# Structural correlates of visuospatial and verbal working memory


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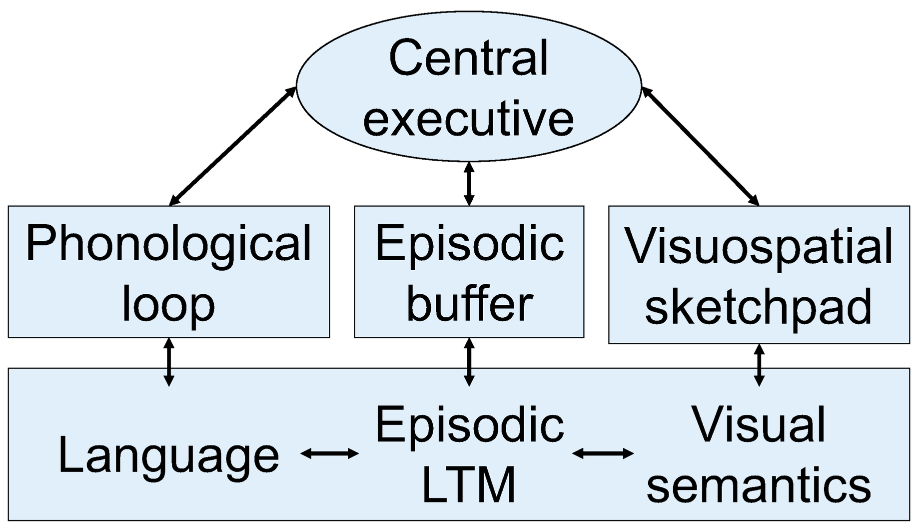
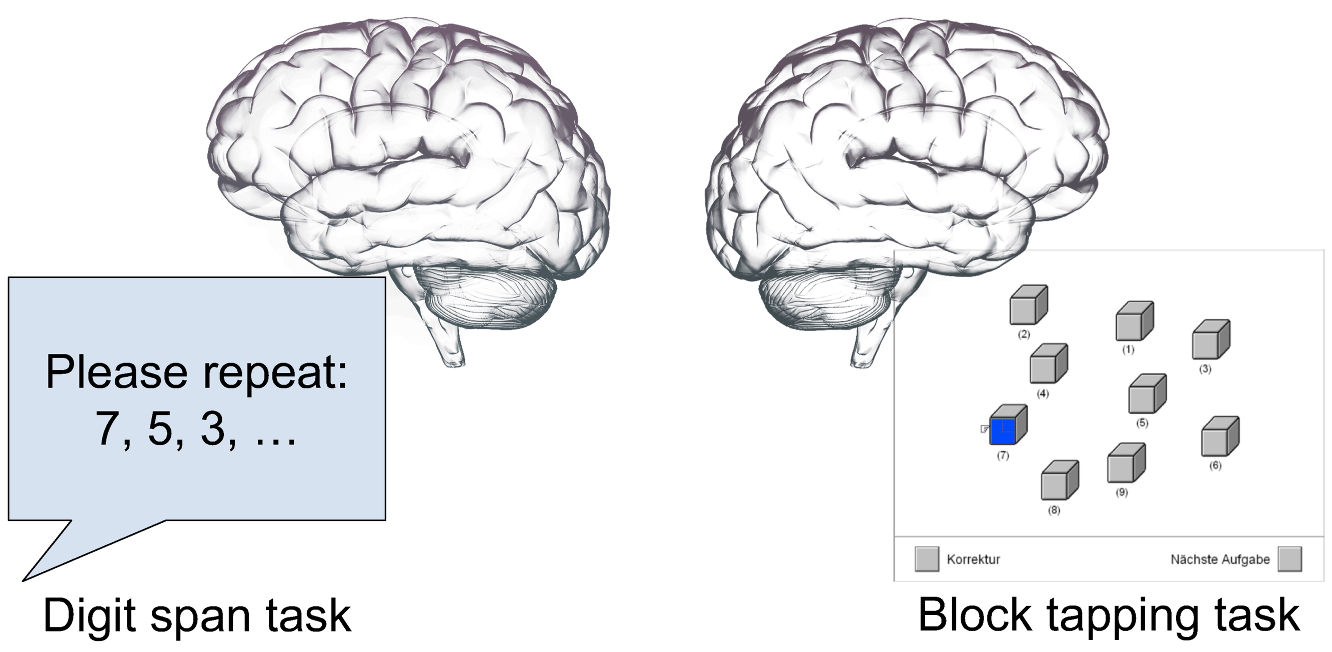
## Introduction



