



Neuroscience Experiments System – NES

Technology Transfer Team

Second NeuroMat Workshop: New frontiers in neuromathematics

November 23th, 2016

- Innovations being developed by NeuroMat are strongly based on theoretical and conceptual developments obtained by our research team
- NeuroMat's technology transfer activities can be divided into two fronts:
 - Neuro-rehabilitation and diagnosis
 - Computational tools

NeuroMat current initiatives on **neuro-rehabilitation and diagnosis**:

- Plasticity in brachial plexus avulsion
- Plasticity in Parkinsons disease
- Psychosis and psychiatric illnesses

NeuroMat focus is on the development of **free and open source** software tools:

- **Neuroscience Experiments System (NES)**
- Goalkeeper game
- NeuroMat database of neuroscientific data



Data curation: Act to staunch loss of research data

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Nature **520**, 436 (23 April 2015) | doi:10.1038/520436c

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Subject terms: [Databases](#) · [Research management](#)

Never before have scientists had the ability to generate and collect so much data — recent estimates suggest that the global scientific output is doubling roughly every decade (see L. Bornmann and R. Mutz, preprint at <http://arxiv.org/abs/1402.4578v3>; 2014, and go.nature.com/nzejwh). It is alarming, therefore, that the odds of data being lost are estimated to increase by 17% in every year after publication (T. H. Vines *et al. Curr. Biol.* **24**, 94–97; 2014). And this does not include the 80% or so of research data that are inaccessible or unpublished (B. P. Heidorn *Libr. Trends* **57**, 280–299; 2008).

<http://www.nature.com/nature/journal/v520/n7548/full/520436c.html>

Some Public Electrophysiological / Neuroimaging Repositories

System	Purpose	Data Access
¹ EEGBase	EEG/ERP, experiments, scenarios	Open
² CARMEN	neurophysiology	Open
³ CRCNS	Visual/auditory cortex, hippocampus, eye movements	Open
⁴ NACC	Alzheimer's (NP, MRI)	Open/Restricted
⁵ ABIDE	Autism (NP, MRI, fMRI)	Open
⁶ OpenfMRI	Primary data (MRI, fMRI)	Open

¹<https://eegdatabase.kiv.zcu.cz>

²<http://www.carmen.org.uk>

³<https://crcns.org>

⁴<https://www.alz.washington.edu>

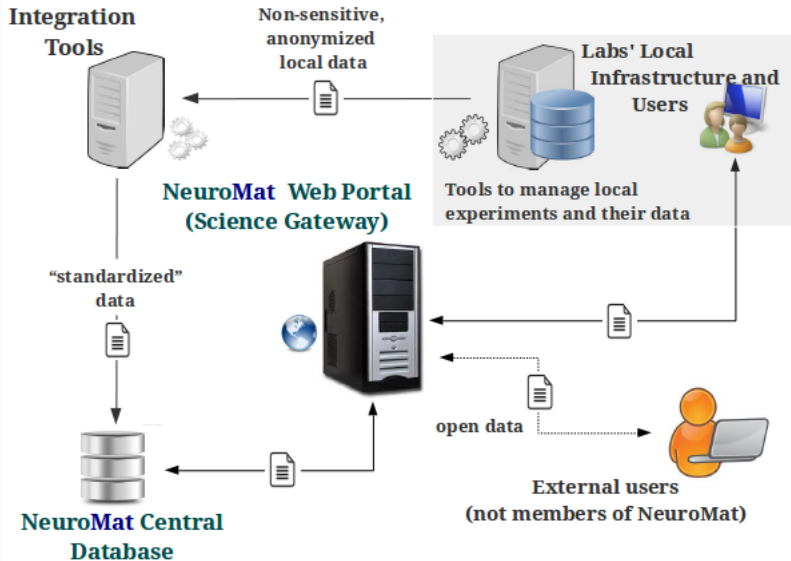
⁵<http://fcon1000.projects.nitrc.org/indi/abide>

