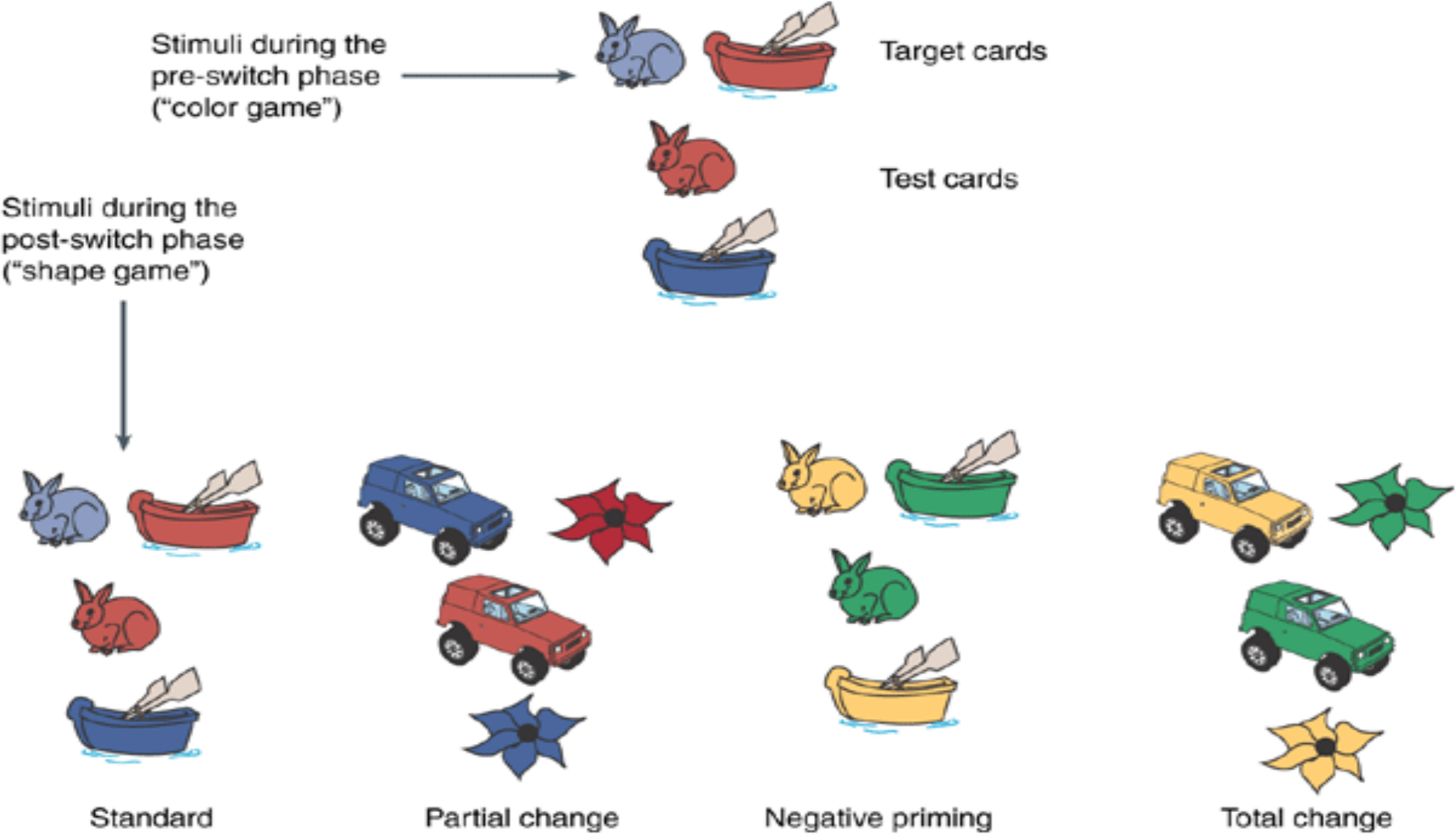
- Ability to shift to a different thought and/or action according to changes in a situation

Cognitive flexibility



Sort cards on one of the three possible dimensions: colour, size and number.

