showcase

Sleep research using **eego**™ systems

In Conversation with Dr. Giulio Bernardi

IMT SCHOOL FOR ADVANCED STUDIES LUCCA

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Meet the researcher

Dr Giulio Bernardi is an associate professor in General Psychology at the IMT School for Advanced Studies, Lucca, Italy and heads the Sleep, Plasticity, and Conscious Experience (SPACE) research group.

Dr. Bernardi obtained his MD degree and PhD in Neuroscience at the University of Pisa, Italy. He worked as post-doc and visiting researcher in prestigious institutions such as the Center for Sleep and Consciousness (University of Wisconsin-Madison) and the Center for Investigation and Research on Sleep (CIRS, Lausanne University Hospital), in Switzerland.

Research work

Dr. Bernardi's main research interests cover the physiology and functions of sleep and dreaming in both pathological and non-pathological conditions [1,2]. His research activity explores factors influencing sleep and the influence of sleep on learning, memory, and emotional regulation [2]. He is the principal investigator in a european funded research project (Horizon 2020 - Call: ERC-2020-STG "TweakDreams", GA 948891). It is aimed at investigating if and how sensory stimuli could be used to modulate sleep and dreams systematically.

In 2012, Dr. Bernardi spent over 2 years at the Center for Sleep and Consciousness of the University of Wisconsin (Madison, WI), under the guidance of Prof. Giulio Tononi. Since 2015 he spent 16 months at the Center for Investigation and Research on Sleep, Lausanne University Hospital, Switzerland, where he had the opportunity to expand his research to the clinical field.

Dr. Bernardi employs a range of neuroimaging methods in his studies, especially magnetic resonance imaging (MRI) and high-density encephalography (hd-EEG) [3,4].

Use of the **eego**™ system in the sleep lab

The conjoint Sleep Lab, resulting from a collaboration between IMT School for Advanced Studies Lucca, Fondazione Toscana G. Monasterio, and Sant'Anna School of Advanced Studies of Pisa (Italy), is equipped with an **eego** system. It is used to record high-density EEG signals using the **wave**guard™ original cap (channel density varying between 64-256 electrodes) and peripheral signals such as chin EMG, EOG, ECG, and respiratory activity using the Sensebox. All sensor data is monitored in such standard polysomnographic recordings to assess sleep quality and for the evaluation of changes in autonomic activity during sleep and/or in response to experimental procedures such as sensory stimulation during sleep. The **eego** system deployed in the lab is powered through external batteries to allow continuous recordings for up to 15 hours, and the system is mounted onto a cart to allow for easy transportation.

The **eego** system in use is also synchronized with a USB based infrared camera for video-polysomnographic recordings. The video feed check helps in the detection of potential unexpected events or correlation of participant activity to artifacts in the EEG data. For example, study volunteers may experience confusional arousal during which they have a partial awakening and introduce movement artifacts into the recordings. The video functionality is especially important in the detection of sleep disturbances in subjects that suffer from dream enacting behaviour (as in REM behaviour disorder), sleep walking or other specific conditions. The **eego** amplifier receives hardware triggers from a dedicated computer placed in the same space, which is used to control the administration of sensory stimuli and the registration of participants' responses.

A **xen**sor™ system is deployed in the Sleep Lab to perform electrode digitization on subject-specific head models. An MRI scan is also collected from all study participants to perform source modeling of particular EEG hallmarks or other events of interest such as stimulus-induced EEG changes.

