PS-7

Unraveling distinct neural mechanisms in dual-task priority during gait across cognitive and motor networks

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OBJECTIVE

- Gait prioritization strategy during gait significantly influences gait performance.
- The association between functional brain networks and task prioritization remains unknown.
- This study aimed to examine within- and between-network connectivity among cognitive and motor networks in association with dual-task priority during gait.

METHODS

- Participants: 29 healthy individuals (66.86 ± 8.53 years)

Motor dual-task effect (mDTE)

- The participants performed the Timed-Up-and-Go (TUG) test and TUG test with an additional cognitive task (serial 3 subtraction task from a randomly selected number between 50 and 100) – repeated twice.
- The average time taken for the dual-task (DT) and the time taken for the single-task TUG (ST) were used to calculate motor dual-task effects.

Cognitive dual-task effect (cogDTE)

- The participants performed the serial 3 subtraction task without walking (single-task; ST).
- The time taken to reach zero was measured for a maximum duration of 1 min.
- The inverse correct response rate (time in seconds / the number of correct responses) was calculated for the dual-task (DT) and ST.

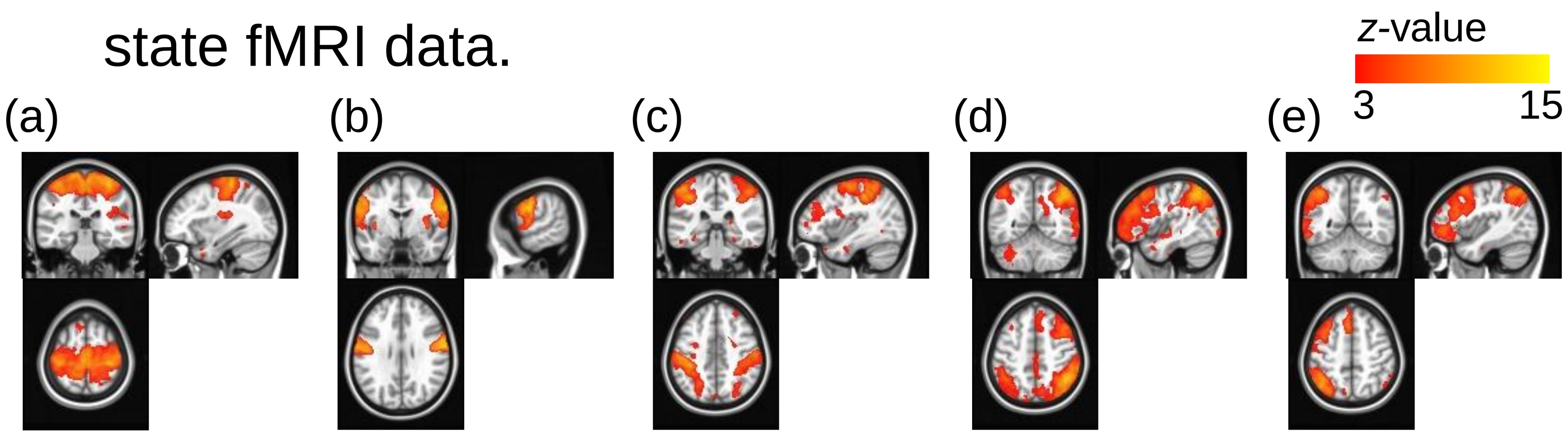
Gait priority

- mDTE and cogDTE, respectively (%) $= -\frac{(DT-ST)}{ST}$
- Combined dual-task effects (cDTE) (%) =

$$-\frac{(motor\ DT \times cog\ DT)-(motor\ ST \times cognitive\ ST)}{(motor\ ST \times cognitive\ ST)} \times 100$$

- Modified attention allocation index (mAAI) $= mDTE - cogDTE$
- Positive values of mAAI represent motor priority, while negative values represent cognitive priority.

- Independent component analysis applied to the resting state fMRI data.



The (a) primary motor network (PM), (b) lateral motor network (LM), (C) dorsal attention network (DAN), (d) right frontoparietal control network and (e) left frontoparietal control network (FPN)

Statistical tests

- Within-network connectivity was examined using the z-maps of individual-specific spatial maps of the five Independent components.
- Individual-specific time course data for the five ICs were used to construct between-network connectivity through Pearson's correlation analysis, and Fisher's z transformation.
- Non-parametric random permutation tests for each, with age and sex as nuisance variables.

