



The Association between Executive Function and Landmark Integration in the Development of Spatial Cognition

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Background

- The process of reorientation – the use of environmental cues to re-establish a mental map – is essential to spatial cognition¹
- Adults are able to use landmarks when asked to reorient themselves in a new environment²
- Children and animals primarily rely on geometric cues such as the environmental boundary, or the shape of a room which appears to have an evolutionary basis³
- Previous work indicates that landmark integration develops independently of other foundational cognitive processes⁴
- Executive function is highly correlated to academic and personal success⁵, which indicates that it may develop alongside other essential cognitive processes
- We set out to test if there is a correlation between reorientation score and executive function

Research Question

Is a child's ability to reorient positively correlated to the development of executive function?

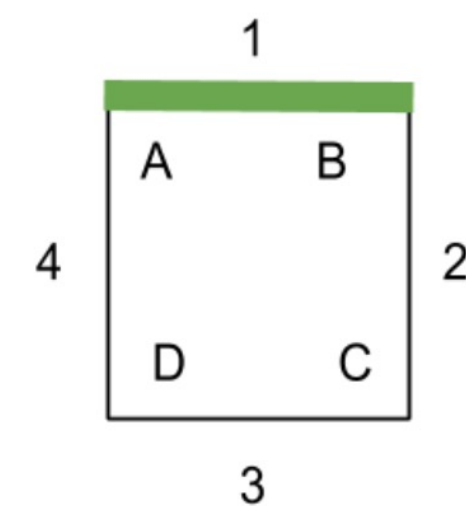
Participants

- $N = 68$
- Mean age = 71 months (5.96 years)
- Male = 32
- Female = 36

Methods

Room Design:

- 10 x 10 ft. square room to eliminate geometric cues
- 3 white walls, 1 landmark wall



Procedure:

- Child's attention is drawn to the landmark wall
- Child watches the experimenter hide a sticker in a predetermined corner
- Child is blindfolded and spun around until disorientation has been ensured
- Child is asked to find the sticker on their first try
- 8 trials are split between 2 corners
- Next, a left / right assessment and executive function task are performed to understand the cognitive underpinnings of landmark use

Results

- There was a significant correlation between reorientation score and development of executive function
 - $r(60) = .35, p = .006$
- Results of a multiple linear regression indicate that there is a collective significant effect between executive function score, reorientation score, and age.
 - $R^2 = .14, F(2, 58) = 5.918, p = 0.005$
- After adjusting for age, executive function is a significant predictor of reorientation, $p = .03$

Reorientation and Executive Function Data:



Figure 1: Correlation between HTKS Score, which measures executive function, and White Indirect, which measures reorientation.

Discussion

- The correlation between executive function and reorientation score indicates that spatial cognition does not develop independently of other essential cognitive processes.
- Executive function and spatial abilities independently predict future success, which indicates that the two domains could have parallel developmental trajectories.
- Both areas of cognition are linked to working memory⁶, which suggests a possible overlap in neural circuitry that could explain the developmental congruence observed here.
- The integration of landmark use and executive functions in reorientation behavior appears to be unique to human cognition. The current findings help to illuminate overlapping neurodevelopmental processes in human navigation.

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