

Linking invasive and non-invasive correlates of somatosensory perception during median nerve stimulation

Insights from simultaneous recordings of intracranial and high-density scalp EEG

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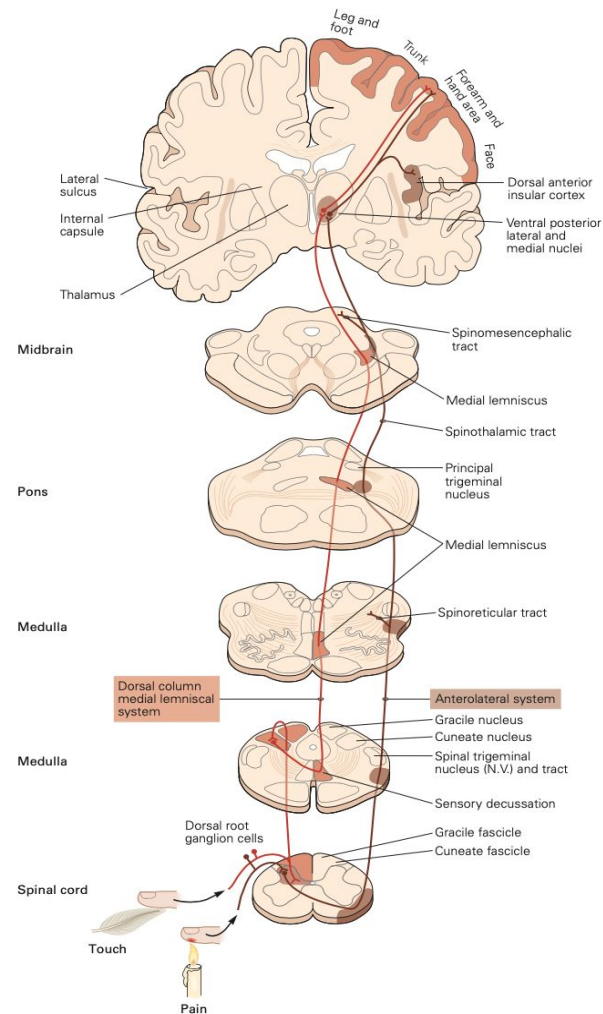
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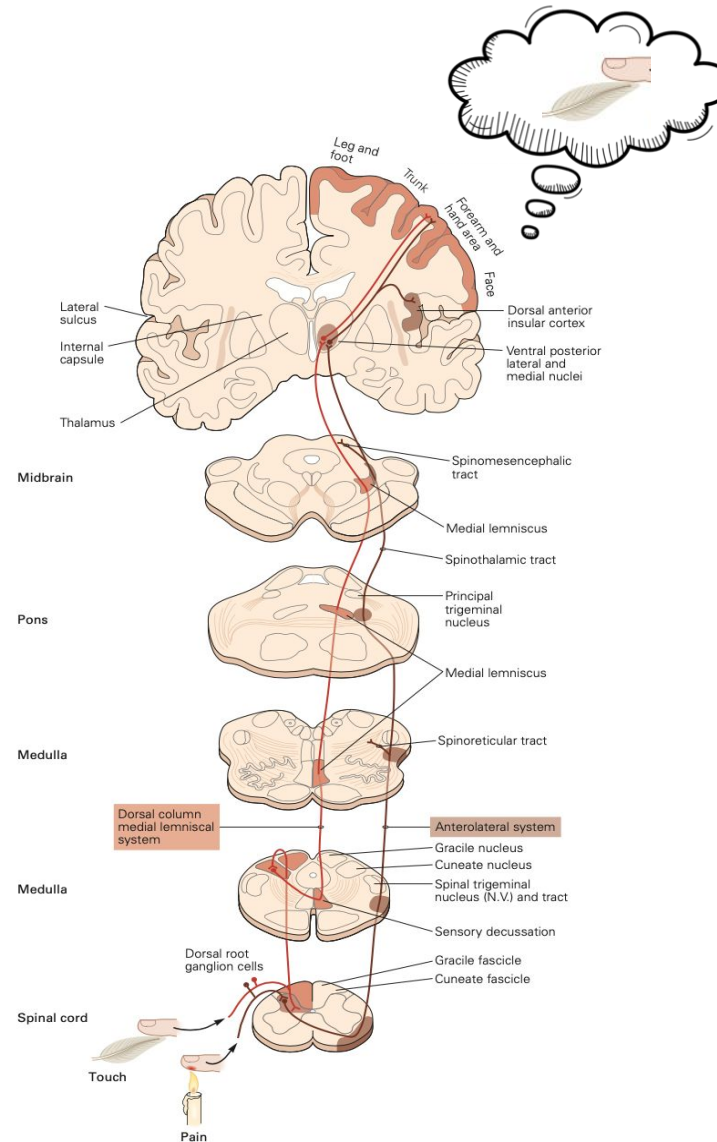
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Somatosensory Perception



