Simulating Cooperative Interactions to Investigate the Neural Correlates of Joint Attention

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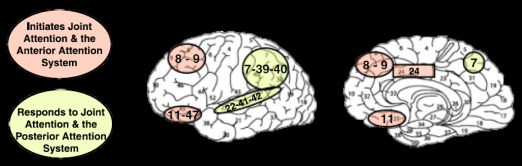
BACKGROUND

Joint attention involves orienting attention between a social partner and an object of interest (Bruner, 1974)

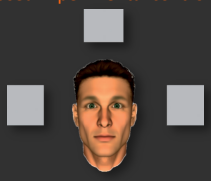
The Parallel Distributed Processing model (PDPM) claims that a posterior (RJA) and anterior (IJA) network integrate enabling the simultaneous representation of 'self' and 'other' attention (Mundy, et al., 2007)

Joint attention is an interactive phenomenon, and must therefore be investigated using interactive paradigms (Schilbach et al., 2013)



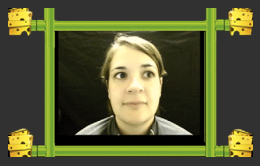
Previous studies pioneering interactive approaches

Schilbach et al., 2010
Increased Experimental control



Not goal driven or intuitive

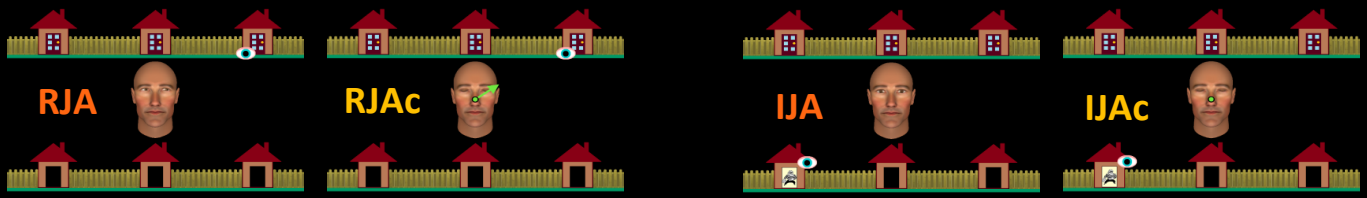
Redcay et al. 2010
Intentional & goal driven



Less control over interaction

Overtly instructed social role
↑ partner predictability , ↓ attention monitoring
Control conditions not equally matched for RJA and IJA

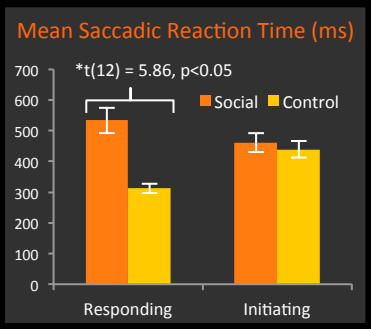
METHOD: Virtual Reality 'Catch the Burglar' Task

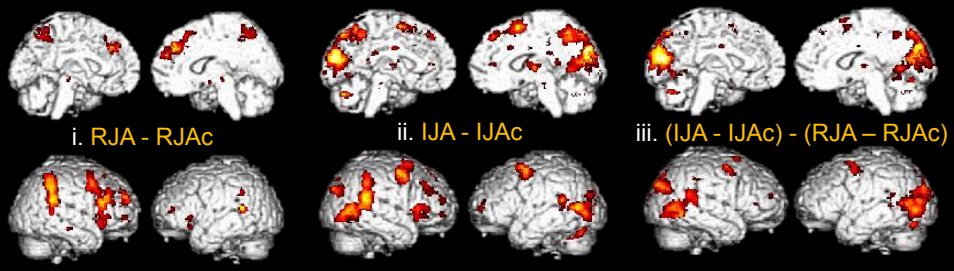


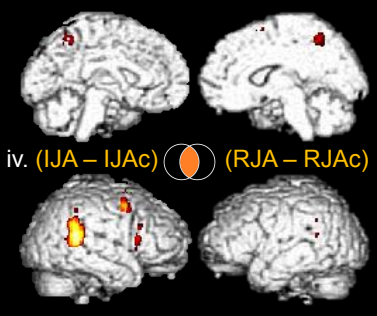
Task: Collaborative search. Subjects interacted with an avatar controlled by a gaze-contingent algorithm
Subject and avatar each search a row of houses. Whoever finds the burglar first must guide the other to the correct location

Paradigm strengths: Interaction is compelling, goal-driven, intuitive and spontaneous (↓ partner predictability, ↑ attention monitoring)
Full experimental control over non-social task demands (complexity, attention, # eye movements)

RESULTS: A Frontotemporoparietal Network Common to RJA and IJA







CONCLUSIONS

Activated regions common to RJA and IJA included:
R pSTS, R TPJ, B Precuneus, R IFG, R Precentral Gyrus, R MTG, R MFG

Greater activation for IJA, (IJA - IJAc) - (RJA – RJAc) at TPJ, Precuneus, IFG and MFG

These data are consistent with the PDPM hypothesis that RJA and IJA processes are integrated in a common neural network in later development

This network is likely to support the parallel processes of representing **self-** and **other-** attention perspectives during dynamic interactions

Note: Threshold maps showing at t > 3.70, equivalent to p < 0.05 FDR correction for (RJA-RJAc), with extent threshold 10 voxels.
The threshold for p<0.05 FDR correction would have been 2.87, 3.18 and 3.10 ii, iii and iv respectively. No voxels survived FDR correction for [*(RJA-RJAc) – (IJA-IJAc)*]

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