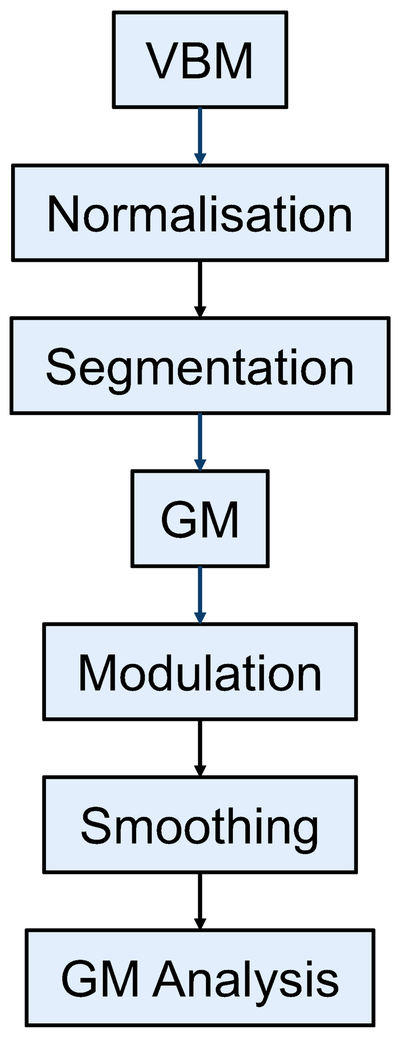

Multi-component model of working memory, adapted from Baddeley, 2000

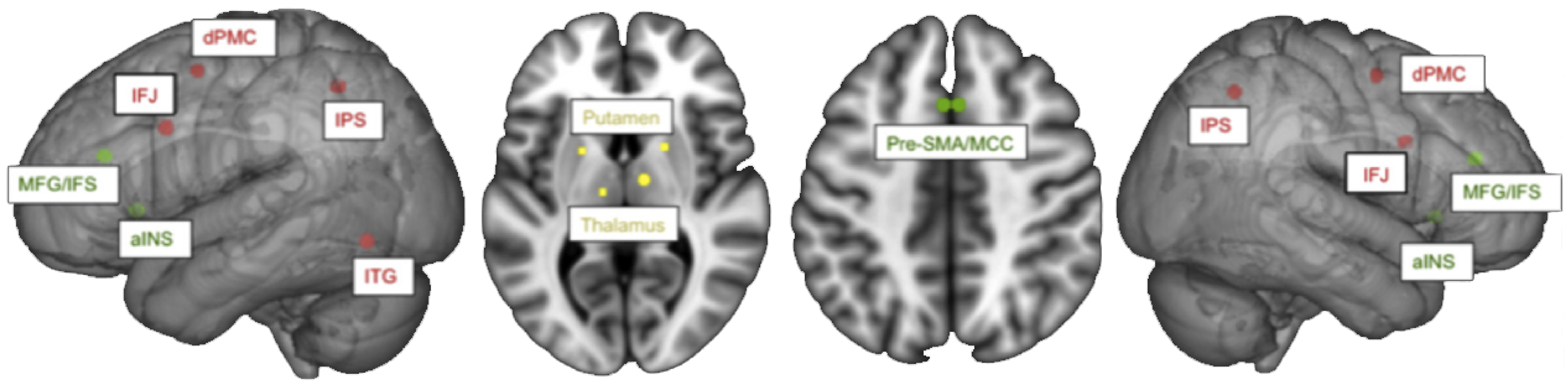
- **Working memory** (WM): ability to store and manipulate information for a short period of time
- Verbal and visuospatial processes associated with left and right hemisphere, respectively
- Functional correlates and involved networks well investigated
- Structural underpinnings of WM components and 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 ± 5,6 yrs)
- Covariates of no interest: age and gender