Somatosensory Perception



Correlates of Somatosensory Perception

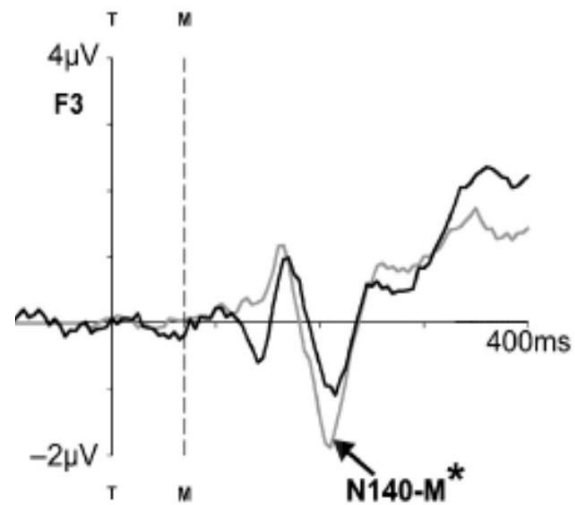
Scalp EEG



Correlates of Somatosensory Perception

N140

Scalp EEG



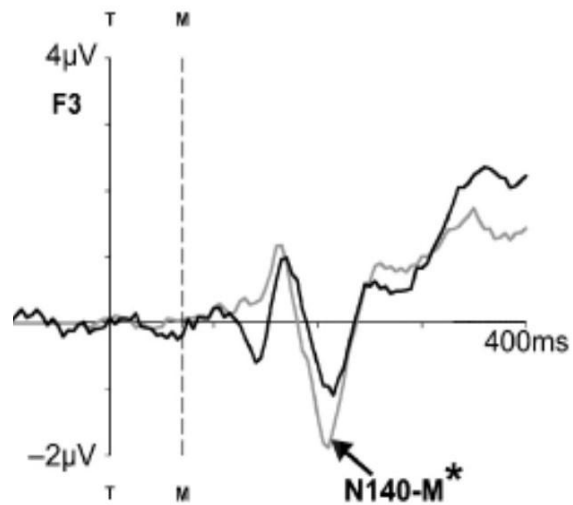
Schubert et al. 2006

Correlates of Somatosensory Perception

Scalp EEG



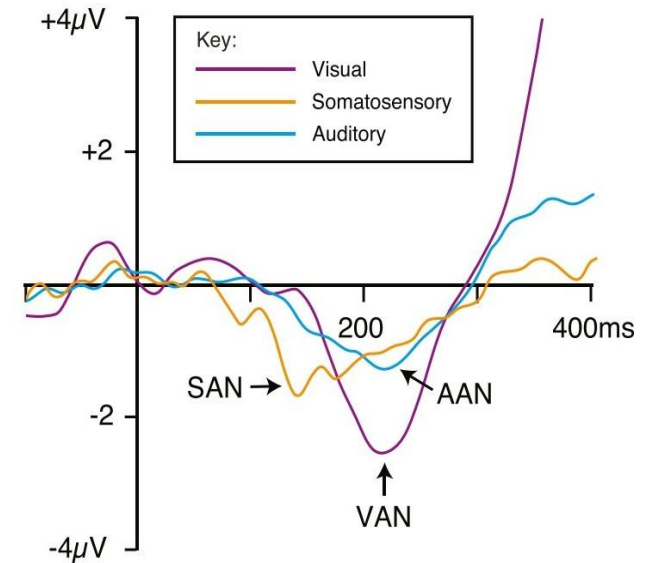
