THE ROLE OF WHITE MATTER INTEGRITY IN TWO FORMS OF IMPLICIT LEARNING

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INTRODUCTION

IMPLICIT LEARNING: Non-conscious acquisition of regularities from the environment (Frensch, 1998)

TWO FORMS OF INTEREST:
- Differ in the type of regularity to be learned
- Rely on different gray matter regions, as seen in multiple functional imaging and patient studies (Chun & Phelps, 1999; Prfui et al., 2000)

IMPLICIT SEQUENCE LEARNING

- Regularity across time
- Regularity in spatial layout

Frontal (DLPFC, prefrontal supplementary motor)
Hippocampus
Parahippocampal gyrus
(Entorhinal, perirhinal, parahippocampal cortices)

AIM: Do the two forms of implicit learning relate to white matter integrity from distinct neural regions?

SEQUENCE LEARNING

ASRT TASK:
- Respond to stimuli at 1 of 4 locations with right hand

2nd order sequence structure
- e.g. 1r2r3r4r
- 1, 2, 3, 4 = target location
- r = target location is randomly determined

2 mixed frequency triplets compared across 9 epochs (45 sequence repetitions per epoch)

IMPLICIT SPATIAL CONTEXT LEARNING

Regularity in spatial layout

Frontal (DLPFC, prefrontal supplementary motor)
Hippocampus
Parahippocampal gyrus
(Entorhinal, perirhinal, parahippocampal cortices)

BEHAVIORAL ANALYSIS:
- Last trial of high-frequency (e.g. 112) and low-frequency (e.g. 113) triplets compared across 9 epochs (45 sequence repetitions per epoch)

Reaction Time (ms) Accuracy (proportion correct)

SUMMARY AND DISCUSSION

Superior learning in the ASRT task was related to higher white matter integrity in:
- Frontal regions adjacent to right dorsolateral prefrontal (DLPFC) and right premotor cortices, and the cerebellum – consistent with activation patterns from functional imaging studies of implicit sequence learning

Superior learning in the SCCT task was related to higher white matter integrity from the corticospinal tract – involved in motor aspects of the task

These findings are consistent with previous research showing that implicit sequence learning and implicit spatial context learning rely on different neural systems

Future analyses will use tractography to examine the white matter networks involved