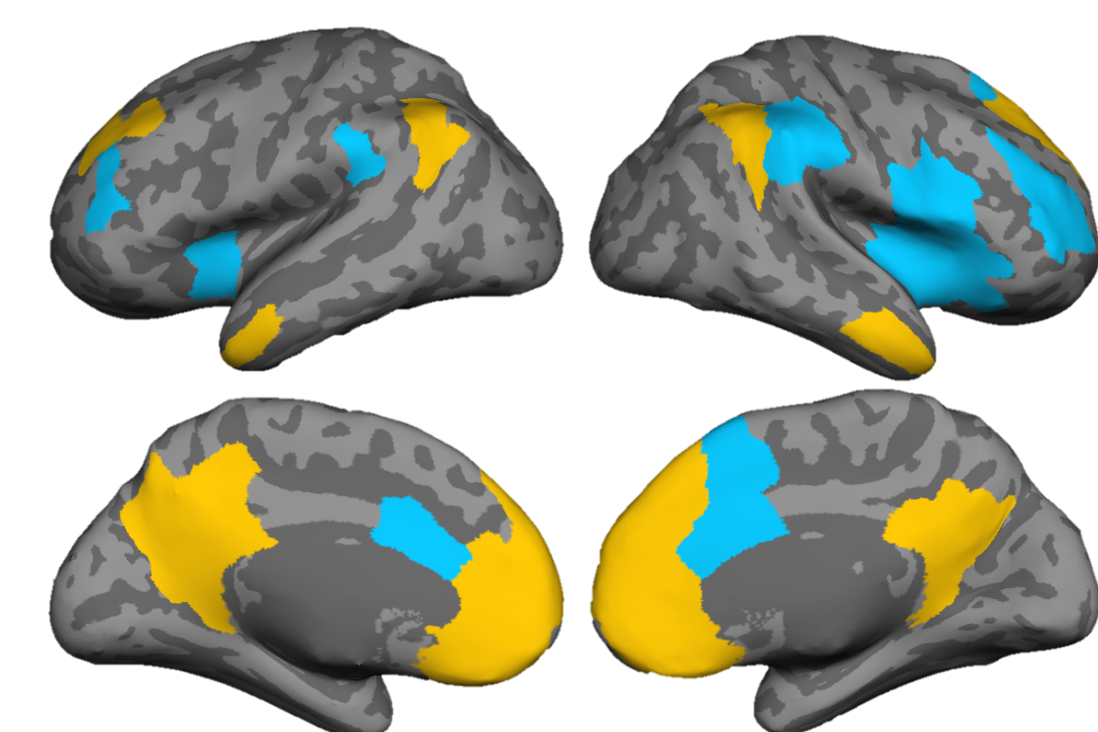


INTRODUCTION

- Memory decline seems universal in normal aging, accompanied by structural and functional decline in the default mode network (DMN) and salience network (SN)
- However, “successful agers” are resilient to memory decline and show preserved DMN and SN morphometry^{1,2} and functional connectivity³
- We hypothesized that structural connectivity within the **DMN and SN, as indexed by connection density and fractional anisotropy, is preserved in successful agers.**
- We also hypothesized that **stronger DMN and SN structural connectivity is associated with better memory performance among older adults.**

