Co-Localization of Time and Space in the Human Brain

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RESEARCH DAY

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IOWA | Interdisciplinary Graduate Program in Neuroscience

University of Iowa Carver College of Medicine

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Introduction

- Impairments in spatiotemporal cognition can affect a patient's ability to function independently.

- Spatial changes are temporally bound to create a meaningful sequence of events.

- Prior work suggests that timing and visuospatial deficits co-occur in several neurological and psychiatric conditions.

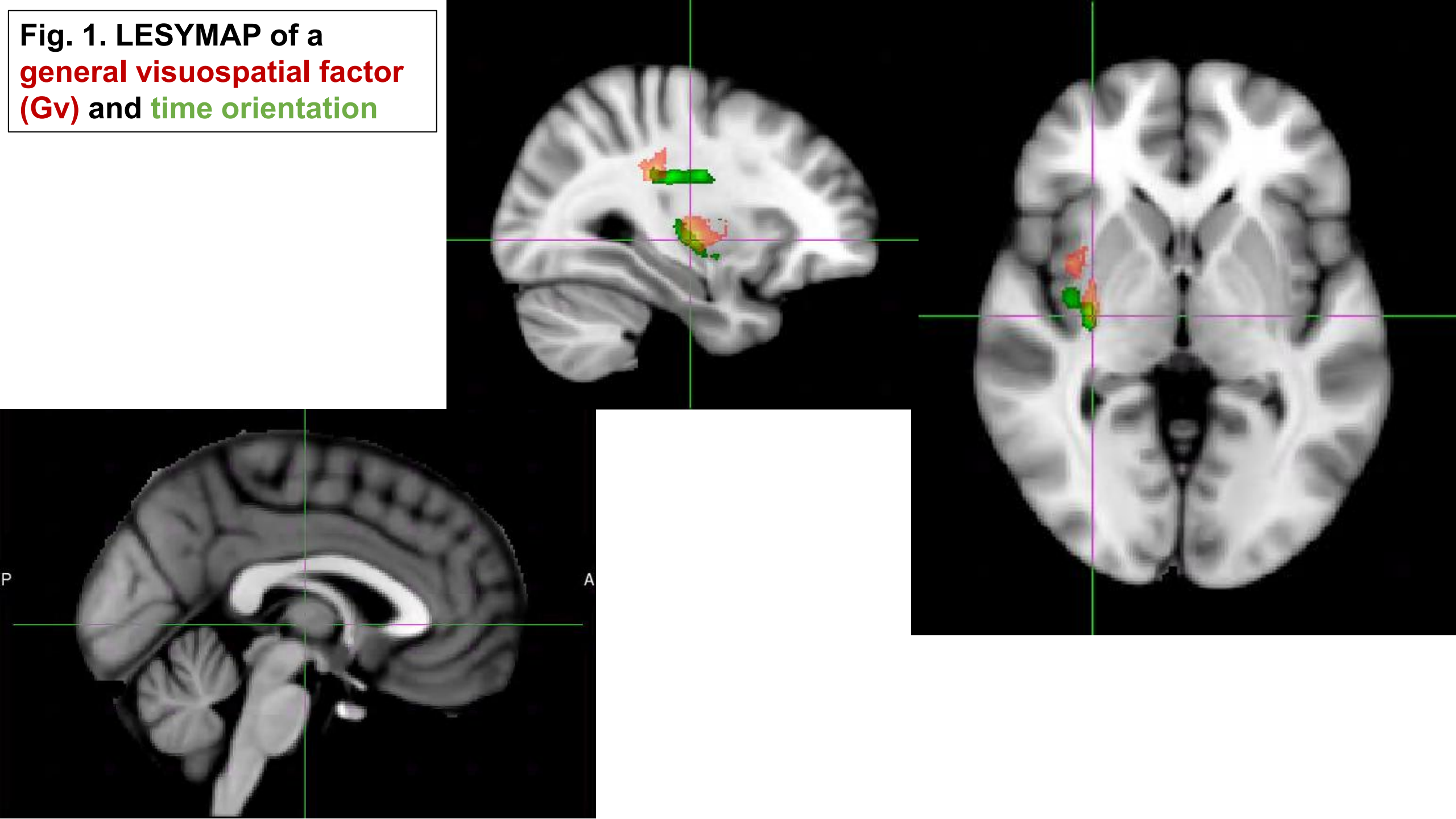
  - *We hypothesized that time and space perception share a partially overlapping network of regions necessary for perceiving both time and space.*