Dimension Change Card Sorting (Zelazo, 2006)



Planning- Tower of Hanoi/ London

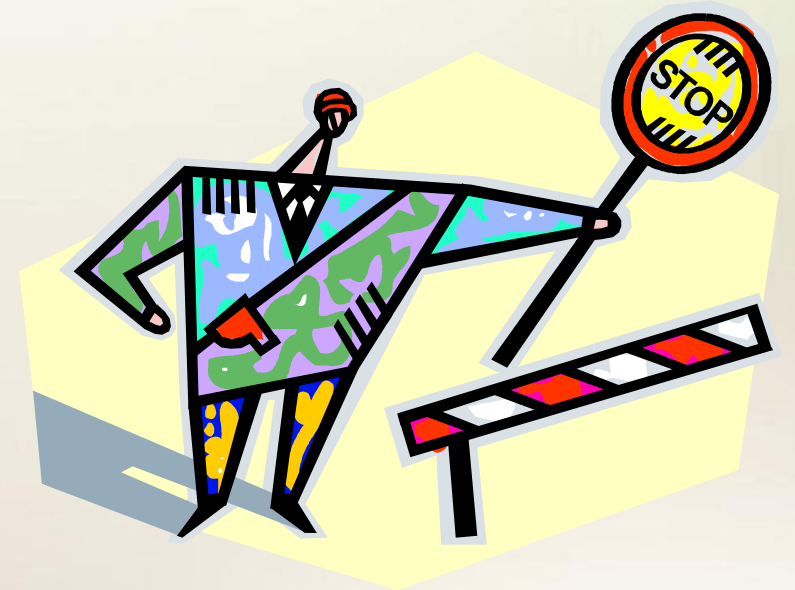
<http://www.dynamicdrive.com/dynamicindex12/towerhanoi.htm>



Planning

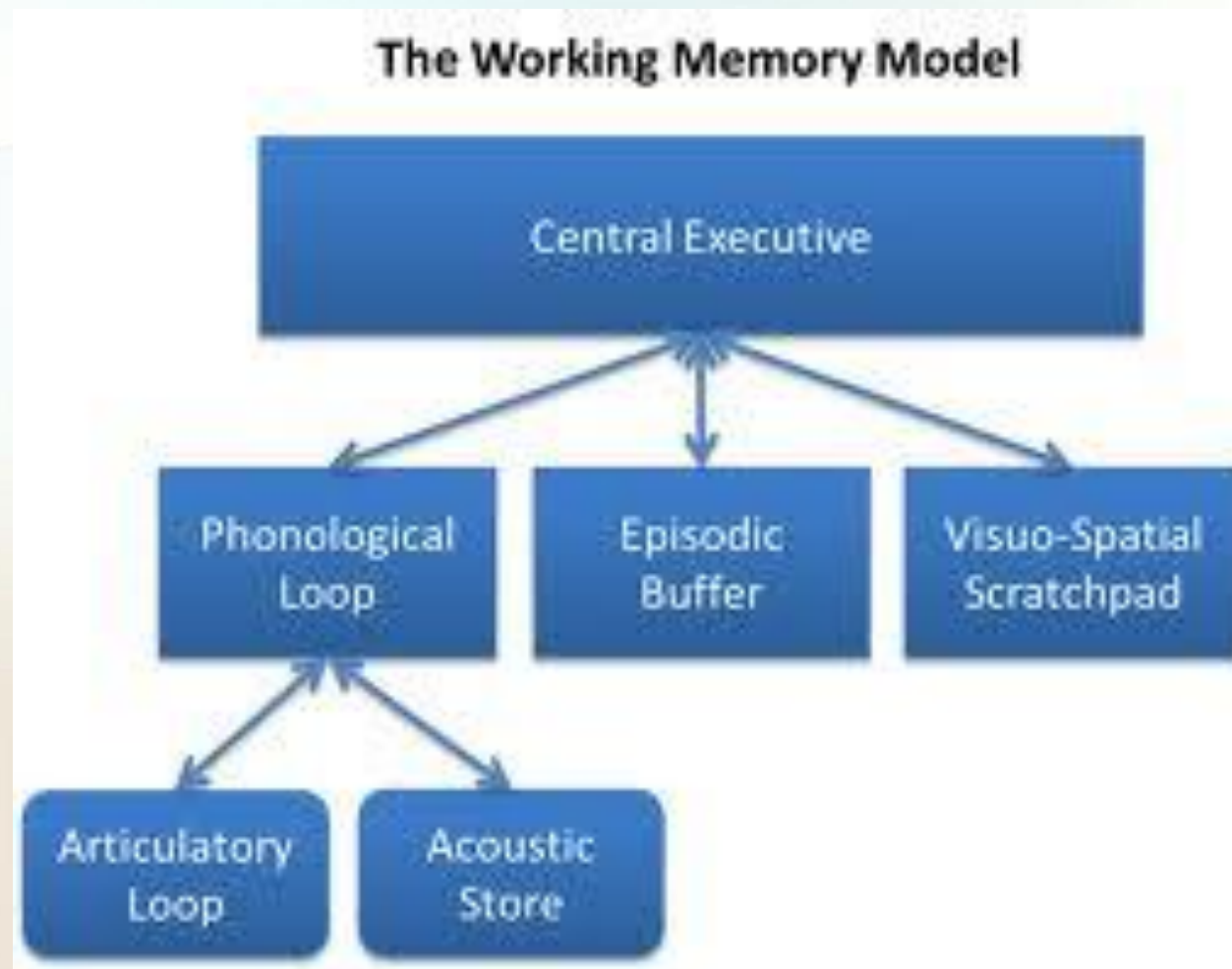
A sequence of actions have to be continually monitored, re-evaluated and updated.