⁶<https://openfmri.org>

Challenges in Public Scientific Databases

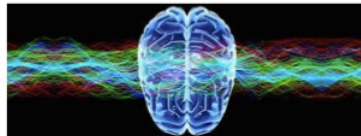
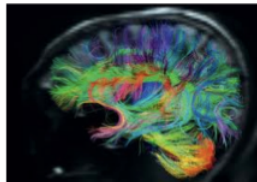
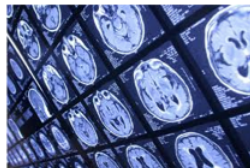
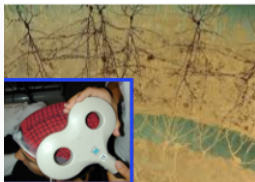
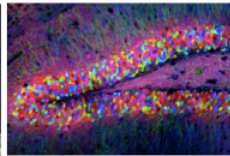
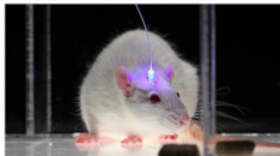
- **Poor quality**: inconsistency, incompleteness, “outdated” data, etc.
- **Insufficient documentation**; lack of metadata
- **Lack of standardization** in data representation
- **Overcomplicated access control** to data
- Requirement of **specific computer knowledge** and **additional software installation**
- Database as **mere data repository** (= “federation of datasets”)
 - Datasets with different levels of quality and structures
 - Lack of an infrastructure where heterogeneous datasets can be viewed as a unique integrated repository

NeuroMat Databases & Data Management Software Tools



Neuroscience Experiments System – NES

Free, open-source software for the management of clinical and experimental neurophysiological data



Free, open-source software for the management of clinical and experimental data

- Stores **raw data and metadata** of the experiment, including the description of the experimental protocol
- Integrates in a **centralized repository** all the experimental data from a research laboratory, group, or project
- Manages data from **different modalities**:
 - clinical, electrophysiological, surveys, etc.
- Web-based system; user-friendly interface

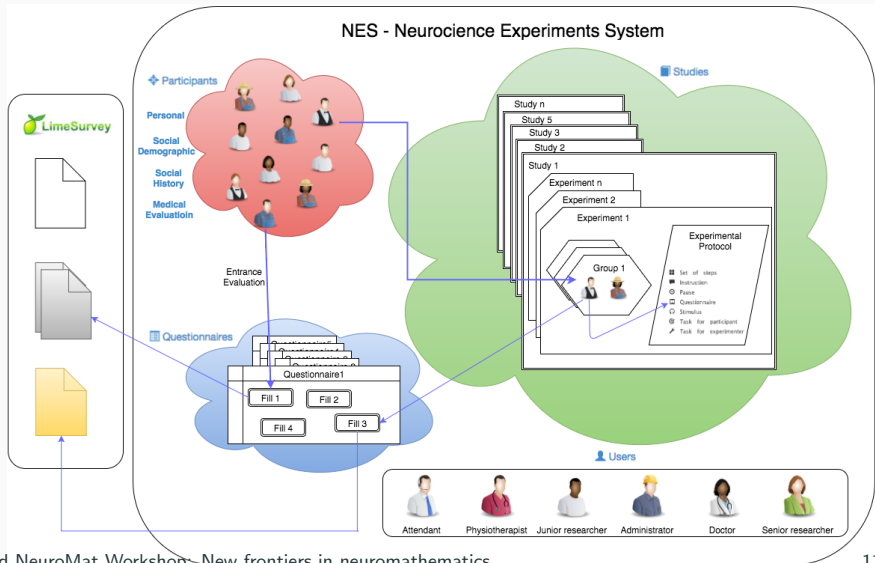
Neuroscience Experiments System – NES

Free, open-source software for the management of clinical and experimental neurophysiological data

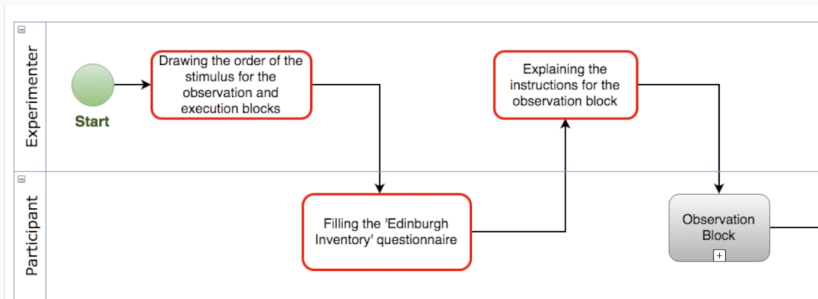
- Based on several proposals from the neuroscience community for data and metadata representation
- Under development since January 2014
- Current version: 1.3
- **In use at the Institute of Neurology Deolindo Couto – Rio de Janeiro State University since November 2014**
- Available at <https://github.com/neuromat/nas>



