Common neural patterns for serial order coding in working memory, number and letter domains: A multi-voxel pattern analysis approach

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Background – The retention of serial order information allows for the structured encoding and maintenance of the sequential order of events and stimuli (Attout & Majerus, 2018). It's a fundamental component of working memory strongly associated with numerical and alphabetical abilities and critical for success in many different cognitive tasks. The codes used to represent serial order remain however poorly understood.

Aims – By using a functional neuroimaging approach (fMRI), we assessed the hypothesis that serial order information is coded using domain general ordinal representations that support serial order coding also in other domains characterized by sequential processing such as numbers and letters.

Methods – Twenty-five healthy young adults were invited to perform a set of four tasks in a 3T MRI scanner. The tasks were comprised of three ordinal judgement tasks (alphabetical, numerical and verbal working memory tasks) with further manipulation of ordinal distance effects, and a luminance comparison control task.

Results – Multi-voxel pattern analyses (MVPA), both at the whole brain level and in regions-of-interest within the parietal cortex, revealed robust ordinal distance effects for all tasks as neural patterns associated with high versus small ordinal distances could be reliably identified within each task. Critically, MVPA further showed greater than-chance-level classification when predicting ordinal distance between tasks. Luminance distance in the control task could not be decoded by ordinal distance neural patterns, indicating that the results are specific to ordinal processing, and not to distance per se.

Conclusion – These results provide support for theoretical accounts considering the existence of domain general serial order coding.