

## Structural correlates of visuospatial and verbal working memory

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**VBM** 

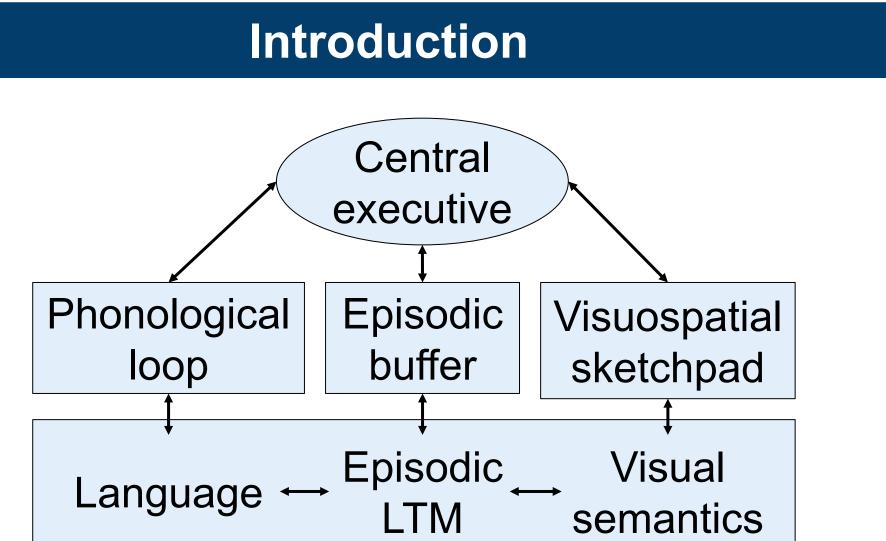
Normalisation

Segmentation

GM

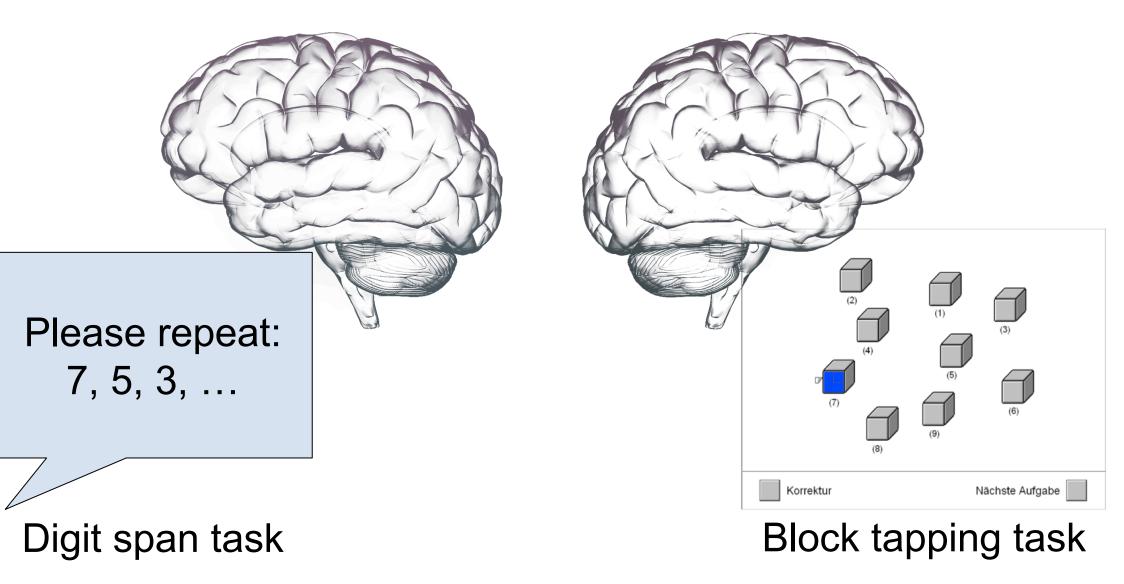
Modulation

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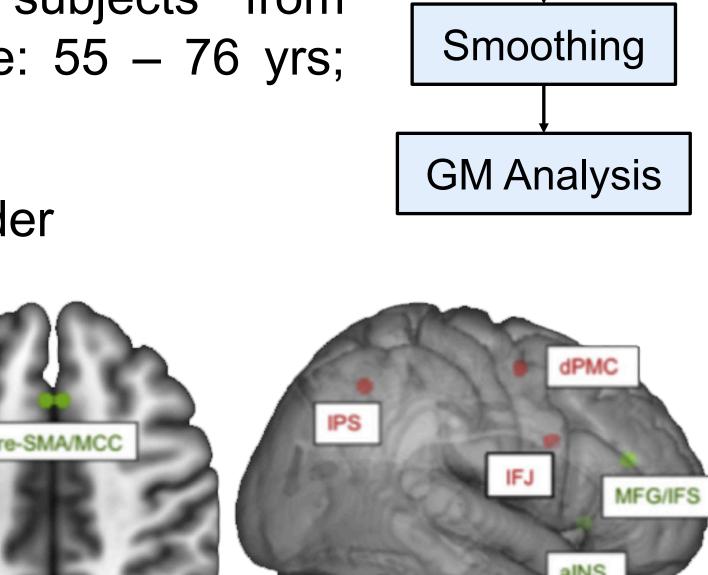
Multi-component model of working memory, adapted from Baddeley, 2000

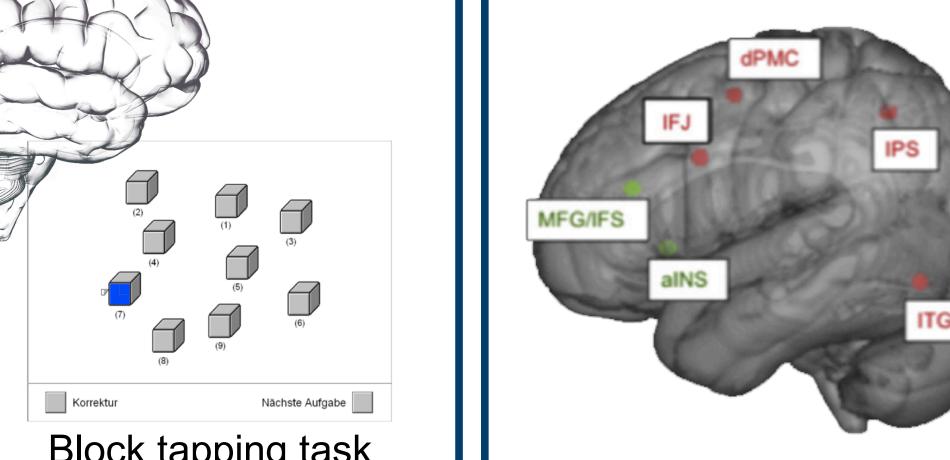
- Working memory (WM): ability to store and manipulate information for a short period of time
- Verbal and visuospatial processes associated with left and right hemisphere, respectively
- Functional correlates and involved networks well investigated
- Structural underpinnings of WM components and their lateralization unclear

