

# Functional Connectivity between Parietal and Frontal Brain Regions and Intelligence in Children



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## Introduction

- Parieto-Frontal Integration Theory (P-FIT) = integrity of interaction between parietal and frontal regions underlies individual differences in intelligence<sup>[1]</sup>
- Parietal-frontal functional connectivity increases in strength during childhood<sup>[2]</sup>
- Research goal = determine whether parietal-frontal functional connectivity is already associated with intelligence in children

## Methods

- Generation R study, population-based cohort<sup>[3]</sup>
- 115 participants (56 boys)
- Non-verbal IQ test at 6.2 years (range = 5.4-7.0)
- Resting-state fMRI at 7.2 years (range = 6.1-8.6)
- Independent component analysis → networks selected:
  - left parietal-frontal network, see Fig. 1a
  - right parietal-frontal network, see Fig. 1b
  - insular-temporal/ACC network, see Fig. 1c
- Functional connectivity = correlation between mean BOLD response time series of each possible pair of regions
- IQ was correlated with functional connectivity, partialling out age at time of imaging

## References

- [1] Jung & Haier (2007) *Behav Brain Sci*  
 [2] Power et al. (2010) *Neuron*  
 [3] Jaddoe et al. (2008, 2010) *Eur J Epidemiol*

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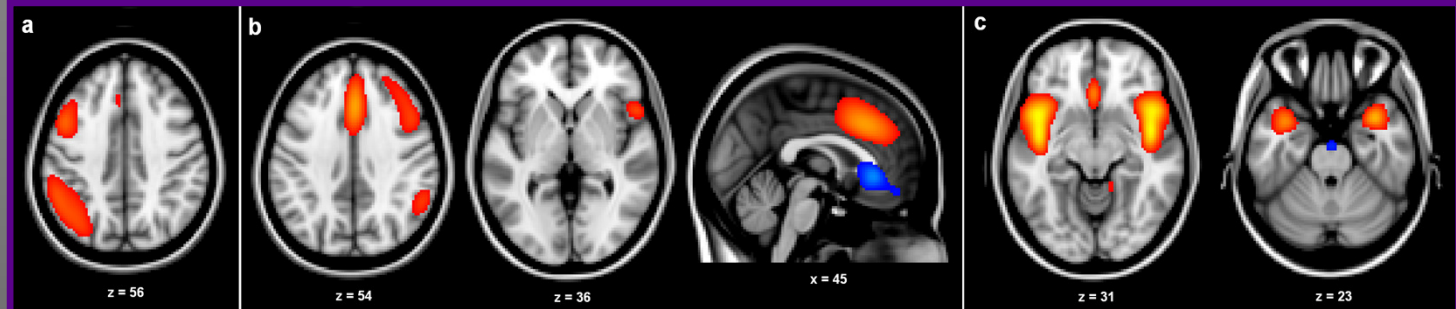


Fig. 1 a) Left parietal-frontal network b) Right parietal-frontal network c) Insular-temporal/ACC network

Table 1 Partial correlations between IQ and functional connectivity within the right parietal-frontal network

	right insula	right frontal	dorsal ACC	right parietal
ventral ACC	$r = .08, p = .41$	$r = .12, p = .22$	$r = .10, p = .28$	$r = .16, p = .10$
right insula		$r = .06, p = .50$	$r = .05, p = .61$	$r = .19, p = .05^*$
right frontal			$r = .15, p = .11$	$r = .25, p = .007^{**}$
dorsal ACC				$r = .29, p = .002^{**}$

Note. \* = trend, \*\* = significant at level determined by Hochberg's procedure

Table 2 Partial correlations between IQ and functional connectivity within the left parietal-frontal network

	dorsal ACC	left parietal
left frontal	$r = .14, p = .14$	$r = .18, p = .06^*$
dorsal ACC		$r = .03, p = .79$

Note. \* = trend at significance level determined by Hochberg's procedure

## Results

- Positive correlation between IQ and functional connectivity between:
  - right parietal and right frontal regions, see Table 1
  - right parietal region and dorsal ACC, see Table 1
  - right parietal region and right insula (trend), see Table 1
  - left parietal and left frontal regions (trend), see Table 2
- No correlations between IQ and functional connectivity within the insular-temporal/ACC network, all  $ps > .11$

## Discussion

- Even in children, increased intelligence is related to increased functional connectivity between parietal and frontal regions
- Increased intelligence is also related to increased functional connectivity between parietal and dorsal ACC regions
- Right lateralization of effects is due to assessment of non-verbal IQ
- Longitudinal studies are needed to examine how maturation of the parietal-frontal connection relates to individual differences in intelligence