N140



Schubert et al. 2006

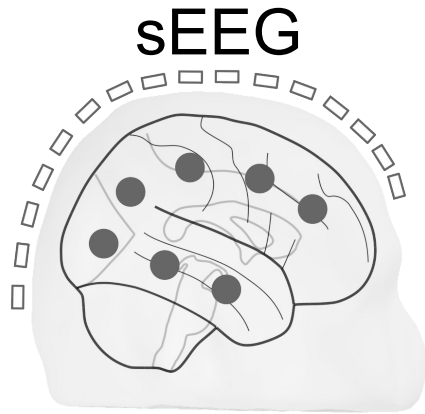
PAN

Perceptual Awareness Negativity

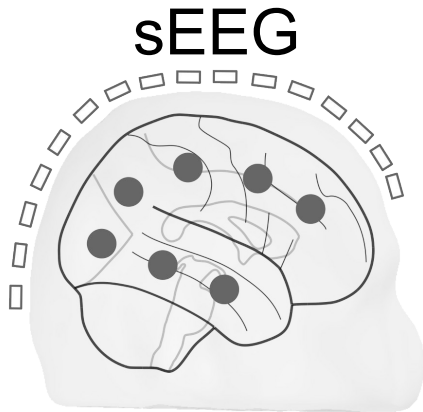


Dembski et al. 2021

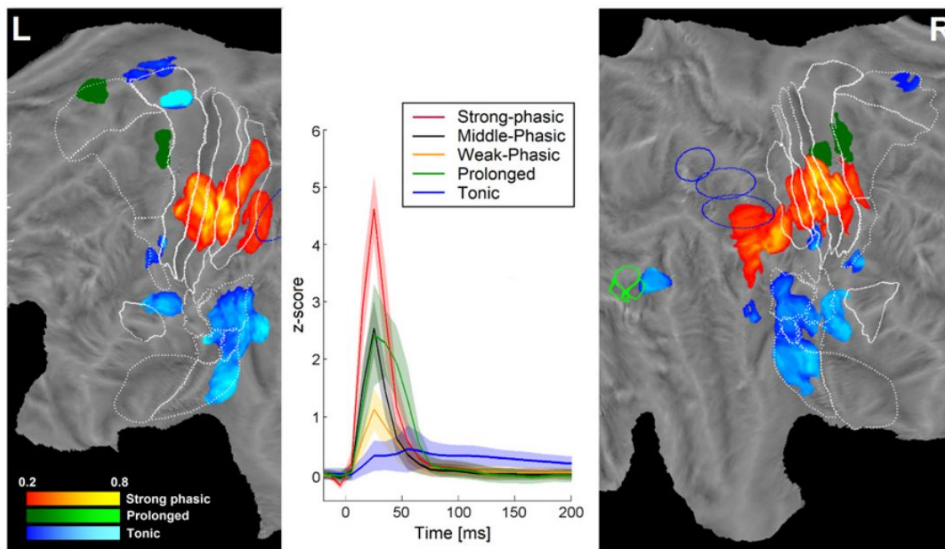
Correlates of Somatosensory Perception



Correlates of Somatosensory Perception

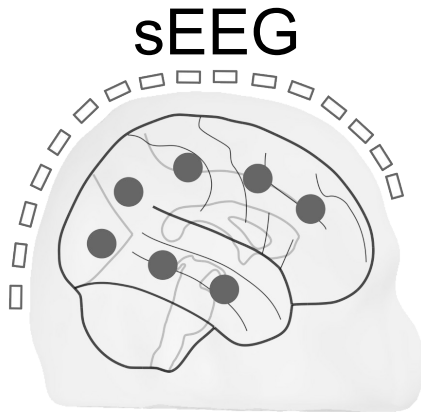