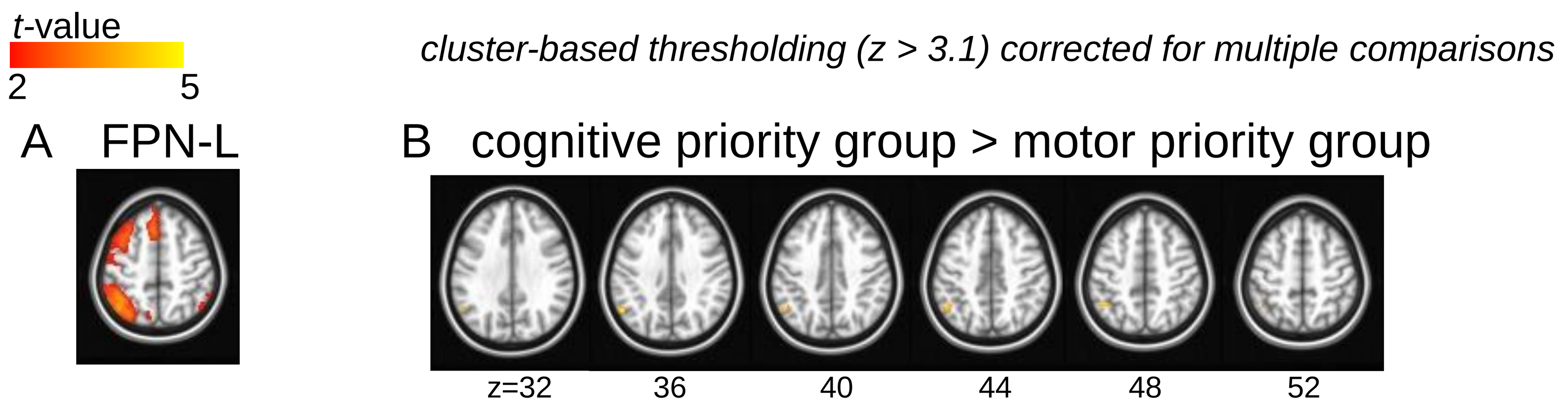
RESULTS

Table 1. Comparison of descriptive statistics of motor and cognitive priority groups

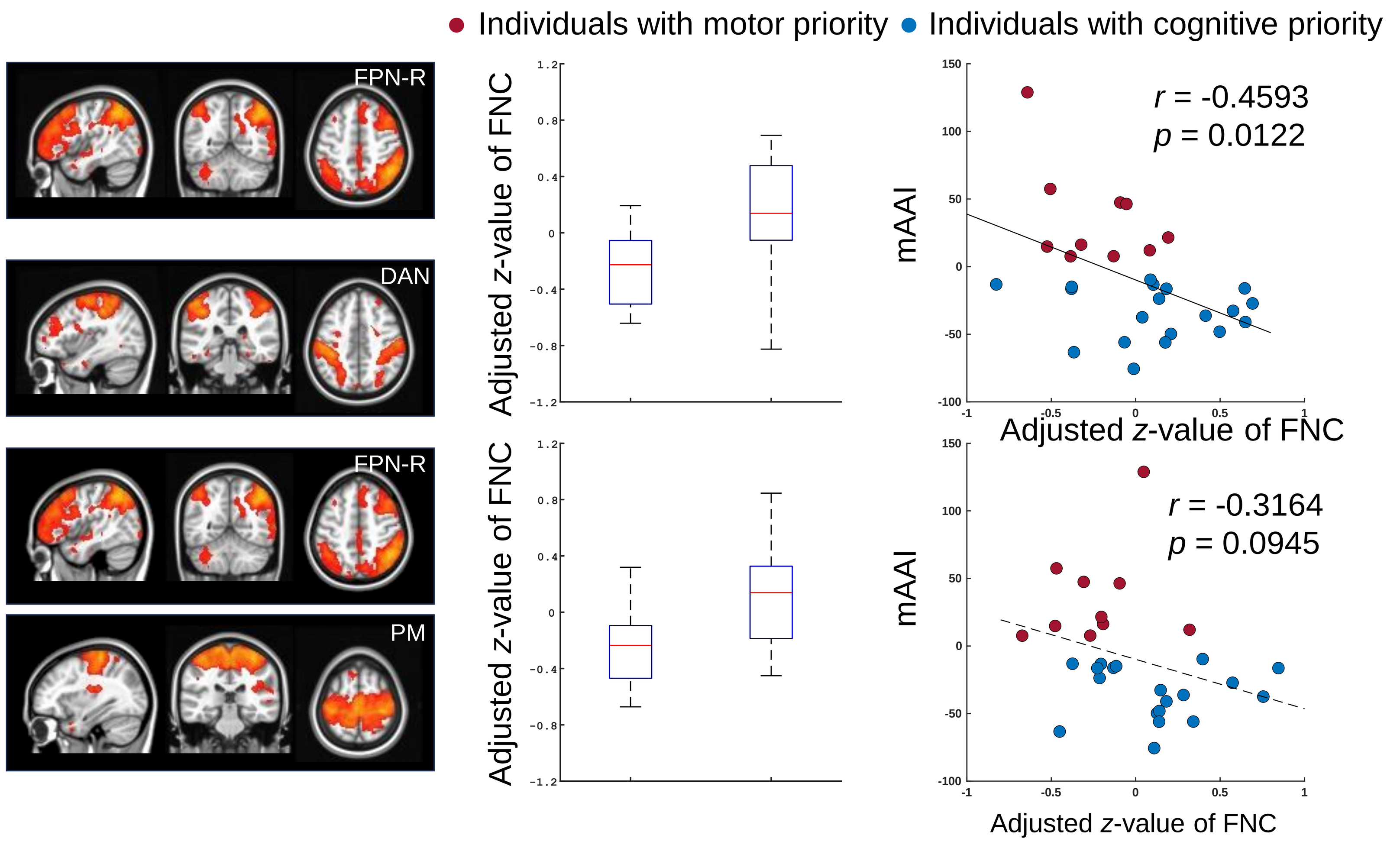
	Motor priority	Cognitive priority	p-value
Number of participants	10	19	-
Age	67.30±10.67	66.63±7.50	0.845
Sex (F:M)	6:4	12:7	1.000
cogDTE	-55.77±37.87	12.81±23.26	<0.001
mDTE	-19.78±14.63	-21.24±14.75	0.802
cDTE	-87.72±54.12	-7.47±38.55	<0.001
Time taken to complete TUG (sec)			
single-task	9.78±1.70	8.95±1.49	0.184
dual-task	11.80±2.88	10.75±1.71	0.225
Inverse correct response rate			
single-task	3.25±1.66	4.36±3.67	0.373
dual-task	5.33±3.41	3.16±1.71	<0.05