Neuroscience Experiments System – NES



Neuroscience Experiments System – NES



EXPERIMENTAL PROTOCOL DESCRIPTION

Experimental Protocol – Definition

Studies

Questionnaires

Users

Teams

Export

Set up

Information about the set of steps

Identification *

Duration 50 minutes

Description

Organization of sub-steps * Sequence Parallel

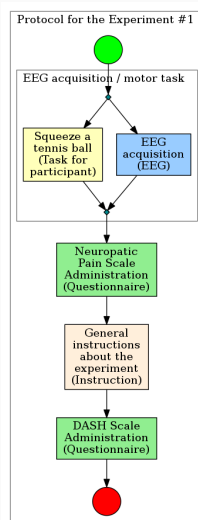
Quantity of steps obligatory. * All

Edit

Steps with fixed position

Type	Step	Name of use	Order	Delete
Task for experimenter	Draw of the blocks display order		↓	×
Questionnaire	Edinburgh Inventory		↓ ↑	×
Instruction	Instructions for the observation block		↓ ↑	×
Set of steps	Observation Block		↓ ↑	×
Instruction	Instructions for the execution block		↓ ↑	×

Experimental Protocol – Graphical Visualization



Experiment Participants

NES English user_test

[Home](#) [Personal data](#) [Social demographic data](#) [Social history](#) [Medical evaluation](#) [Questionnaires](#)

[Participants](#)

[Studies](#)

[Questionnaires](#)

[Users](#)

Basic Information

Full name*	<input type="text" value="Participant 11"/>	Security id	<input type="text" value="123.456.789-09"/>
Origin	<input type="text" value="Public Hospital"/>	Medical record	<input type="text" value="111222333"/>
Date of birth*	<input type="text" value="11/05/1965"/>	Gender*	<input type="text" value="Male"/>
RG	<input type="text"/>	Marital status	<input type="text" value="Married / Cohabit"/>

Address

Country	<input type="text" value="Brazil"/>	Zip code	<input type="text" value="01311-300"/>		
Address	<input type="text" value="Avenida Paulista"/>	Number	<input type="text" value="123"/>	Complement	<input type="text"/>
District	<input type="text" value="Bela Vista"/>	City	<input type="text" value="São Paulo"/>	E-mail	<input type="text" value="fulano@mail.com"/>
State	<input type="text" value="Sao Paulo"/>				



Electroencephalography (EEG) Data

NES English researcher01

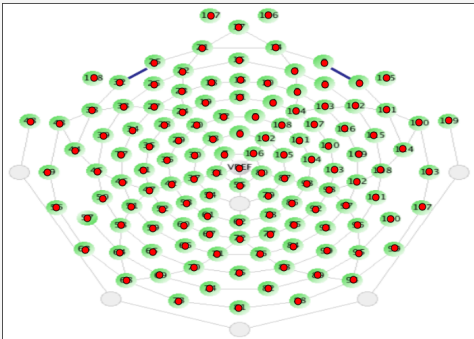
[Home](#) [Participants](#) **Studies** [Questionnaires](#) [Users](#) [Export](#) [Set up](#)

Home / Studies / Prediction of future events in humans / EEG register and observation of movements / Acquisition protocol - EEE and movements prediction /

EEG electrode layout setting

Electrode net setting | **Electrode position setting** | Electrode model setting

Step 2 of 3



Used positions: 129 of 129

Position	Used
VREF	<input checked="" type="checkbox"/>
1	<input checked="" type="checkbox"/>
2	<input checked="" type="checkbox"/>
3	<input checked="" type="checkbox"/>
4	<input checked="" type="checkbox"/>
5	<input checked="" type="checkbox"/>
6	<input checked="" type="checkbox"/>
7	<input checked="" type="checkbox"/>
8	<input checked="" type="checkbox"/>
9	<input checked="" type="checkbox"/>
10	<input checked="" type="checkbox"/>

[Edit](#) [Previous](#) [Next](#)



