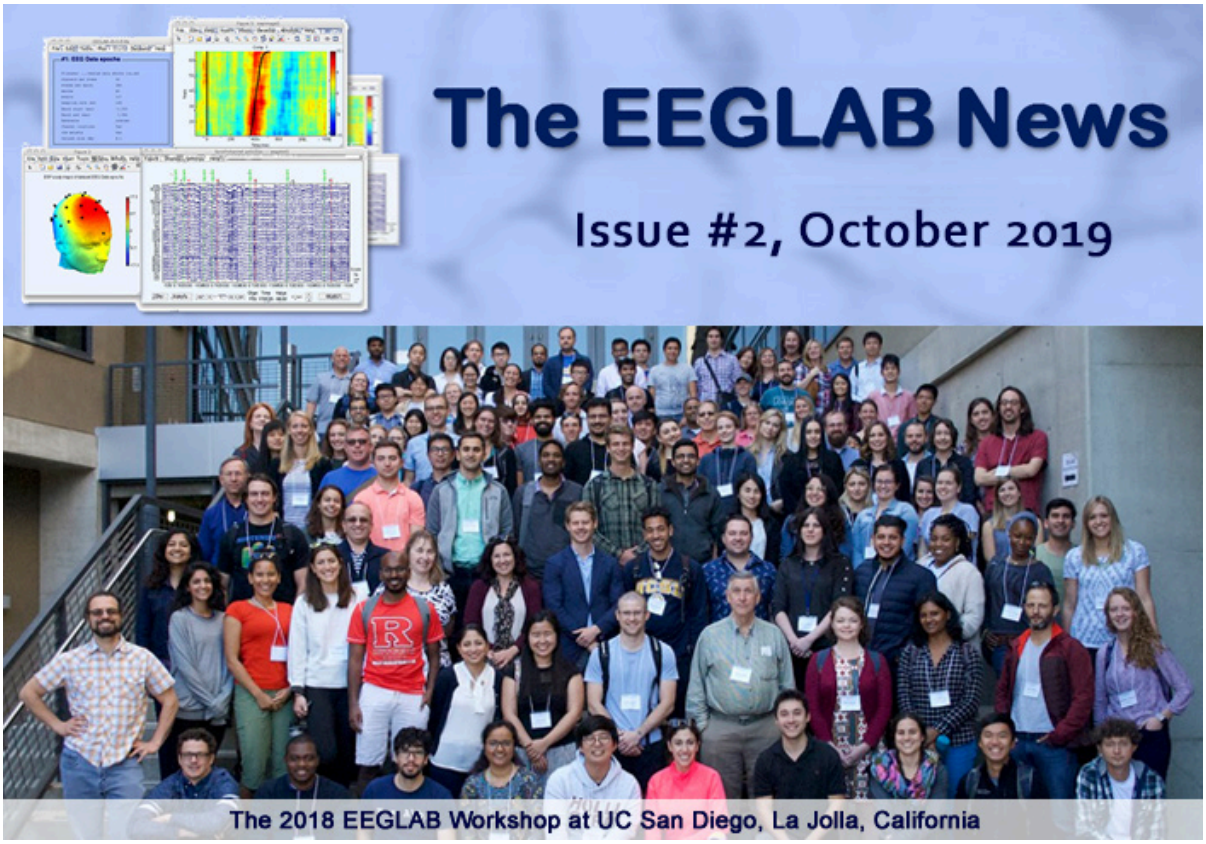

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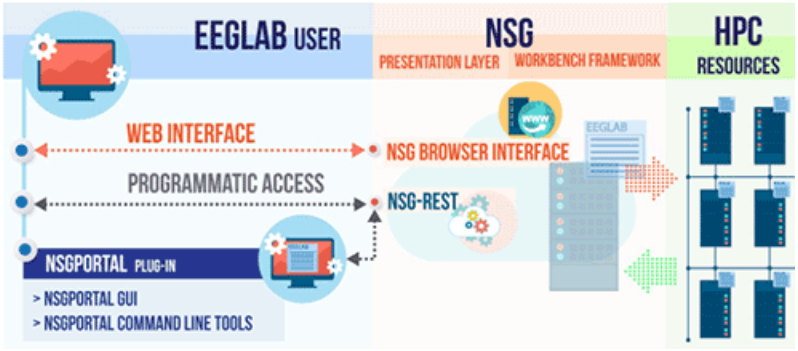
What's New