Tonic Responses

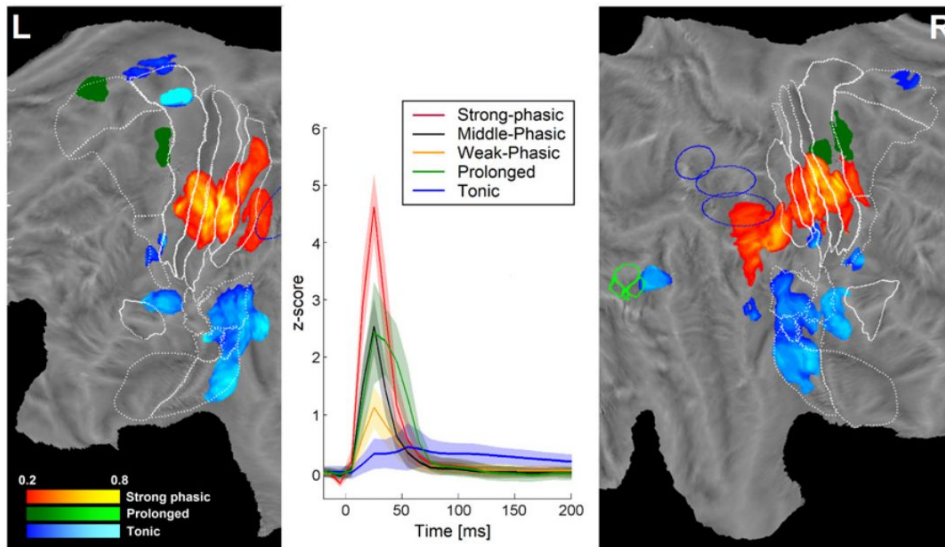


Avanzini et al, 2016

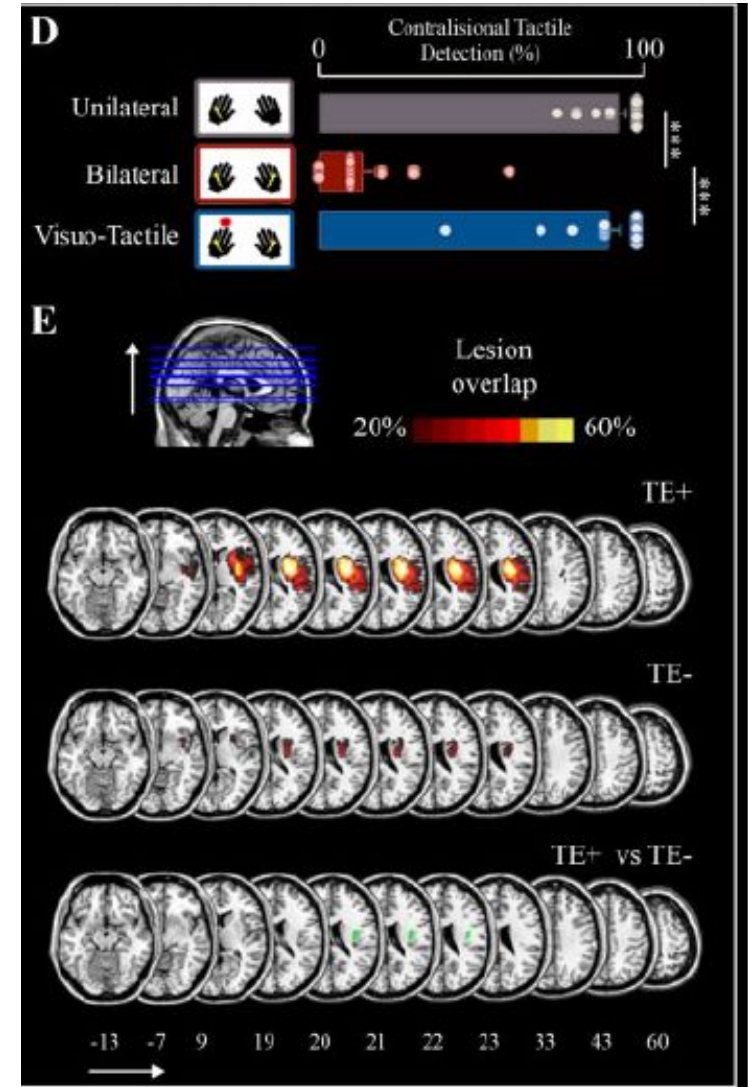
Correlates of Somatosensory Perception



Tonic Responses

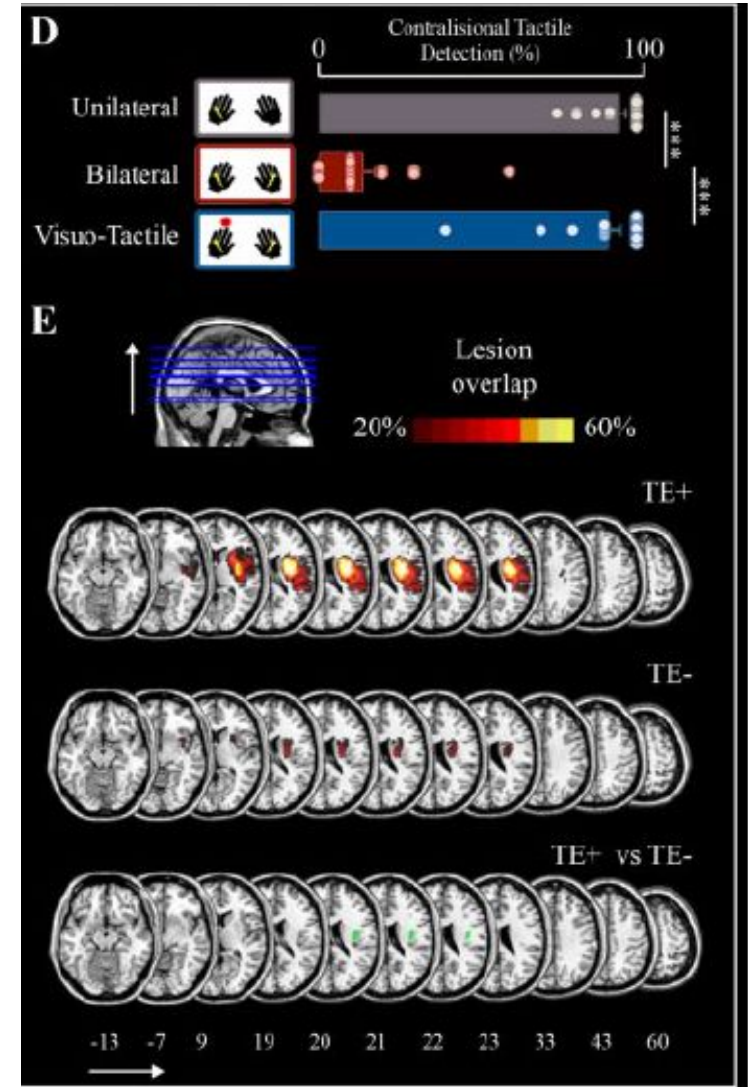
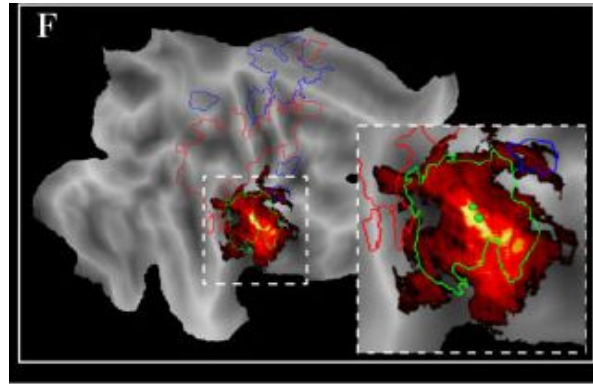
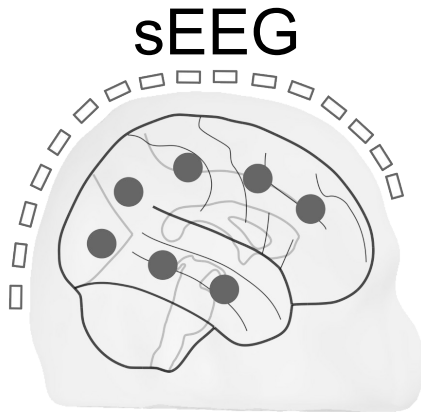