Electromiography (EMG) Data

Studies

Questionnaires

Users

Teams

Export

Set up

EMG Setting

Name *

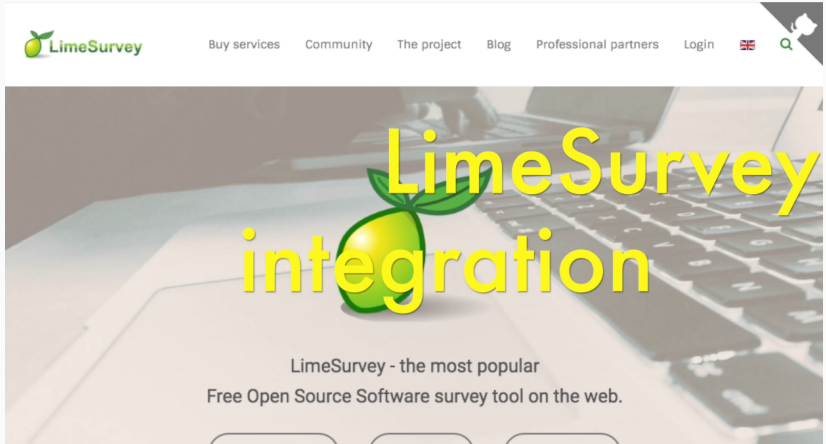
Description *

Acquisition software version *

Edit

Electrode settings:

Setting	Delete
<p>SENIAM - Arm or hand - Biceps brachii - Short head and long head</p> <p><i>Muscle side: Right</i> <i>Electrode: EL258S</i> <i>Remarks: The area of skin on which the electrodes were positioned was washed with water and mild soap. Also abrasion was performed with sponge and shaving with disposable razor. The coupling of the electrodes to the skin was made with conductor gel.</i> <i>Amplifier: MP100 - gain: 1000.0</i></p>	x



The image shows the homepage of the LimeSurvey website. At the top left is the LimeSurvey logo, which consists of a green lime with a leaf and the text "LimeSurvey". To the right of the logo is a navigation menu with the following items: "Buy services", "Community", "The project", "Blog", "Professional partners", "Login", a flag icon for the United Kingdom, and a search icon. The main content area features a large, stylized lime with a green leaf, positioned over a background image of a laptop keyboard. The text "LimeSurvey" is written in a large, yellow, sans-serif font, and "integration" is written below it in a smaller, yellow, sans-serif font. Below the lime and text, there is a subtitle in black text: "LimeSurvey - the most popular Free Open Source Software survey tool on the web." At the bottom of the page, there are three rounded rectangular buttons, but they are mostly obscured by the bottom edge of the image.

Electronic Questionnaires

The screenshot displays the 'Questionnaires' section of the NES interface. A navigation menu on the left includes Home, Participants (selected), Studies, Questionnaires, Users, Teams, Export, and Set up. The main content area has tabs for Personal data, Social demographic data, Social history, Medical evaluation, and Questionnaires. The 'Entrance evaluation' section contains a table of questionnaires.

Questionnaire	Fills
578559 - Neuropathic pain diagnostic questionnaire - DN4	April 28, 2016 Complete
271192 - The assessment of handedness: Edinburgh Inventory It must be filled	New fill
957421 - Narakas and Waikakul	April 28, 2016 Incomplete

Electronic Questionnaires

The assessment of handedness: Edinburgh Inventory
OLDFIELD, 1971.

English

The assessment of handedness: Edinburgh Inventory
Oldfield (1971)

* **Have you ever had any tendency to left-handedness?**

Yes No

* **Is there someone left-handed in your family?**

Yes No

* **Please indicate your preferences in the use of hands in the following activities by putting + in the appropriate column. Where the preference is so strong that you would never try to use the other hand unless absolutely forced to, put ++. If in any case you are really indifferent put + in both columns. Some of the activities require both hands. In these cases the part of the task, or object, for which hand-preference is wanted is indicated in brackets. Please try to answer all the questions, and only leave a blank if you have no experience at all of the object or task.**

	Right limb			Left limb		
	0	+	++	0	+	++
Writing	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drawing	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Threading	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Currently available modules enable users to manage data from:

- **Participants (subjects) of experiments**
 - Identification, social demographic and history data, medical records
- **Experiments**
 - Subject groups and their experimental protocols
 - Electrophysiological data and metadata (EEG, EMG, TMS)
- **Electronic questionnaire management**
(integrated to *LimeSurvey* – <https://www.limesurvey.org/>)
- **Project organization**
- **Users and access control**

Currently under development:

- Neuroimaging data acquisition
- Data searching, importing and exporting

Next Steps:

- Behavioral data acquisition
- Derived Data
 - Analysis processes (= scientific workflows)
- Data from experiments with non-humans

Development Team

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Team involved with the design and use of NES:

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- Fernanda Torres
- Juliana S. Maia
- Lidiane Souza
- Maria Luiza S. Rangel
- (...)