

## Project\_Aims

Research in design and implementation of the ?Neural ElectroMagnetic Ontologies? (NEMO) system will address a critical need for tools to support representation, storage, mining, and dissemination of brain electromagnetic data. Electro-encephalography (EEG) and event-related potentials (ERP) are venerable techniques for cognitive and clinical research on human brain function. To realize their full potential, however, it will be necessary to address some long-standing challenges in conducting large-scale comparison and integration of results across experiments and research laboratories. NEMO will address this need by providing ERP ontologies that can be used for meta-analysis of patterns across experiment contexts and research labs. Given the widespread use of EEG and ERP methods, and their clinical as well as research applications, development of such a system is both timely and significant.

System design and implementation will rest on six specific aims. The first goal is to develop rigorous procedures for classification and labeling of electrophysiological patterns (event-related potentials, or ERPs) (Specific Aim 1). The methods and tools that are developed initially for classification and labeling of surface (sensor-level) data will then be extended to support classification of data in source (anatomical) space (Specific Aim 2). Next, we will represent the rules and concepts that define ERP patterns as formal ontologies. Relational databases will be modeled based on the ontologies to support high-level questions about the nature of ERP patterns and the relationships between patterns that are associated with different lab, experiment, and analysis contexts (Specific Aim 3).

The application domain for our project is reading and language. We have established a consortium of experts in this area who will contribute EEG and ERP data from experimental studies and will collaborate with us on the design and testing, and evaluation of the tools developed for this project. The practical scientific aim will be to conduct meta-analyses of ERP patterns in reading and language, with a focus on sublexical (orthographic and phonological) processing. In addition to re-analyses of existing cross-lab data, new experiment paradigms (adapted from the fBIRN project) will be carried out across research sites to calibrate data acquisition and preprocessing methods, and to test the robustness of patterns across different experiment contexts (Specific Aim 4). Initially, we will develop a different ontology for each representational space (e.g., sensor and source space) and each analysis method. Then, we will capture the semantic mappings between different sets of patterns (different ontologies) using ontology-based methods in computer science (Specific Aim 5).

To support this work, we will develop an integrated tool environment for storage and management of EEG and ERP data and meta-data, measure generation and labeling, ontology development, and meta-analysis. This environment will be web-accessible so that partners will have shared access to the project data, analysis tools, ontologies, and meta-analysis results (Specific Aim 6). At the end of this project, the ontologies, annotated database, tools, and technologies will be made available to the larger research community.

## See Also

- [About Ontology Development](#)
- [About ERP Pattern Analysis](#)
- [About EEG Signal Cleaning](#)

## Resources

- [NEMO ERP ontologies](#)
- [NEMO ERP analysis tools](#)
- NEMO project documentation
  - ◆ [Publications](#)

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- ◆ Technical Reports
- ◆ References