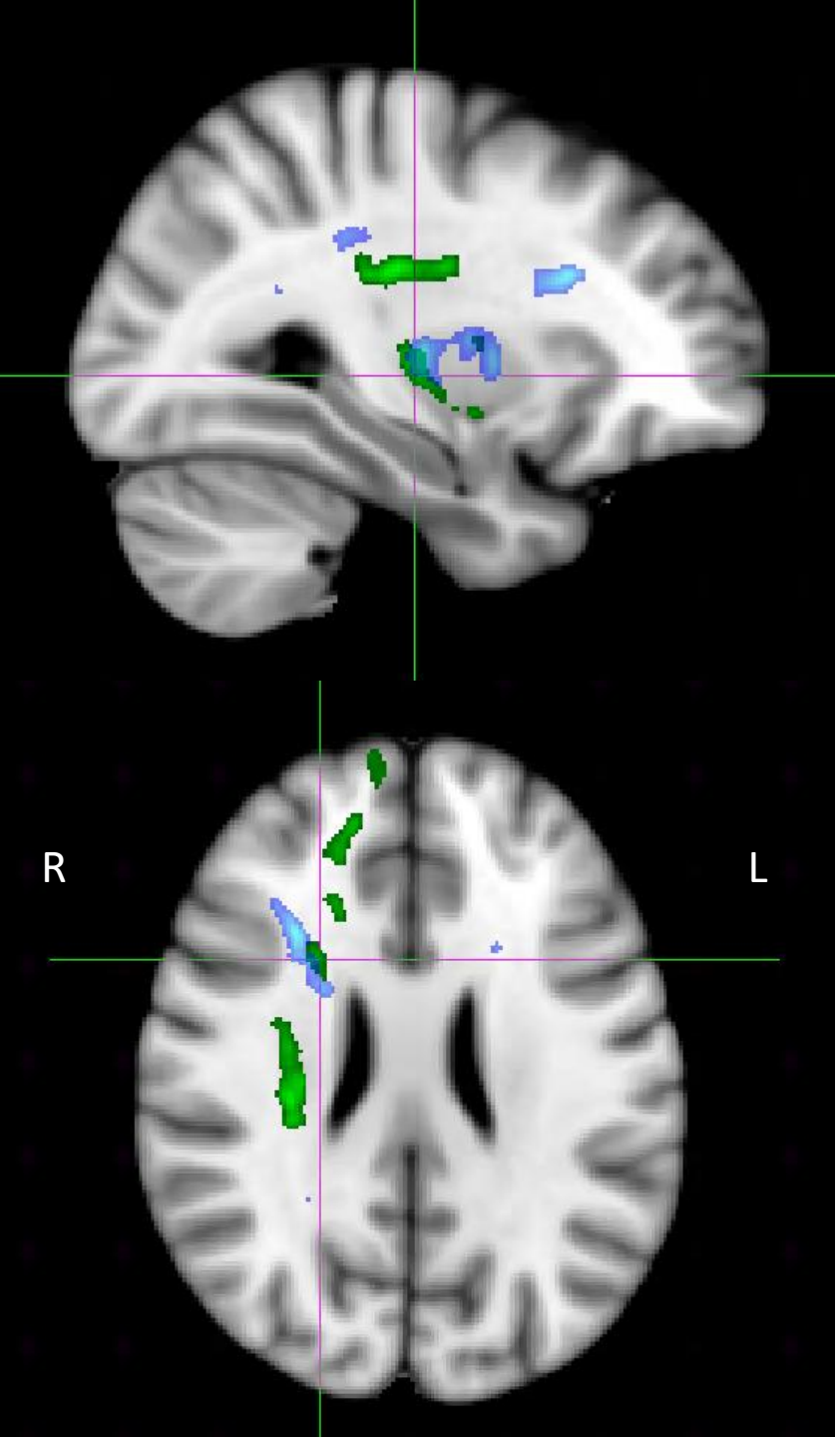
	TIME ORIENTATION	VISUOSPATIAL FACTOR (GV)	JUDGMENT OF LINE ORIENTATION (JLO)	CLOCK DRAWING (CD)
N	722	402	613	485
IMPAIRED	139	N/A	401	106
AGE	51 (17.6)	58.2 (13.8)	49.7 (18.0)	53.2 (16.6)
EDUCATION	13.3 (2.8)	13.5 (2.7)	13.5 (2.8)	13.2 (2.7)
GENDER	339 F 383 M	190 F 212 M	276 F 338 M	219 F 266 M
HANDEDNESS	622 R 49 L 51 BOTH	360 R 26 L 15 BOTH	552 R 51 L 10 BOTH	434 R 38 L 13 BOTH
ETIOLOGY	stroke (ischemic)= 379, stroke (hemorrhagic)= 128, SAH= 32, surgical resection= 123, encephalitis= 18, TBI= 25, other= 17	stroke (ischemic)= 238, stroke (hemorrhagic)= 87, surgical resection = 64, TBI= 4, encephalitis= 9, other= 0	stroke (ischemic)= 329, stroke (hemorrhagic)= 100, SAH= 25, surgical resection= 31, encephalitis= 17, TBI= 23, other= 88	stroke (ischemic)= 282, stroke (hemorrhagic)= 78, SAH= 23, surgical resection= 18, encephalitis= 15, TBI= 13, other= 56

