Johanna Wagner, Postdoctoral Scholar at SCCN, prepares a participant for an EEG gait recording

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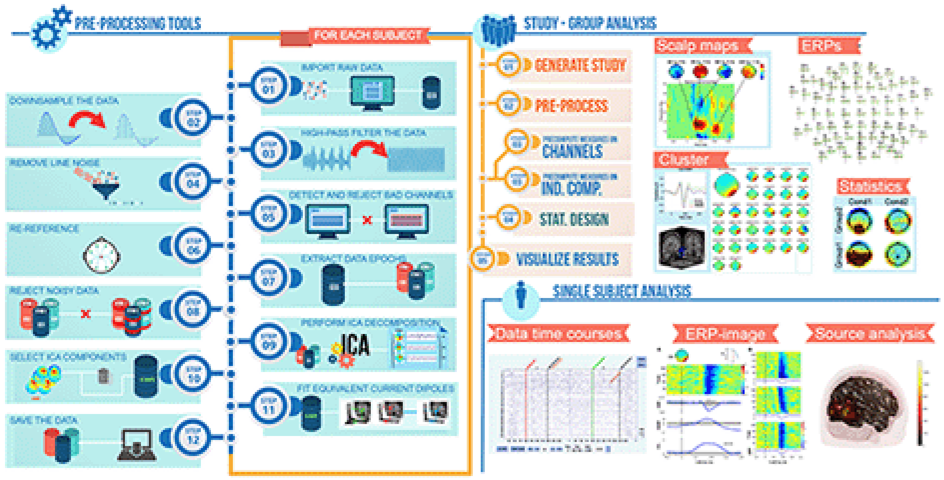
What's New?

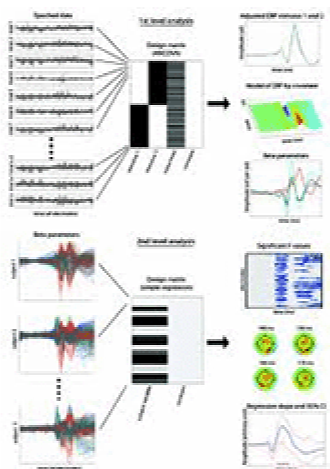
EEGLAB Documentation Moved to Github and new version of EEGLAB. We have completely revamped the EEGLAB documentation and tutorial and moved the EEGLAB documentation to Gitlab/Jekyll. We have also moved the EEGLAB plug-in documentation pages to respective Github repositories. In the EEGLAB tutorial, each tutorial section web page is now stand-alone to make it easier for users to follow the tutorial or to jump from section to section. This means that you can go to and read a tutorial section independently of other tutorial sections. The documentation has also been thoroughly updated with new screen captures. We have removed irrelevant sections and have added new sections on automated artifact rejection. We have also added a new section about importing and processing BIDS data, as well as a new scripting section. To suggest improvements, you may fork the new website on Github and modify it, then issue a pull request for us to consider and then adopt. Click here to go to the new EEGLAB Wiki.

We have also released a new version of EEGLAB 2021.0 with improved group analysis support, improved backward compatible EEG file format and a collection of tutorial scripts. The full list of changes are available here. – *Arnaud Delorme*

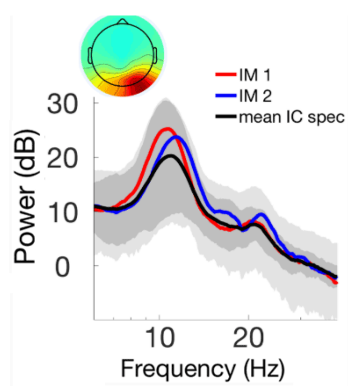


Plug-Ins

Here we highlight new EEGLAB plug-ins of possible wide interest to EEGLAB users. Please send descriptions of new plug-ins for consideration. These should have a brief lead introduction, and further text and images to be published on a continuation page.



LIMO EEG. LIMO EEG is an EEGLAB plug-in (and stand-alone toolbox) allowing M/EEG data processing using single trials and hierarchical linear models. Almost all statistical designs can be analyzed with LIMO. Across subjects, analyses are performed using robust statistics coupled with bootstrap correction for multiple comparisons (maximum, spatial-temporal clustering, TFCE) providing strong inference. The LIMO-EEGLAB partnership has been long in the making, with substantial challenges for code stability. We are happy to announce that LIMO 3.0, available in the EEGLAB plug-in manager, is the most stable version of LIMO for EEGLAB ever released. It has been thoroughly tested with EEGLAB 2021.0, and passes unit tests run nightly to ensure the LIMO code base remains stable and fully compatible with EEGLAB. The LIMO tutorial is available here, and more LIMO documentation here and here. A series of short how-to YouTube videos is also available here.