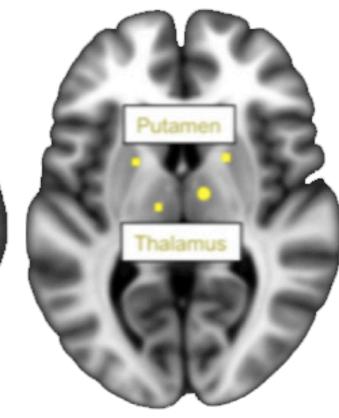


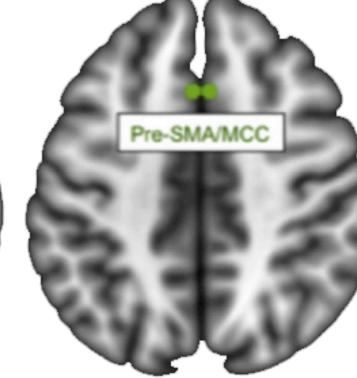
## Methods

- Digit span task and Block tapping task to assess verbal and visuospatial components
  - Forward and backward recall versions
- Voxel-based morphometry (VBM): association of grey matter volume (GMV) and performance on both recall versions of both tasks
  - Voxel-wise whole-brain analysis
  - Regional analyses using averaged grey matter values of regions of extended multiple demand network (eMDN): linked to WM but integrates further, related functions
- T1-weighted imaging data of 765 subjects from "1000BRAINS" study (413 males | age: 55 - 76 yrs;  $M=65.9 \pm 5.6 \text{ yrs}$
- Covariates of no interest: age and gender