METHODS

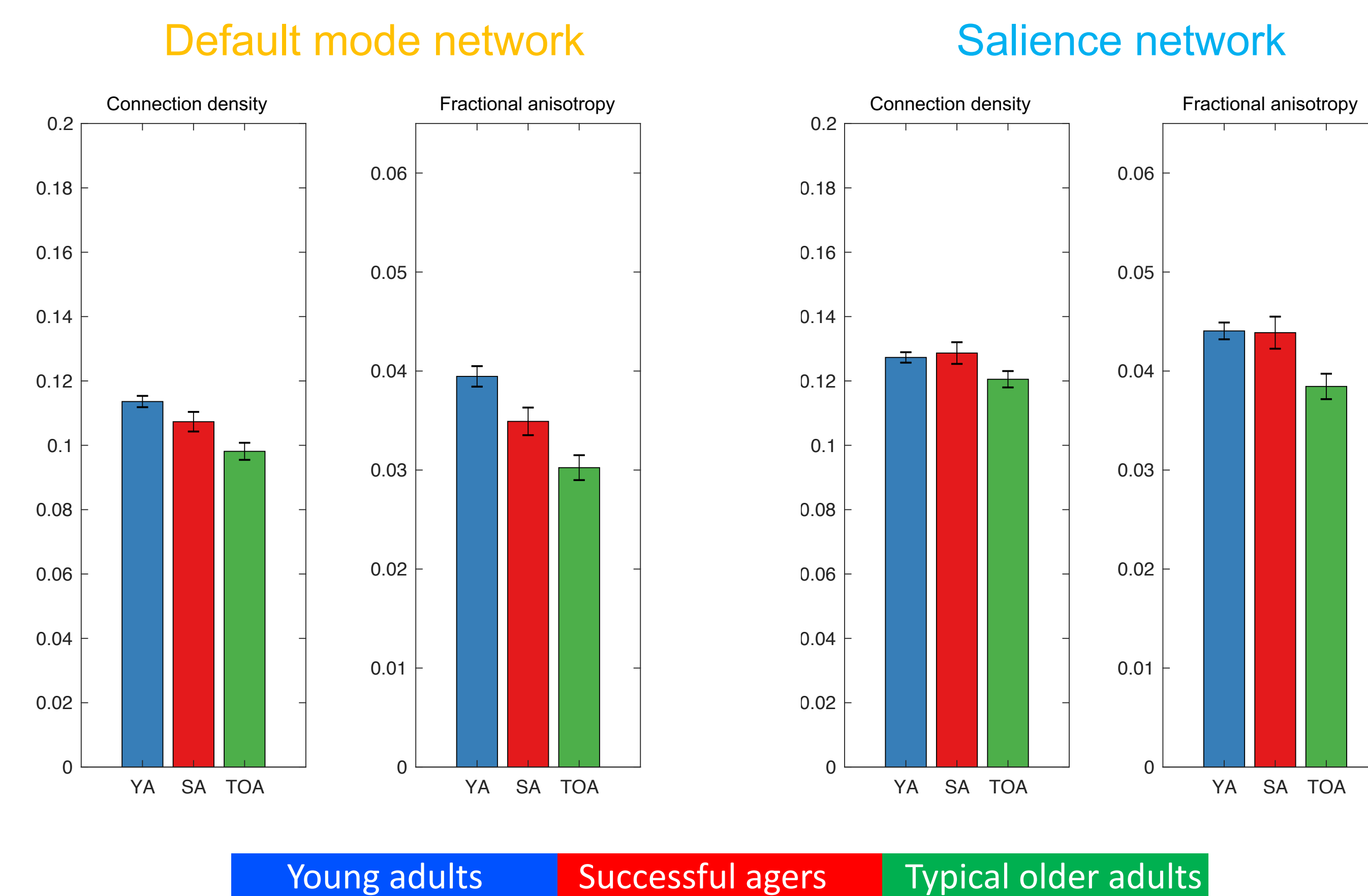
- Participants: 41 young adults (24.5±3.6) and 40 elderly adults (66.9±5.5)^{1,3}
- Procedure: California Verbal Learning Test (CVLT); item and associative recognition test; 6-min T1 (MPRAGE); diffusion-weighted imaging (GRAPPA)
- Successful aging definition: equivalent to young on CVLT and age-normal on Trail Making Test
- MR data processing: Freesurfer automatic segmentation of T1; DWI data were realigned, corrected for eddy currents and susceptibility distortions; diffusion directions were determined by generalized q-sampling; 8 seeds were started per voxel and tractography streamlines were constructed; we reconstructed the white matter streamlines between 219 cortical parcels of the Desikan-Killiany atlas⁴; *a priori* DMN (yellow) and SN (blue) masks^{1,3} were matched to the atlas
- Structural connectivity indices: mean connection density and fractional anisotropy were computed as the average of the values associated with all pairwise connections within the network