- Need to conceptualise changes from the CURRENT situation
- looking ahead by taking an objective and abstracted approach to consider ALTERNATIVES
- making CHOICES and
- IMPLEMENTING the plan
- and REVISING accordingly



Working memory

Baddeley & Hitch

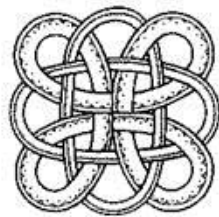
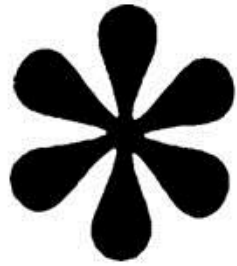


Self-Ordered Pointing Test (SOPT) Petrides & Milner, 1982

Working men

Examples of Abstract Images & Verbal Images

**Abstract: Set
Size 4**



Images for the ABSTRACT condition were courtesy of Robert Joseph

Images for VERBAL condition were taken from Snodgrass and Vanderwart (1980).



Generativity

Generativity – capacity to generate novel ideas & behaviours spontaneously



Studies that show correlations:

- **EF correlated with FB (with strong effect size)- Perner & Lang, 1999**
- **And even after controlling for age, verbal ability and general cognitive abilities- Carlson & Moses, 2001, Frye, Zelazo & Palfai, 1995...**
- **EF & FB significantly correlated across cultures- Sabbagh, Xu, Carlson, Moses & Lee, 2006**

Longitudinal studies:

- **Hughes(1998): EF at 4 predicted performance on FB at 5 but not vice versa**
- **Kloo & Perner (2003): training FB in children improved EF performance & training EF improved FB**
- **Flynn, (2007); Flynn, O'Malley & Wood (2004): good performance on EF was pre-requisite for good performance on FB**

Stronger evidence that advances in EF is required for advances in ToM (in particular FB) than the other way around

Which executive functions are specifically found to be related to ToM?

- Cognitive flexibility
- Inhibition
- Working memory
- Planning
- Generativity

- EF for performance of ToM or for conceptual development of ToM? (Carlson, Moses & Breton, 2002; Joseph & Tager-Flusberg, 2004)

- Cognitive flexibility

- Inhibition

- Working memory

- Planning

- Generativity



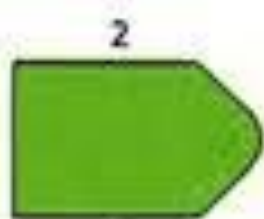
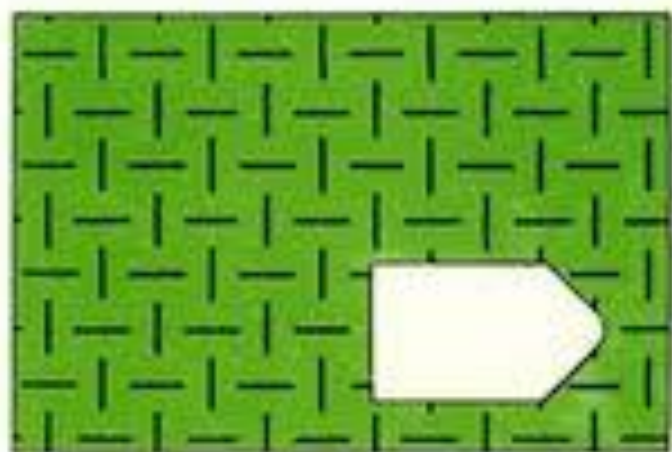
Combination

IQ




General definition

- Rational thought and reasoning
- The ability to act purposefully in an environment.
- The ability to deal with situations, in an effective manner, within an environment.
- Cognitive – Examples of cognitive ability: memory, perception, concept formation, problem solving, mental imagery, action, association, language and attention.
- The ability to learning from experience
- The ability to live and cope with the demands of daily life.