Methods:

We used multivariate lesion symptom mapping (LSM) to analyze structural neuroimaging and neuropsychological test data from the Iowa Neurological Patient Registry.

Fig. 1. LESYMAP of a general visuospatial factor (Gv) and time orientation





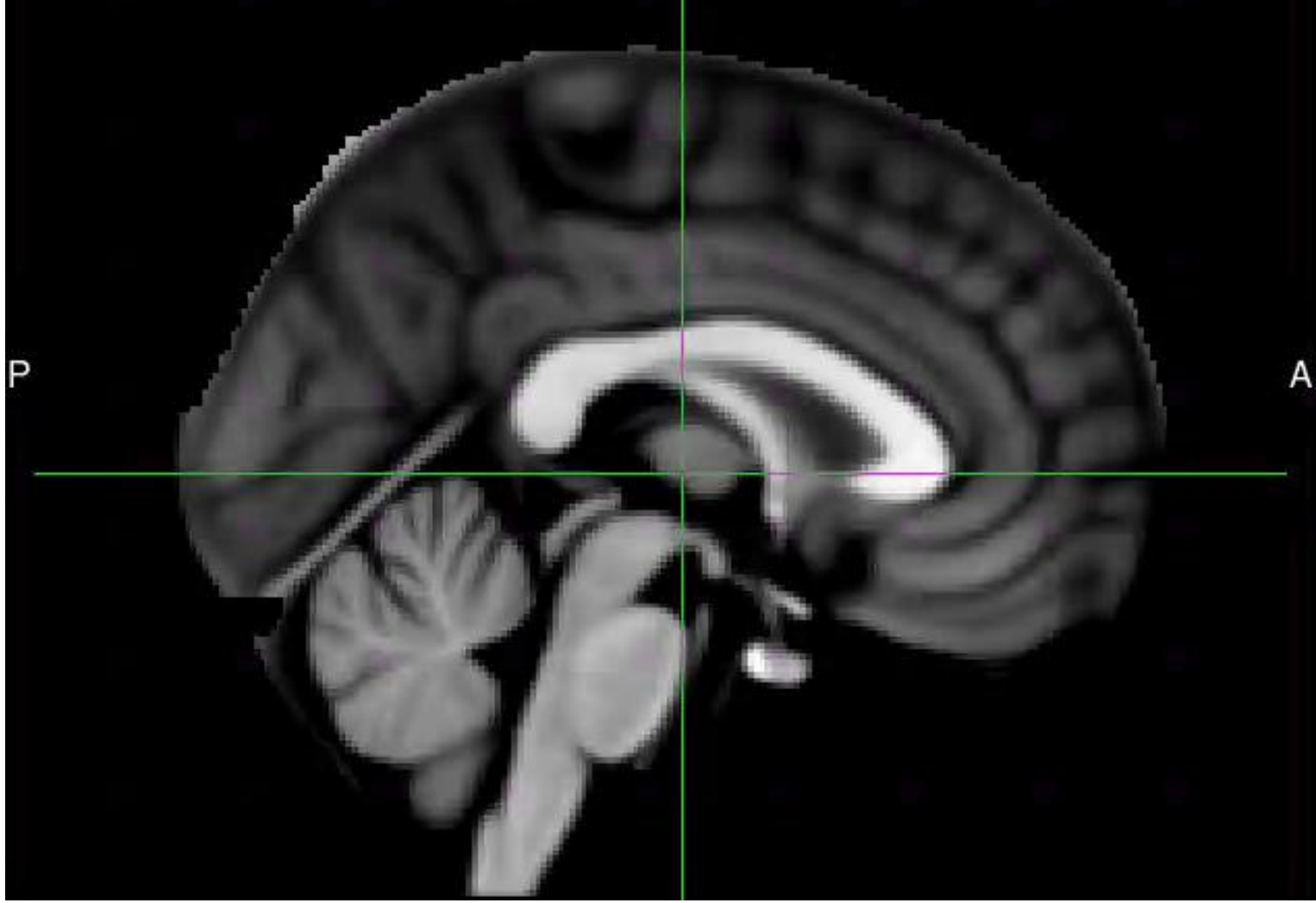
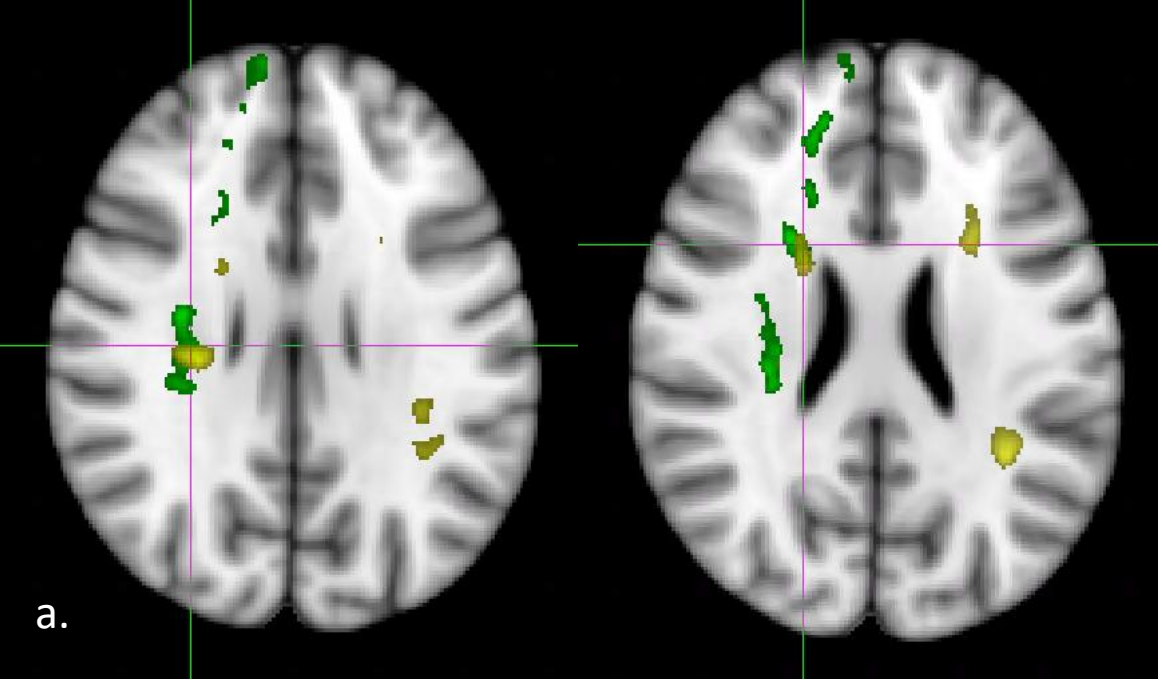
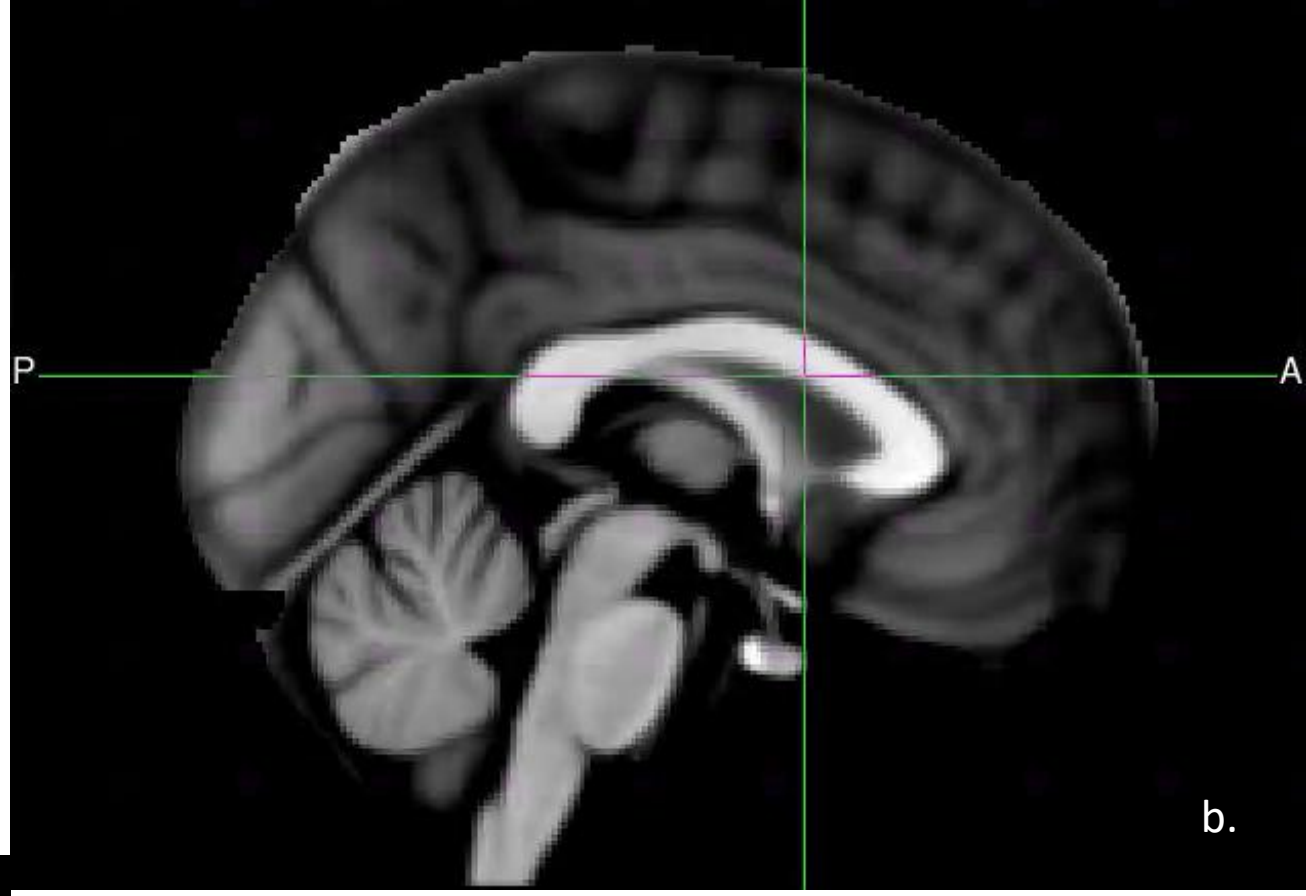
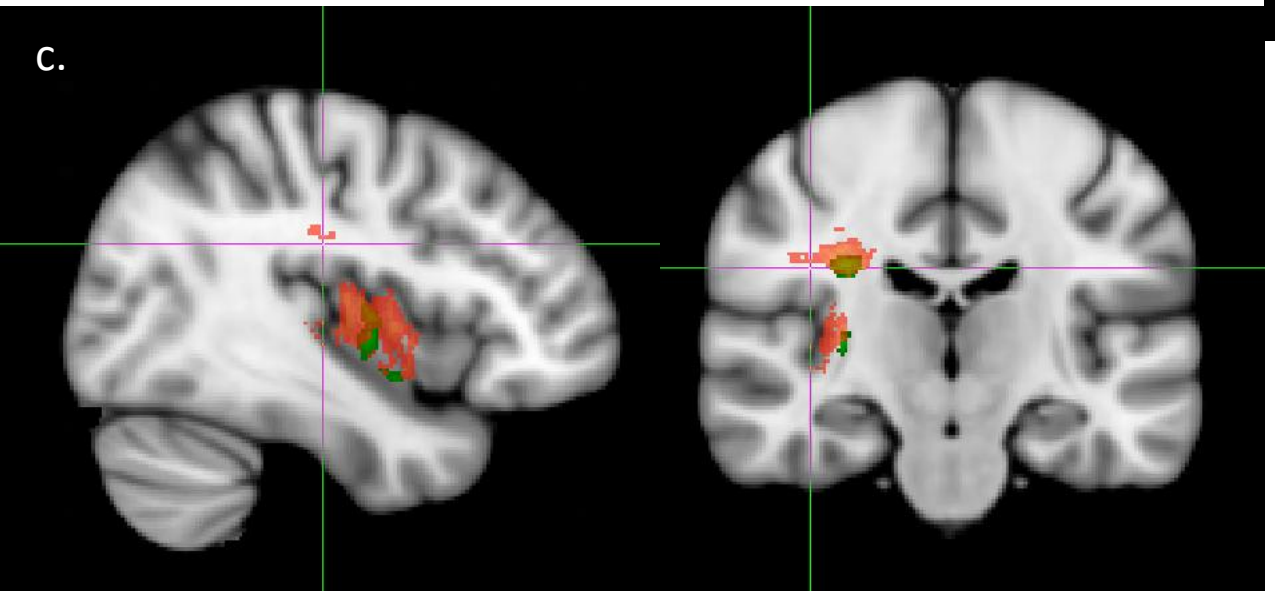


Fig. 2. LESYMAP of JLO and time orientation co-localize in the right putamen and white matter tracts in the right hemisphere







Figs. 3a&b. LESYMAP of clock drawing and time orientation co-localizes in right frontoparietal white matter.
Fig. 3c. Crude overlap of subjects impaired in clock drawing and time orientation LESYMAP

Conclusions

- The right putamen, frontoparietal white matter, and insula are associated with both space and time impairments.

- Future directions:
  - Could this merely be broad impairment?
  - More robust assessment of time perception

THANK YOU:

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