The New NEMAR Project - Scott Makeig and Arnaud Delorme at the Swartz Center for Computational Neuroscience (SCCN) at UC San Diego, together with co-PIs Amitava Majumdar from the San Diego Supercomputer Center (SDSC), UC San Diego, and Russ Poldrack of Stanford University, have been awarded $4.6 million from the National Institute of Mental Health (NIMH) to create the Neuroelectromagnetic Data Archive and Tools Resource (NEMAR). NEMAR will act as a portal or gateway for entering EEG, MEG, and ECoG/iEEG data into the OpenNeuro data archive created by Dr. Poldrack and his team, and computing on it using the Neuroscience Gateway (NSG) of the San Diego Supercomputer Center. OpenNeuro is a free and open platform that allows researchers to upload and share human neuroimaging data. NEMAR will build the infrastructure and tools necessary to add human neuroelectromagnetic brain imaging to the archive and will provide data visualization tools for OpenNeuro users. Drs. Makeig and Delorme, and the EEGLAB and NSG teams, are excited about the potential reach of this project. "NEMAR will help us learn more about how brain dynamics support thought and action, and can therefore be a catalyst for advancing brain science and clinical brain research." Read More! »

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.

***nsgportal*: Bringing High-Performance Computing to EEGLAB.** High-performance computing (HPC) resources are not commonly available to EEG researchers who also may not have the technical expertise available to install and use them. Although publicly available HPC resources exist at national academic supercomputer centers, access by neuroscientists to these resources is limited by both administrative and technical barriers including the steep learning curve required to understand HPC hardware, software, and policy environments, to install and run applications. In a recent publication (Delorme et al., 2019) we introduced the Open EEGLAB Portal (OEP) framework, operating within and between EEGLAB and the Neuroscience Gateway (NSG, nsgportal.org). The OEP offers free use of high-performance computing resources of the NSF-funded XSEDE network to any not-for-profit researcher for analysis of EEG and related data from the EEGLAB environment. (Image: Schematic of the OEP linking EEGLAB users to High-Performance Computing resources of the U.S. XSEDE network.)



To fulfill the primary goal of the OEP, to give cognitive neuroscientists free and ready access to use of HPC resources, we have released a plug-in, *nsgportal* (github.com/sccn/nsgportal) that allows users to submit computational jobs to NSG directly from within EEGLAB running on MATLAB on any lab computer. *Nsgportal* can be called from the command line or from its graphic user interface. Users can submit, manage and retrieve NSG jobs directly from their EEGLAB sessions on any machine. Extensive documentation online on github, including real data examples, makes the use of *nsgportal* straightforward. We invite EEGLAB users who wish to perform extensive analyses not feasible using their available computing resources to explore the new possibilities the OEP and *nsgportal* make possible. Via *nsgportal*, HPC resources are now readily available to cognitive neuroscientists studying human brain dynamics using EEG source imaging, time/frequency and functional connectivity analysis and other approaches. For more info visit the *nsgportal* wiki.

***clean_rawdata* (v2.0): A data cleaning pipeline.** The user interface to *clean_rawdata* has been redesigned and will soon become a core EEGLAB tool for removing artifacts from EEG and related data. The plug-in detects and can separate low-frequency drifts, flatline and noisy channels from the data. It can also apply ASR (automated subspace removal) to detect and reject data periods containing high-amplitude non-brain ('artifact') activity (produced by eye blinks, muscle activity, sensor motion, etc.), or can estimate and subtract out the artifact activity by comparing the structure of the data to that of known artifact-free reference data, thereby revealing and recovering (possibly smaller) EEG background activity that lies outside the subspace spanned by the artifact processes (Note: We typically use ICA to do this in post hoc analysis; ASR data correction was designed to correct data as it is being collected). For more information, see the *clean_rawdata* wiki.

Profiles

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

Klaus Gramann, Ph.D.

Dr. Klaus Gramann, head of the chair Biological Psychology and Neuroergonomics at Technische Universität (TU) Berlin, first became interested in Mobile Brain/Body Imaging as a postdoc at the LMU Munich in 2006, when he first visited SCCN for three months. He began working with Scott Makeig on the development of MoBI methods to investigate human brain dynamics in actively behaving participants. Before he left SCCN, Dr. Gramann was already eager to establish a MoBI lab in Germany. He and his team created a prototype in 2014 and officially opened the Berlin Mobile Brain/Body Imaging Lab (BeMoBIL) in 2018, before the 3rd international MoBI Conference in Berlin. He states, "Twenty-five years ago, this MoBI technology wouldn't have been possible. But now we have two facilities dedicated to Mobile Brain/Body Imaging!" And he envisions an even bigger future: "I hope to see an international network of MoBI labs addressing more and more ecologically valid studies of human cognition. Read more »

Scott Burwell, Ph.D.