STANDARD
PROGRESSIVE MATRICES
SETS A, B, C, D & E
Prepared by J.C. Raven



WITNESS
EDUCATIONAL
PUBLISHING

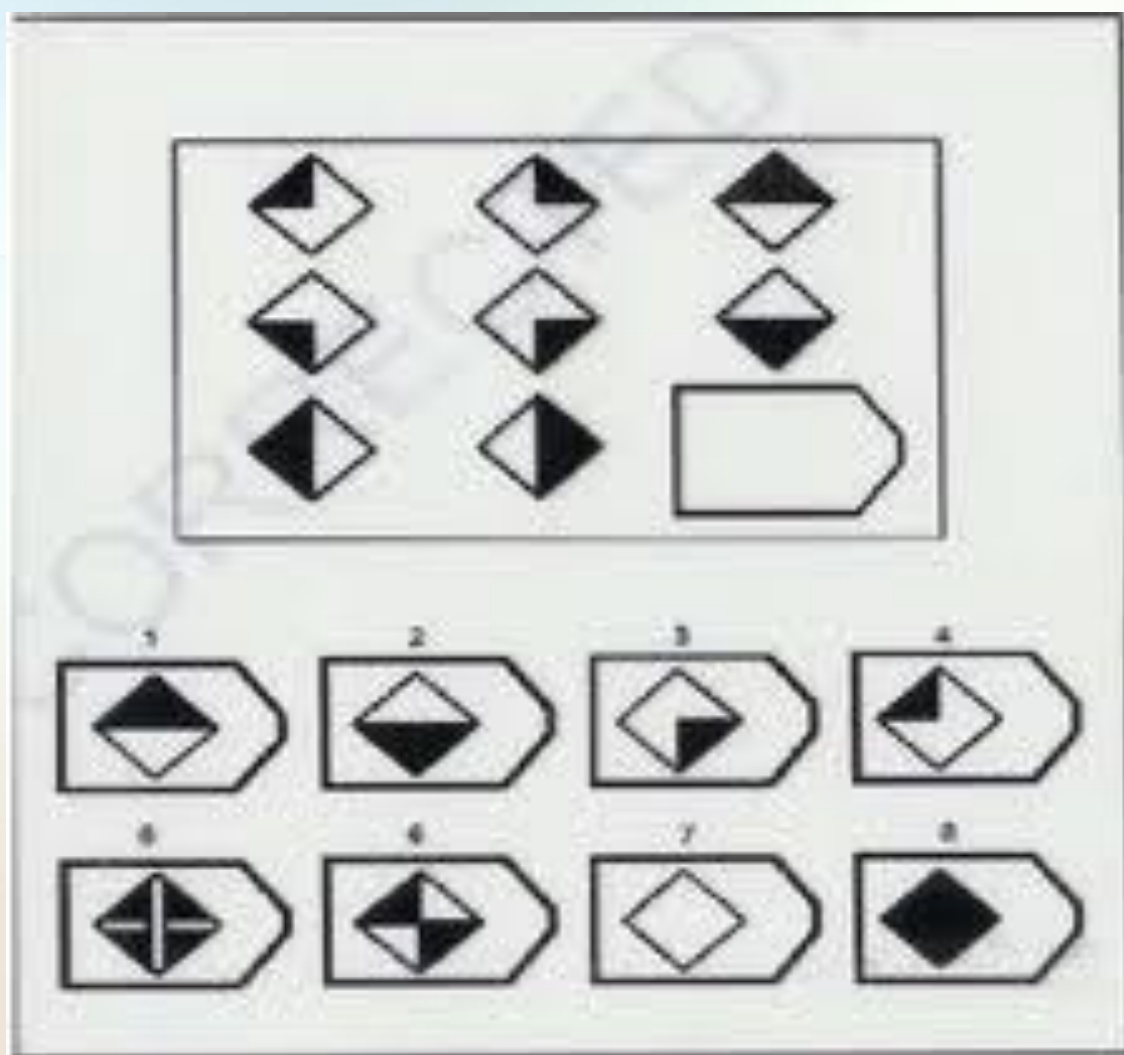


Fig. 2. Problem illustrating the Raven's Progressive Matrices Test.



Summarise

Why is executive function related to ToM?

Next week

- Test – lectures 1 -4: lecture notes, compulsory readings and Frith & Frith, 2012
- Presentation