Avanzini et al, 2016

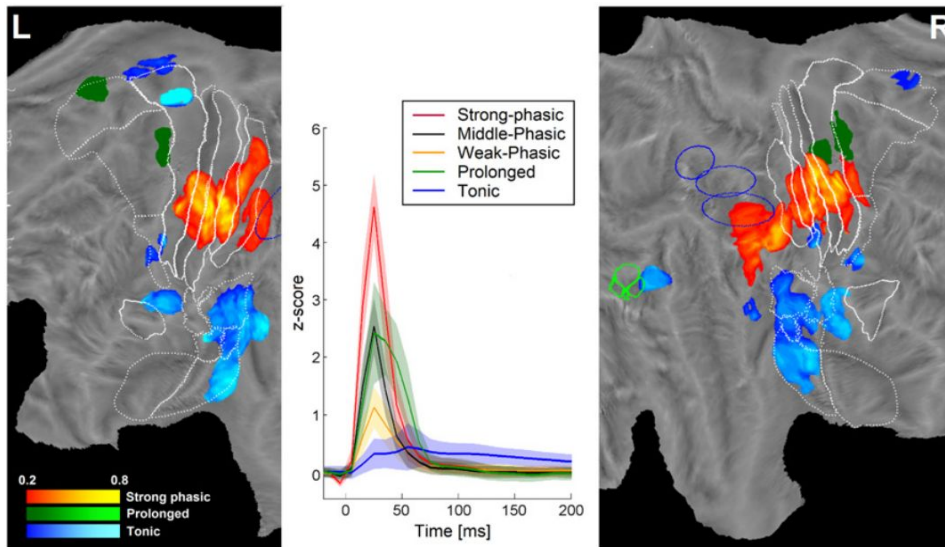


Del Vecchio et al, 2021

Correlates of Somatosensory Perception



Tonic Responses

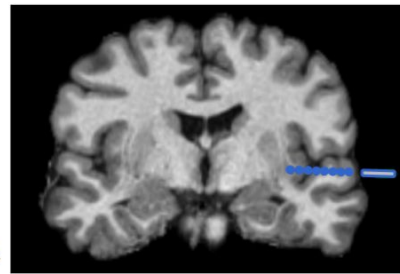
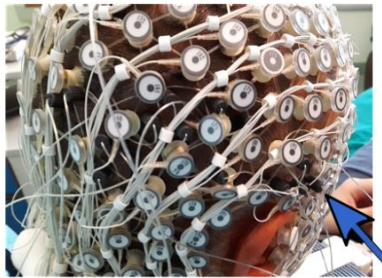
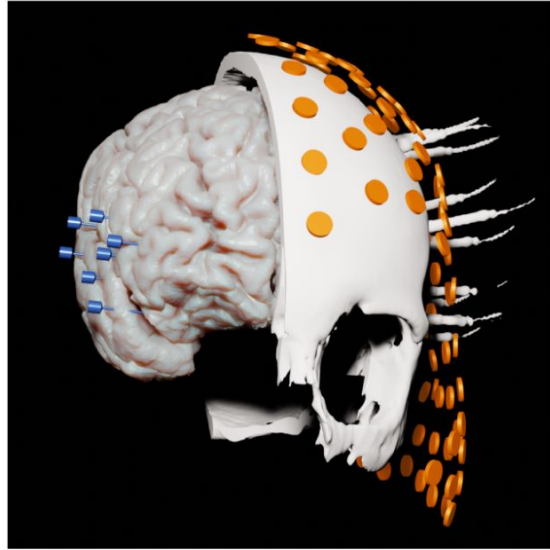


Avanzini et al, 2016

Del Vecchio et al, 2021

Simultaneous HD-EEG and SEEG recordings

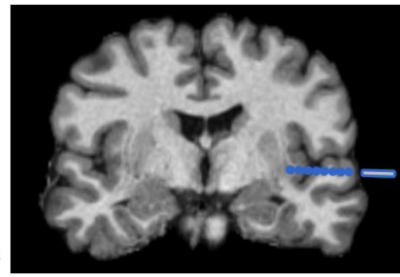
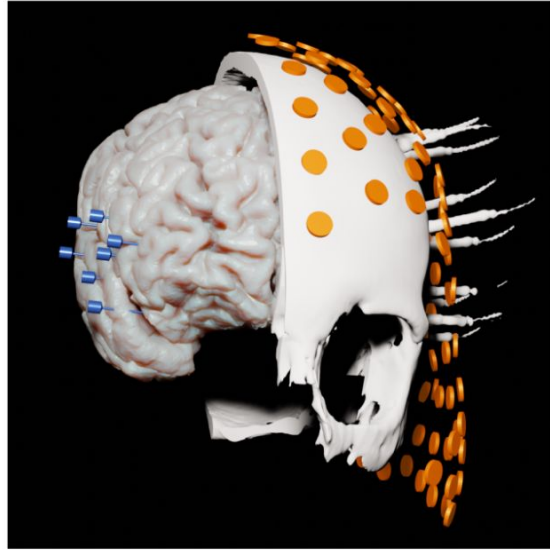
A