F, Female; M, Male; cogDTE, cognitive dual-task effect (%); mDTE, motor dual-task effect (%); cDTE, combined dual-task effect (%); TUG, Timed-Up-and-Go.

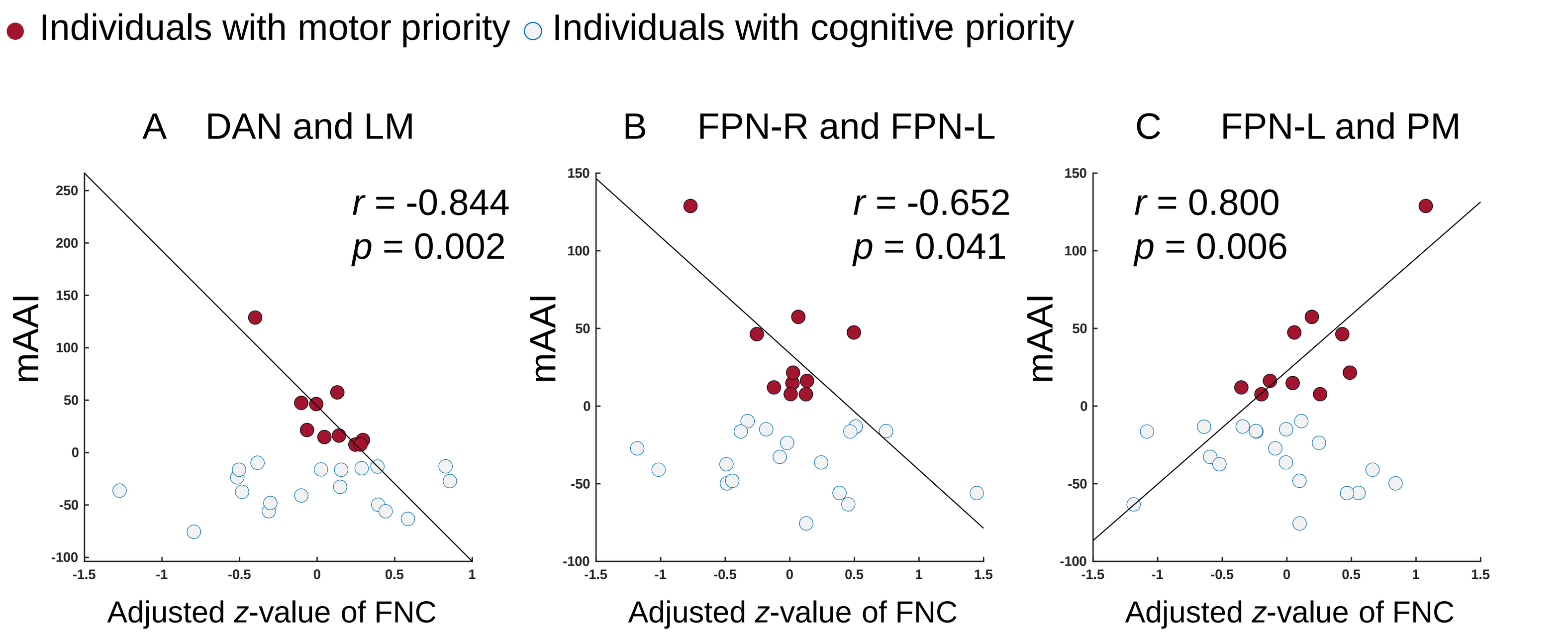
1. within-network connectivity difference



2. between-network connectivity changes associated with task priority



3. Associations between between-network connectivity and task priority observed in the motor priority group



CONCLUSION

- The cognitive priority group showed better dual-task engagement without additional adverse effects on the motor task.
- We observed distinct neural mechanisms across cognitive and motor networks based on individuals' dual-task strategies.
- This study may have implications for developing targeted interventions to improve gait performance in individuals with clinical populations.

Acknowledgements
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