IMAT plug-in (beta). A plug-in toolbox, **IMAT (for Independent Modulator Analysis Toolbox)**, has been developed by Johanna Wagner & Ramon Martinez-Cancino with Scott Makeig based on earlier work by Julie Onton and Scott (Onton & Makeig, 2006, 2007, 2009) for decomposing spectral fluctuations of temporally independent EEG sources into 'spatio-spectrally' distinct spectral modulator processes. Such processes may identify coordinated multiplicative scaling effects of functionally distinct modulatory influences, for example cortical-subcortical feedback loops or brainstem-originating *event import* recognition systems involving neuromodulatory transmitters such as dopamine, serotonin, noradrenaline, etc. They also, for example, separate alpha harmonics from distinct beta activities, broadband from narrow band high-frequency activities, etc. Rather than modeling a mean spectrum as a sum of 1/f noise plus narrow-band oscillations, for example, IMA models spectral *variation* in the activities of identified independent brain sources across the recording period. Read more »

Profiles

This section contains personal profiles of EEGLAB developers and/or users, with a description of how they use EEGLAB in their research.

Dr. Johanna Wagner
Postdoctoral Scholar, Institute for Neural Computation

"It is really exciting to work at the frontier of a new research area." Dr. Johanna Wagner, Postdoctoral Scholar at the Institute for Neural Computation (INC) at UC San Diego, enthusiastically discusses her research. "When I began my Ph.D. studies at Graz University of Technology in Austria in 2011, the field of Mobile Brain Body Imaging (MoBI) was in its infancy. A lot of neuroscience research was done in extremely controlled settings -- people sitting in front of a computer in a dark room pressing buttons in response to mostly very boring tasks," she says candidly. "Instead, MoBI allows us to study natural behavior and movements in the real world."

As someone who has been fascinated about the brain since she was young, Dr. Wagner decided to delve head-first into the burgeoning field. Her most recent focus at the Swartz Center for Computational Neuroscience (SCCN) involves running multimodal MoBI data collection paradigms including the electroencephalogram (EEG) to investigate cortical activity supporting gait. "I use EEGLAB in all my EEG preprocessing pipeline," she shares, "from filtering to data cleaning to running independent component analysis (ICA) to group analysis ... ICA source analysis has helped me identify different oscillatory networks involved in gait adaptation and different EEG signatures of inhibitory top-down control involved in gait adaptation." Read more »

Upcoming Events

This section contains announcements of future events of possible interest to EEGLAB users. Please submit brief descriptions.

› **A 5-day Virtual EEGLAB workshop will be held online via** Gather.Town **this June, 2021**. This workshop will be held during waking hours for American and European/African attendees. A future edition will accommodate Asian time zones. As we are new to organizing online events, we welcome suggestions and feedback from the community. Please find a preliminary program (still under development) here. Registration will open within the next month or so.

› **The Second Hands-on LSL Workshop** has also been postponed as well, as has **the Fourth International MoBI Conference and a Group-EEG Recording Workshop** led by John Iversen (jiversen@ucsd.edu) on recording and analysis of group EEG and other data streams. These will also be held fully or partially online. No date has been set yet.

› **The 32nd EEGLAB Workshop in Lublin, Poland,** has likewise been postponed. New dates have not been set yet. For more information, contact Dariusz Zapała (d.zapala@gmail.com).

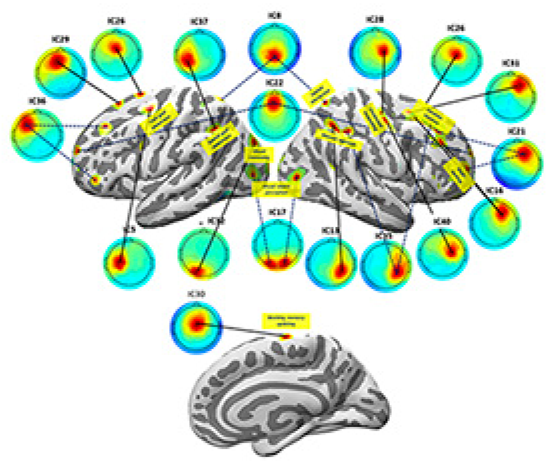
From the eeglablist

This section contains brief questions and answers from the eeglablist mailing list

Q: Justin Fine, Post-doctoral researcher at Indiana University: I have a question that the literature does not really seem to answer regarding source analysis: **Why should someone prefer to use a given source method to find EEG sources in areas that are known or assumed *a priori*?** Specifically, I am asking about the benefits and obvious trade-offs of (1) an ICA + equivalent current dipole (ECD) modeling, else (2) distributed (sparse or group) hierarchical source localization methods (e.g., MSP in SPM) or, (3) a Bayesian ECD approach that does not rely on fitting separate IC components but rather on specifying source locations *a priori*?

Quick background: I have T1 MR head images and recorded electrode positions (64-channel Acticap) for all participants. The main goal here is to extract time-frequency measures and evoked potentials (ERPs) from sources in three cortial areas: rIFG, pre-SMA/ACC/MCC, and left M1. The study is a standard stop signal task, for which the literature tends to prefer the method (1) using ICA + ECD fitting. But I gather that might have something to do with researchers typically (1) not having electrode locations and (2) not having T1 head images? Any thoughts and feedback would be greatly appreciated. Thanks!