Channel
2 mm Spacing

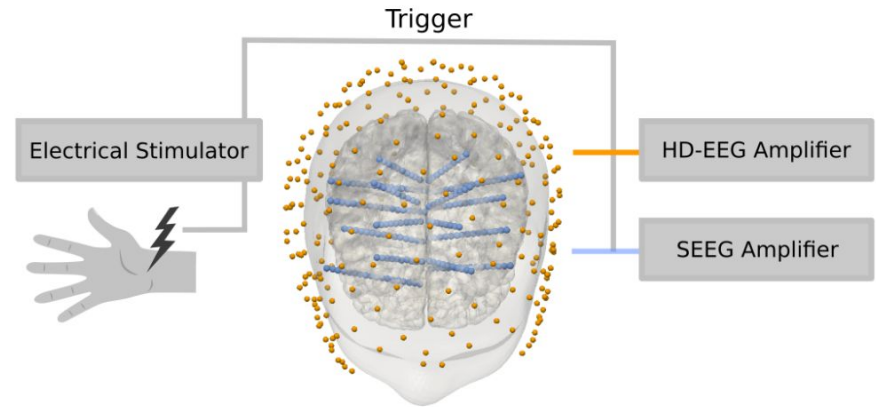
Simultaneous HD-EEG and SEEG recordings

A



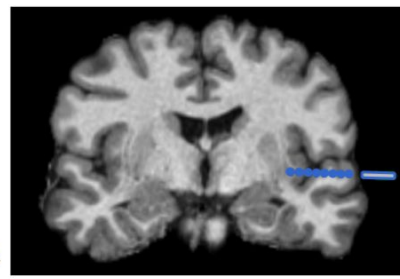
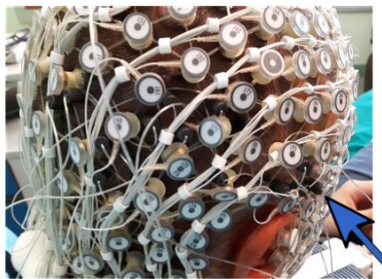
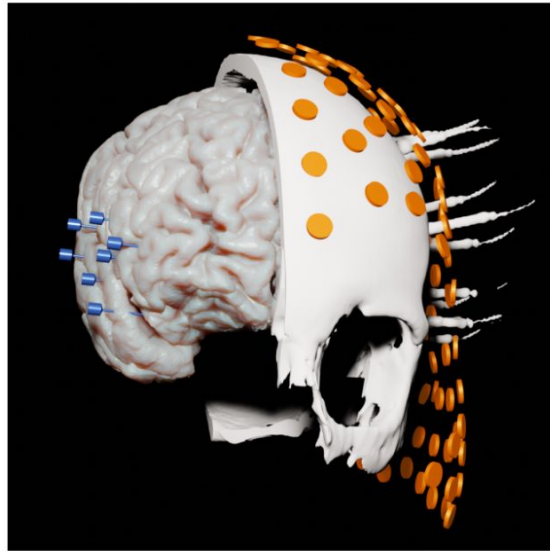
Channel
2 mm Spacing