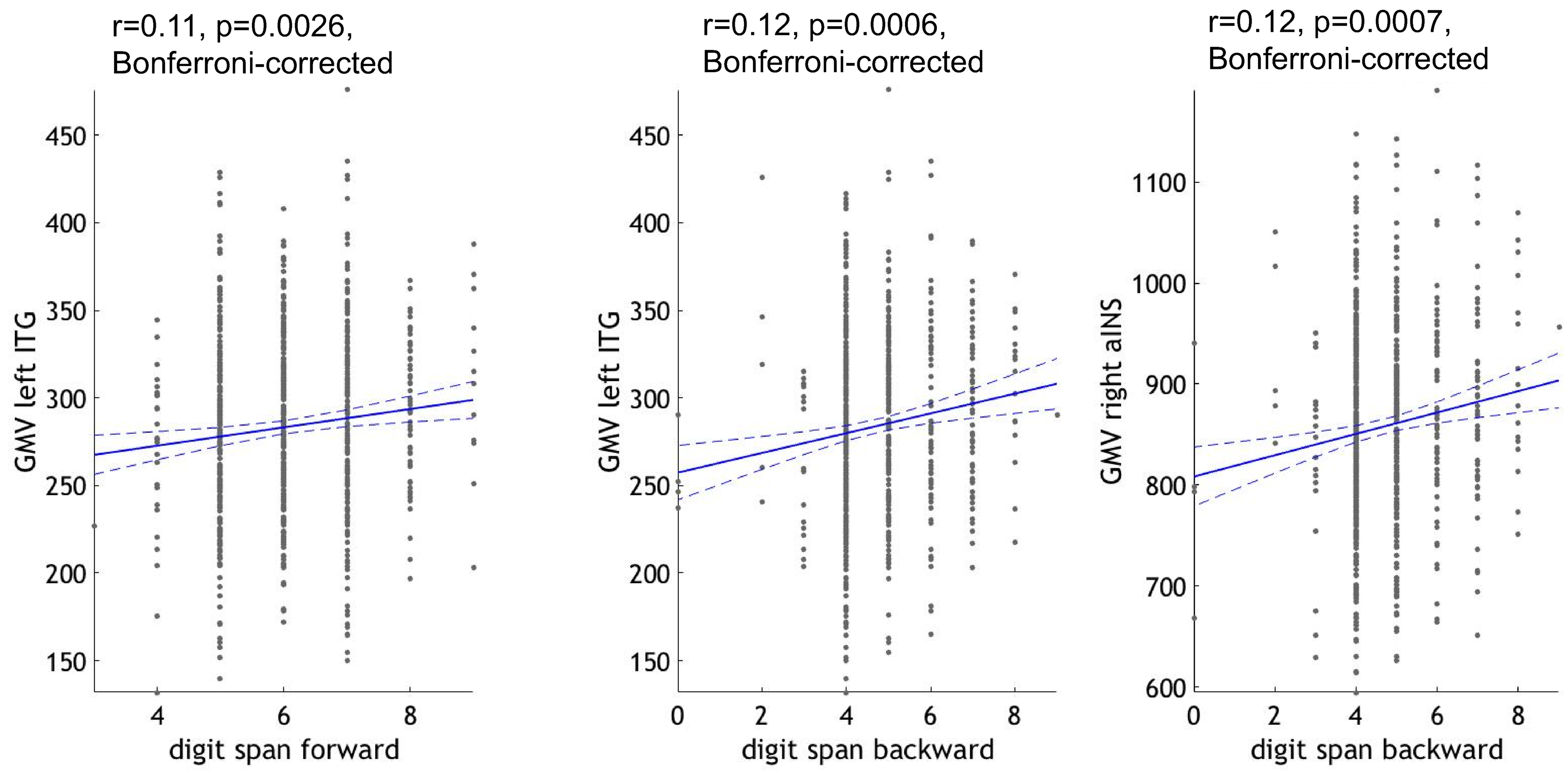

Regions of the eMDN, adapted from Camilleri et al., 2018

## Results

**1** Whole brain results: **No significant correlations** between GMV and performance in either recall version of either test

**2** Regional results

- Digit span task
  - Forward recall positively correlated with GMV in the left inferior temporal gyrus (ITG) ($r$(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



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