Dr. Scott Burwell, National Institute on Drug Abuse T32 Postdoctoral Research Fellow, admits, "I have many questions I'd like to answer in my lifetime, but one question that I think is especially important is to understand what position brain sensing tools using noninvasive (or invasive) electrophysiology might ultimately take in *clinical practice for mental disorders*." He finds EEGLAB to be instrumental to his research, with his favorite features being the ease of access to advanced signal processing and brain modeling tools, such as independent component analysis (ICA) implementations, Zeynep Akalın Acar's Neuroelectric Forward Head Modeling toolbox (NFT), and Nima Bigdely Shamlo's Measure Projection Toolbox (MPT).

Dr. Burwell has co-developed an automated EEG preprocessing pipeline (*github.com/sjburwell/eeg_commander*) with Steve [Malone] at the Minnesota Center for Twin and Family Research (MCTFR). He also recently published an article with Dr. Makeig, *Reduced premovement positivity during the stimulus-response interval precedes errors: Using single-trial and regression ERPs to understand performance deficits in ADHD* (Burwell, Makeig, Iacono, & Malone, 2019; Psychophysiology). Read more »

Upcoming Events

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

May-June 2020 will be busy for the EEGLAB team, as we will organize, host, and/or

deliver a series of workshops. (click image to open larger PDF)

› **First Long-format 31st EEGLAB Workshop (May 27 - June 5).** The 31st EEGLAB workshop, presented at SCCN, will be the first to feature a two-day **Pre-Workshop Course** on the basics of EEG and using MATLAB (The Mathworks, Inc.) and EEGLAB to load and process EEG data. Workshop attendees who might otherwise not be able to keep up with the main Workshop are encouraged to attend. The main EEGLAB Workshop, beginning with an Open House reception and poster show on Sunday, May 29, and ending at noon on Tuesday, June 2, will follow the format of previous workshops at UCSD, with new material incorporated when/as time and need permit. Following the Workshop, we will offer another new feature, a two-and-a-half day Data Collaboratory workshop in which Workshop attendees with data to analyze will work with Workshop faculty to build analysis pipelines to process their data. The Collaboratory will be limited to 20 participants.

› **The 2nd Hands-on LSL Workshop (June 7).** A second Hands-on Workshop on the **Lab Streaming Layer** software framework will be held at the San Diego Supercomputer Center on the UCSD campus preceding the Fourth International MoBI Workshop. Christian Kothe and other developers in the LSL community will give an overview of the LSL project and lead parallel sessions at the introductory, demonstration, and advanced coding (including LSL driver design) levels. (photo: Hiroyuki Kambara)

› **The 4th International MoBI Conference (June 7-10)**. The fourth **International Conference on Mobile Brain/Body Imaging** will take place at ce at UCSD from Sunday, June 7 (evening) through Wednesday, June 10. The successful third meeting in this series was held in Berlin in summer of 2018. Sessions on technology and analysis, and applications to cognitive neuroscience, biodynamics, education, arts, and biofeedback are planned.

› **A Group-EEG Recording Workshop** on recording and analysis of group EEG and other data streams (for example during musical performance) will be held on Thursday, June 11. For more information contact Dr. John Iversen (jiversen@ucsd.edu).

› **The 32nd EEGLAB Workshop** will be held at the **John Paul II Catholic University of Lublin** in **Poland** beginning Monday, June 15. For more information, contact Dariusz Zapała (d.zapala@gmail.com).

From the eeglablist

This section contains brief questions and answers from the eeglablist archives or elsewhere.

Q: If you study development using EEG/MEG, how can you generate head models for specific ages?

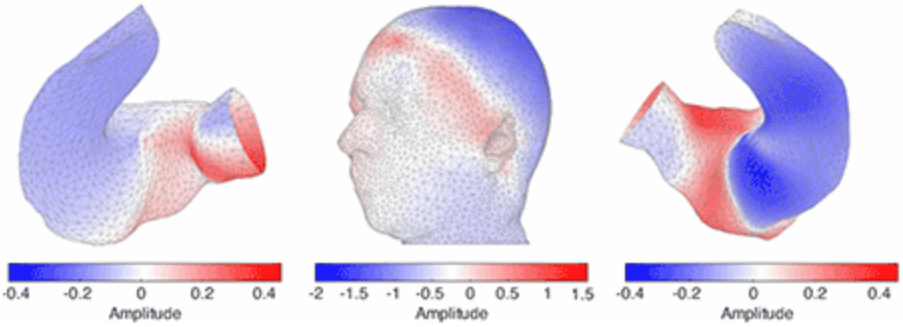
A: (Suggestion from Scott Makeig from SCCN): If you do have an MR head image for each subject, you can use Zeynep Akalin Acar's NFT toolbox (Akalin Acar, 2009) to build a custom head model for each subject (Akalin Acar, 2016a). Using an individualized skull conductance estimate will make such a model still more accurate (Akalin Acar, 2016b).