Default mode network
Salience network

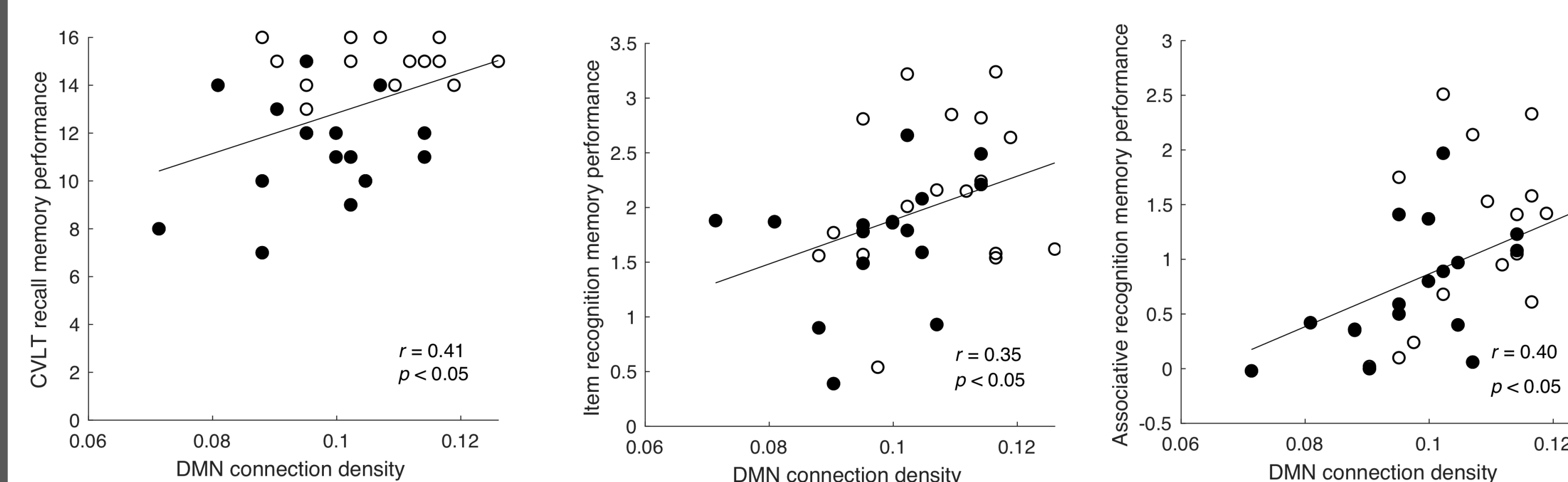
RESULTS

Successful agers have partially preserved default mode network structural connectivity and fully preserved salience network structural connectivity



Compared to typical older adults, successful agers had higher DMN connection density ($t[72] = 2.73, p < 0.01$), DMN fractional anisotropy ($t[72] = 2.51, p < 0.01$), SN connection density ($t[72] = 2.35, p < 0.02$) and SN fractional anisotropy ($t[72] = 2.89, p < 0.01$). Compared to young adults, successful agers had lower DMN connection density ($t[72] = 1.87, p < 0.07$) and fractional anisotropy ($t[72] = 2.53, p < 0.01$), and statistically indistinguishable SN connection density ($t[72] = -0.42, p < 0.68$) and fractional anisotropy ($t[72] = 0.11, p < 0.92$).

Default mode network structural connectivity predicts memory performance



Stronger structural connectivity within DMN supports better memory in older adults. Scatter plots illustrate the correlation in the entire older adult group between connection density and memory performance (left: CVLT recall for assessing criterion validity; middle and right: item and association recognition for assessing construct validity). Successful agers are indicated by hollow points. Recall memory was scored out of a total of 16. Displayed p-values are uncorrected.

RESULTS

Default mode network, not salience network, structural connectivity predicts memory performance

Network	Recall		Item recognition		Associative recognition	
	r	p	r	p	r	p
Default mode network						
Connection density	0.41	0.01*	0.35	0.02*	0.40	0.01*
Fractional anisotropy	0.27	0.07	0.48	0.00*	0.43	0.01*
Salience network						
Connection density	0.20	0.13	0.13	0.24	0.10	0.29
Fractional anisotropy	0.23	0.11	0.25	0.08	0.22	0.11

As predicted, DMN connection density and fractional anisotropy predicted all three memory measures in older adults at a FDR (q) of 0.05, except the marginal association between fractional anisotropy and recall memory (top row). However, we did not find significant association between SN structural connectivity and memory (bottom row).

CONCLUSIONS

- The current study builds on the growing body of work on the role of DMN and SN in successful aging by identifying yet another preserved characteristic – structural connectivity – in these two networks
- We demonstrated partially preserved DMN structural connectivity and fully preserved SN connectivity in successful agers
- Further, we showed that DMN structural connectivity predicted both recall and recognition memory
- The lack of association between SN structural connectivity and memory performance may be due to small sample size or cortical parcellation-based methodology

References

- ¹Sun et al. (2016). Journal of Neuroscience.
- ²Harrison et al. (2018). Neurobiology Aging.
- ³Zhang et al. (2020). Cerebral Cortex.
- ⁴Hagmann et al. (2008). PLoS Biology.