B



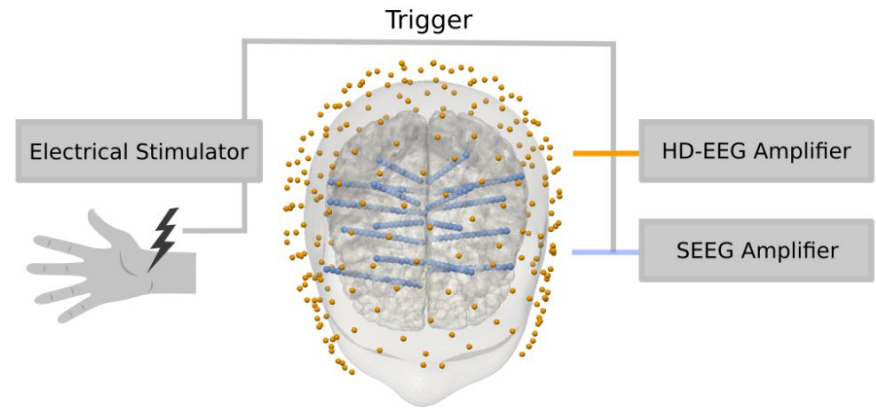
Simultaneous HD-EEG and SEEG recordings

A

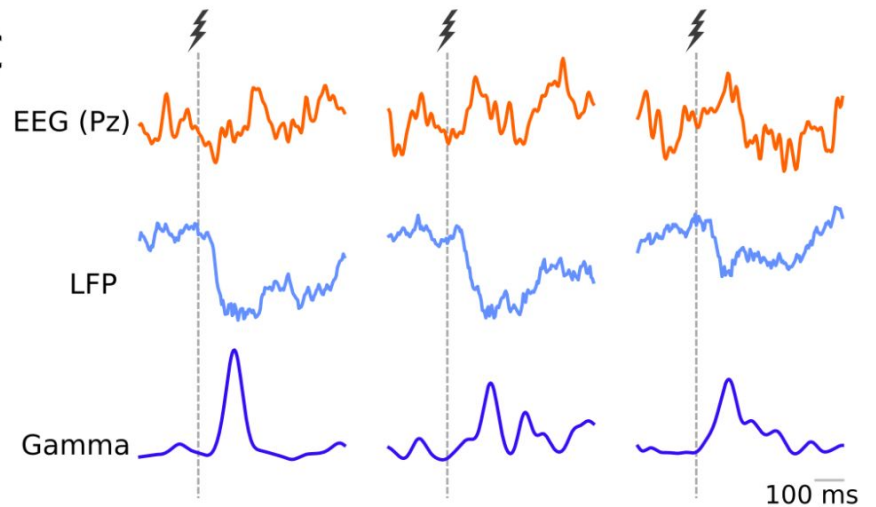


Channel Spacing
2 mm

B

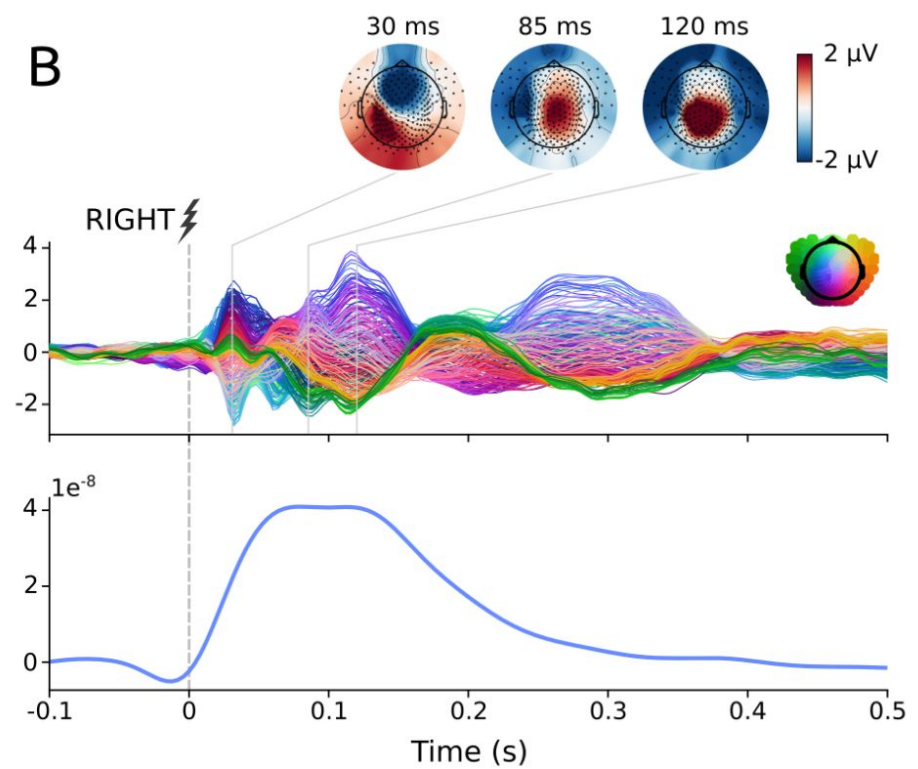
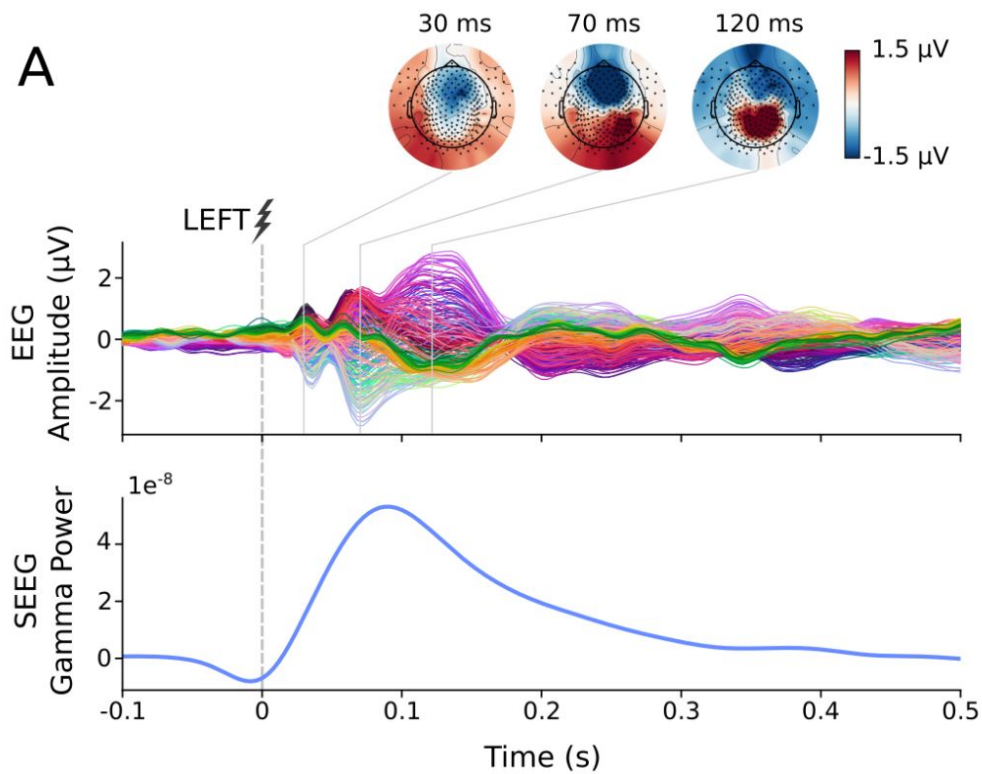