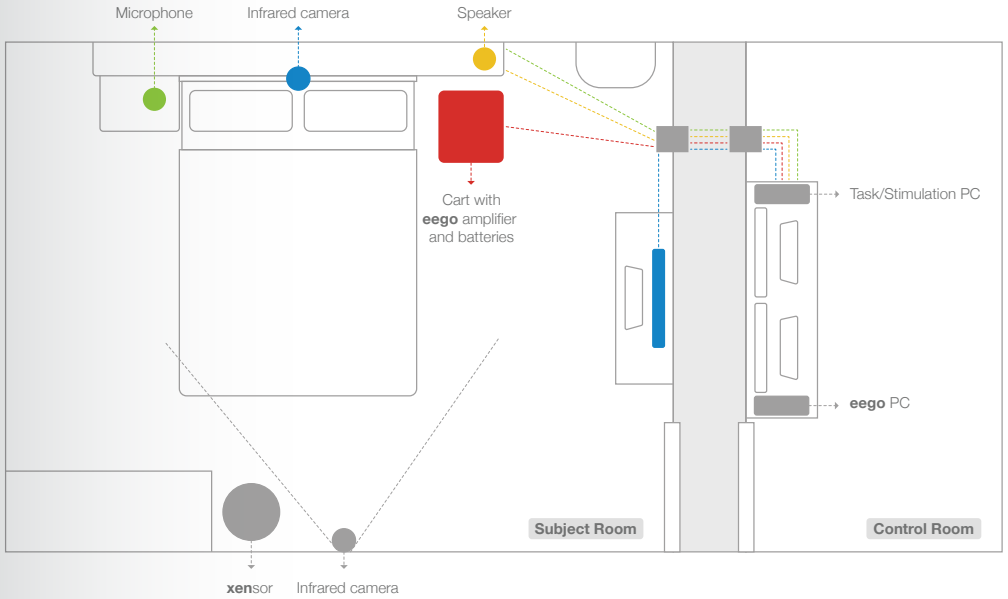

Figure 1.a: *Top-view schematic and room architecture of the sleep lab.*

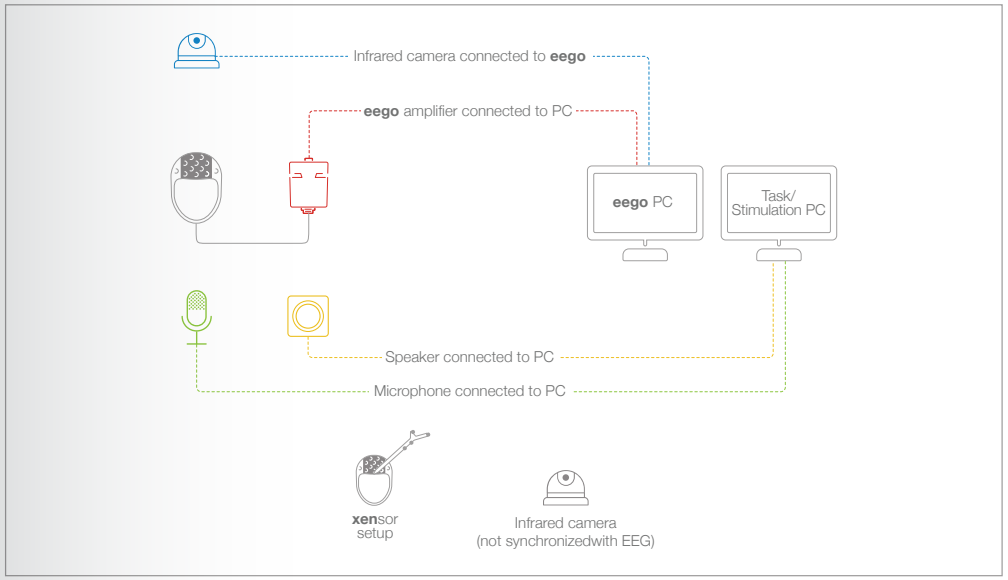

Figure 1.b: *Hardware connections in the sleep lab.*

Basic system schematic and room architecture of the sleep lab. In addition to the products displayed in this figure, Dr. Bernardi utilizes a set of devices to administer auditory, visual and tactile stimuli during sleep. The choice of peripheral devices may be adapted per study.

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The **eego** *system proved to be extremely flexible and able to provide high-quality signals. In particular, the system's modularity allows us to easily shift from a 64 to a 256 channels configuration, thus adapting to different experimental requirements. The system also allows us to record many additional signals thanks to the possibility of connecting additional Sensebox devices. The active shielding implemented in the* **eego** *system allows us to achieve excellent noise immunity even without a shielded room. Last but not least (especially for a sleep laboratory), all our volunteers found the* **wave**guard *caps extremely comfortable and easy to sleep with.*

-Dr. Giulio Bernardi

ANT Neuro is excited to revolutionize sleep research in collaboration with innovative researchers such as Dr. Giulio Bernardi.

External Links

https://www.imtlucca.it/en/giulio.bernardi

https://momilab.imtlucca.it/research/space

https://www.ant-neuro.com/products/eego-mylab

https://www.ant-neuro.com/products/xensor

https://www.ant-neuro.com/products/waveguard_caps

Scan the QR code to contact ANT Neuro!

References

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[3] Imperatori LS, Cataldi J, Betta M, Ricciardi E, Ince RAA, Siclari F, BERNARDI G. Cross-participant prediction of vigilance stages through the combined use of wPLI and wSMI EEG functional connectivity metrics. SLEEP, 44(5):zsaa247, 2021.

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