

# Methodological Advances in Lesion Symptom Mapping

## Organizer:

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The analysis of behavioral deficits in lesion patients is arguably the root of cognitive neuroscience and all brain imaging efforts. Single case studies like H.M., Phineas Gage, and Paul Broca's "Monsieur Tan" have critically shaped initial theories about human cognition and remain highly influential today. Most lesion mapping studies of the 20th century compared neuropsychological performance of relative small samples of controls and patients with rather coarse anatomical precision. The advent of voxel-based lesion symptom mapping (VLSM) ten years ago (Bates et al., 2003) revolutionized the field by bringing mass-univariate statistical analysis to lesion symptom mapping akin to standard analysis techniques for functional brain imaging. As a results VLSM has become the de facto standard for large-scale studies on lesion symptom mapping. This symposium will take a look at the future of lesion symptom mapping beyond VLSM and present cutting-edge methods that will revolutionize the field once again. Speakers will present studies that (a) employ Bayesian approaches to lesion symptom mapping, (b) utilize graph theory for modeling brain connectivity in patients, (c) make use of multivariate decoding techniques for analyzing lesion-induced behavioral impairments, and (d) combine computational modeling with lesion mapping to identify neural signatures of cognitive models. We believe that these modern analysis techniques will reshape lesion symptom mapping and lay the foundation for a computational neuropsychology.

## Learning Objectives:

1. Learn about the lesion symptom mapping compared to other functional brain imaging techniques.
2. Recognize the advantages and limitations of voxel-based lesion symptom mapping.
3. Realize how the presented methods can overcome these limitations and allow for novel and exciting explorations of lesion and brain imaging data.

## Game-theoretical analysis of multi-site lesions in the brain

Claus Hilgetag, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

## Spatial Bayesian Modelling of Binary Lesion Data

Thomas Nichols, University of Warwick, Dept. of Statistics, Coventry, United Kingdom

## Multivariate approaches to large scale lesion-function mapping

Parashkev Nachev, Institute of Neurology, London, United Kingdom

## Combining computational cognitive modeling and lesion symptom mapping

Jan Gläscher, University Medical Center Hamburg-Eppendorf, Hamburg, Germany