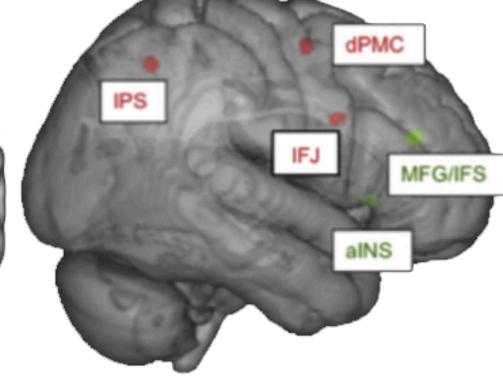






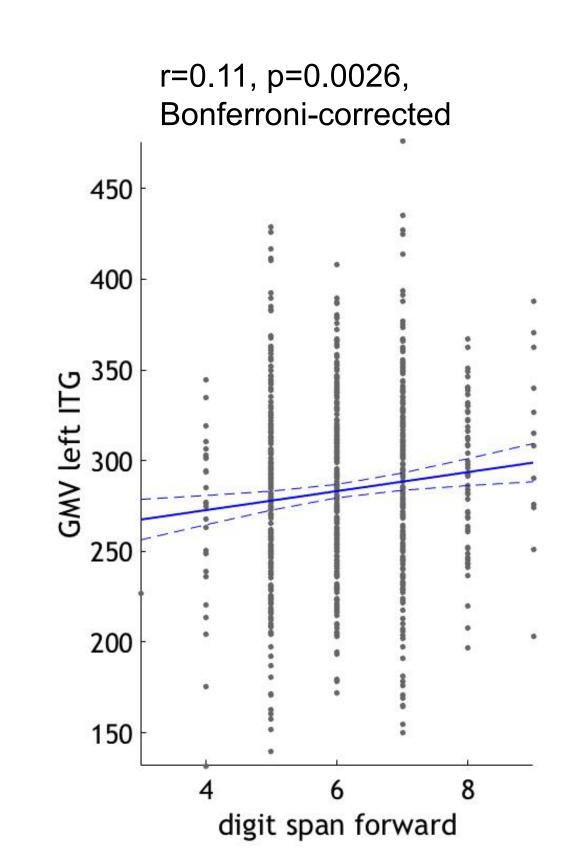


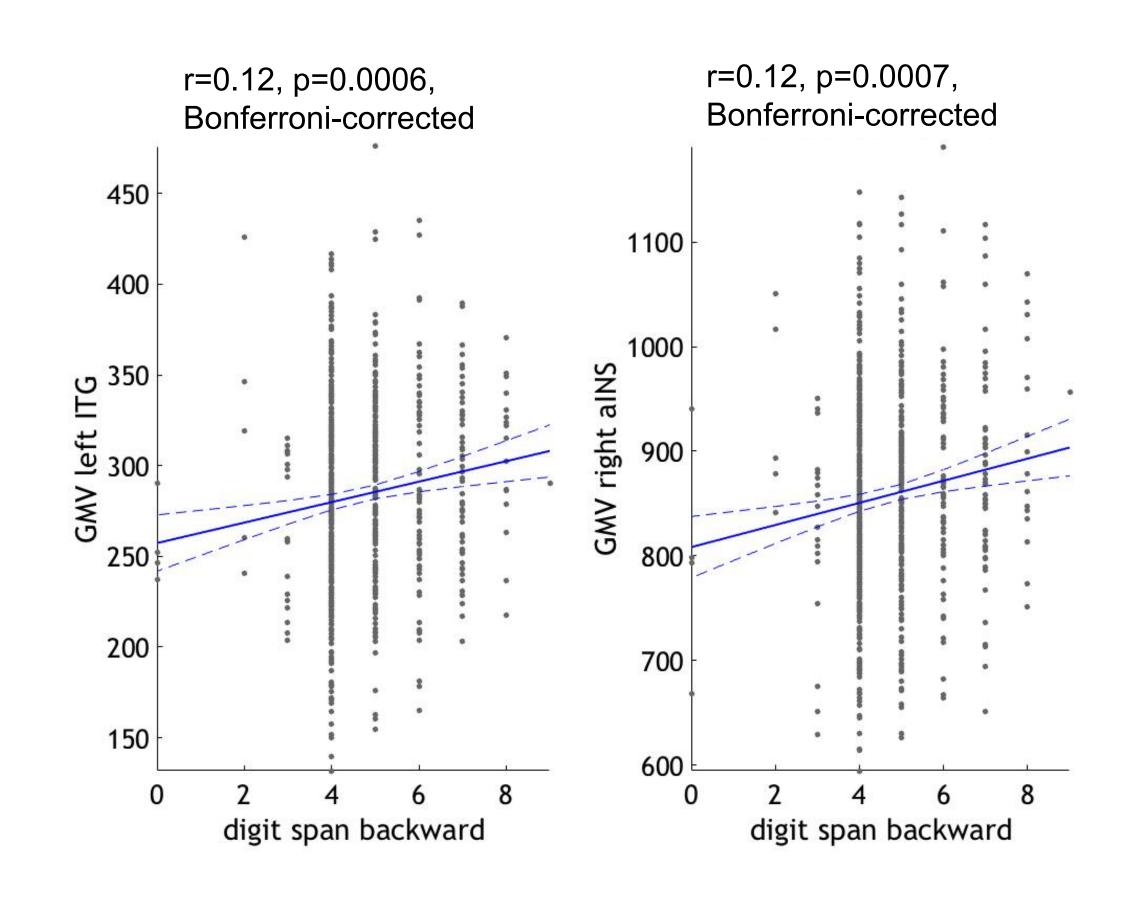
Regions of the eMDN, adapted from Camilleri et al., 2018



## Results

- Whole brain results: No significant correlations between GMV and performance in either recall version of either test
- Regional results
- Digit span task
  - Forward recall positively correlated with GMV in left inferior temporal (ITG) gyrus (r(764)=0.11, p=0.0026)
  - Backward recall positively correlated with GMV in the right anterior insula (aINS) (r(764)=0.12, p=0.0007) and left ITG (r(764)=0.12, p=0.0006)
- Block tapping task
  - No significant correlations between GMV in either region of the eMDN with performance on forward or backward recall





- Insula involved in executive processes
  - Significant correlation for right aINS only for the backward digit span: more executive control involved in backward compared to forward recall
- Left ITG linked to semantic processes and word maintenance in verbal WM
  - Confirmation of expected lateralization

- Significant correlations showed only small effect sizes
  - Similar to recent large sample studies using VBM
- Lack of significant results on whole-brain level:
  - GMV might not be relevant neural substrate when investigating WM performance or differences between the visuospatial and verbal component
  - Other factors might have stronger contribution

References: Baddeley, A. (2012). Working Memory: Theories, Models, and Controversies. In S. T. Fiske, D. L. Schacter, & S. E. Taylor (Eds.), Annual Review of Psychology, Vol 63 (Vol. 63, pp. 1-29). Palo Alto: Annual Reviews.; Camilleri, J. A., Muller, V. I., Fox, P., Laird, A. R., Hoffstaedter, F., Kalenscher, T., & Eickhoff, S. B. (2018). Definition and characterization of an extended multiple-demand network. Neuroimage, 165, 138-147. doi:10.1016/j.neuroimage.2017.10.020; Caspers, S., Moebus, S., Lux, S., Pundt, N., Schutz, H., Muhleisen, T. W., . . . Amunts, K. (2014). Studying variability in human brain aging in a population-based German cohort-rationale and design of 1000 BRAINS. Frontiers in Aging Neuroscience, 6, 14. doi:10.3389/fnagi.2014.00149