Akalin Acar Z & Makeig S (2009). Neuroelectromagnetic Forward Head Modeling Toolbox, *Journal of Neuroscience Methods*.
Akalin Acar, Z, Ortiz-Mantilla S, Benasich A, Makeig S (2016a). High-resolution EEG source imaging of one-year-old children. *Conf Proc IEEE Eng Med Biol Soc*. 2016 Aug:117-120.
Akalin Acar, Z, Acar C, Makeig S (2016b). Simultaneous head tissue conductivity and EEG source location estimation. *NeuroImage* 124:168-180.

(Makoto Miyakoshi): If you do *not* have individual MR head images of the subjects, Cincinnati Children's Hospital has proposed a solution for this. From this link, you can generate and download the age- and gender-specific averaged child head MR images. You still need to use Fieldtrip and NFT (or some other toolbox) to generate an actual forward model, but at least you will have an appropriate MR template to start with.

Q: Has anyone ever tried to record EEG from an ear canal?

A: Yes, more than one actually! This study was just published in Frontiers in Neuroscience: Ear-EEG Forward Models: Improved Head-Models for Ear-EEG (Simon L. Kappel, Scott Makeig, and Preben Kidmose, Frontiers, 2019). First author Simon Kappel, a former SCCN graduate student visitor, is currently in Sri Lanka continuing his research in this area.



In Print

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

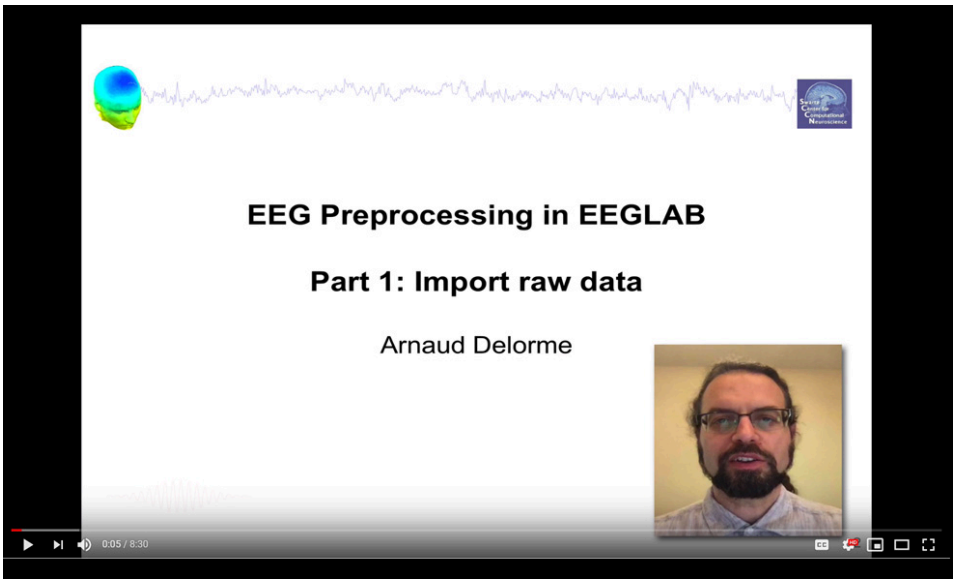
Burwell SJ, Makeig S, Iacono WG, Malone SM (2019). Reduced premovement positivity during the stimulus-response interval precedes errors: Using single-trial and regression ERPs to understand performance deficits in ADHD. *Psychophysiology* 56,9, doi:10.1111/psyp.13392. *Describes a premovement feature of ERPs time locked to erroneous responses in a flanker task, and its alteration in ADHD subjects.*

Delorme A, Majumdar A, Sivagnanam S, Martinez-Cancino R, Yoshimoto K, Makeig S (2019). The Open EEGLAB Portal. *9th International IEEE/EMBS Neural Engineering Conference*, San Francisco, March 2019. DOI: 10.1109/NER.2019.8717114. *A first glimpse at running large EEG analysis on high-performance computing facilities, now open to all nonprofit researchers. .*

Kappel, SL, Makeig S, Kidmose P (2019). Ear-EEG forward models: Improved head-models for Ear-EEG. *Frontiers*. *Uses the NFT toolbox to build a forward head model for an EEG montage including two in-ear electrode arrays, and uses it and ICA to match the recorded sensitivities to the model-based 'receptive field' of the ear electrodes.*

Wagner J, Martinez-Cancino R, Makeig S (2019). Trial-by-trial source-resolved EEG responses to gait task challenges predict subsequent step adaptation. *Neuroimage* 199, 1:691-703. doi:10.1016/ j.neuroimage.2019.06.018. *Reports a source-resolved correlate of the Error-Related Negativity (ERN) in ERPs time-locked to mistimed stepping cues in a cued gait paradigm.*

Online



This lecture was given in 2018 by Dr. Arnaud Delorme