A: Scott Makeig, SCCN: Justin - You are right that the choice of inverse source localization approach typically depends on the information available as well as the goals of the analysis. If you have T1 images for your study participants, I assume you also measured the 3D locations of the electrodes? If so, I suggest you try using the NFT and NIST toolboxes by Zeynep Akalin Acar, as these build electrical head models, optionally optimize these models using the SCORE algorithm for estimating the individual skull conductance (the largest unknown affecting EEG source localization), and then perform either (optimized) equivalent dipole localization OR high-resolution distributed source localization using the SCS (Sparse-Compact-Smooth) localization algorithm of Cheng Cao. Read More >



(Figure: SCALE/SCS-estimated source distributions and matching whole-data IC scalp maps, connected by line segments, for 17 of 45 brain IC effective sources drawn from a single-model AMICA decomposition of 128-channel data recorded during a complex (STRUM) multiscreen video game playing task session, superimposed on the participant's semi-inflated cortical surface mesh constructed using the NFT toolbox from the participant MR head image. Dashed (not solid) connecting line segments show IC source estimates again using a SCALE-optimized head model by SCS but consisting of two (not one), presumably anatomically well-connected source areas. Labels indicate area functional associations in the functional imaging literature. From: Z. Akalin Acar & S. Makeig, IEEE BIBE, 2020. Click on the figure for an enlarged view).

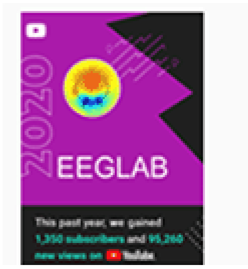
In Print

Here we list recent papers highlighting EEGLAB function and plug-in capabilities. Please submit suggested papers, with a brief summary description.

Martínez-Cancino R, Delorme A, Truong D, Artoni F, Kreutz-Delgado K, Sivagnanam S, Yoshimoto K, Majumdar A, Makeig S. (2020). The open EEGLAB portal Interface: High-Performance computing with EEGLAB. *Neuroimage*. 2021 Jan 1;224:116778. doi: 10.1016/j.neuroimage.2020.116778. Epub 2020 Apr 11. PMID: 32289453.

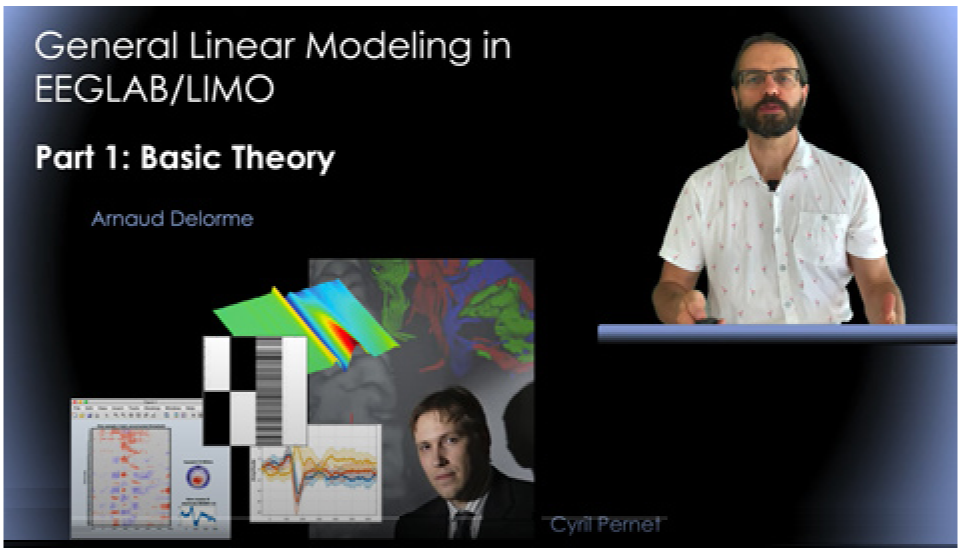
Martínez-Cancino R, Delorme A, Wagner J, Kreutz-Delgado K, Sotero RC, Makeig S. What Can Local Transfer Entropy Tell Us about Phase-Amplitude Coupling in Electrophysiological Signals? *Entropy* (Basel). 2020 Nov 6;22(11):E1262. doi: 10.3390/e22111262. PMID: 33287030.

Online



In 2020, we published more than 30 new videos on the EEGLAB educational YouTube channel. We also added and edited subtitles to our collection of educational videos for those who have a limited understanding of the English language. We gathered 1,350 more subscribers and 95,260 new views, and we wish to thank you for your support. We will continue to publish educational videos to support the community.

General Linear Modeling in EEGLAB/LIMO
Part 1: Basic Theory
Arnaud Delorme, Cyril Pernet - September 9, 2020



See also Part 2: Practice
September 15, 2020