C



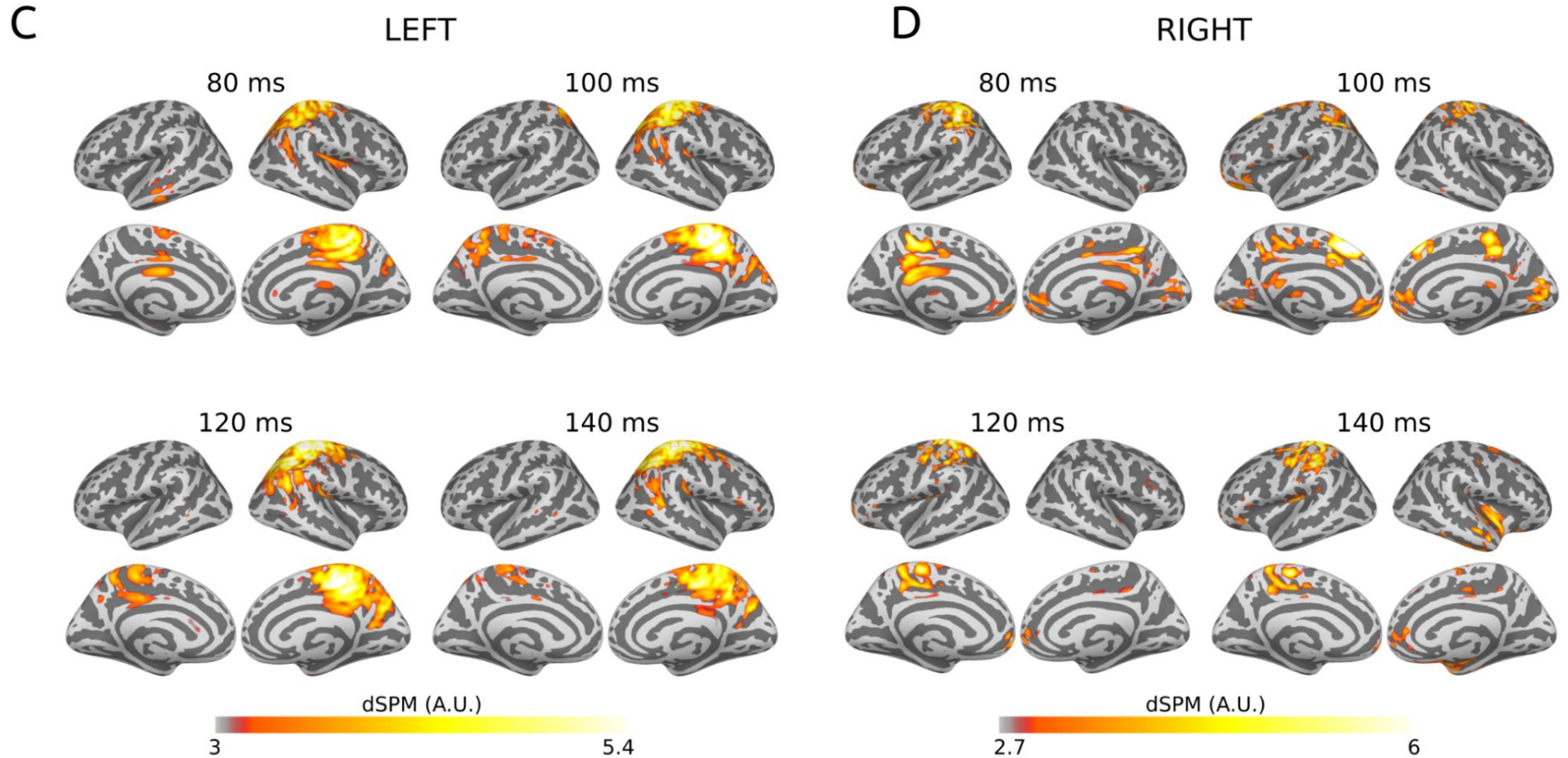
Mikulan et al, in preparation

Simultaneous HD-EEG and SEEG recordings



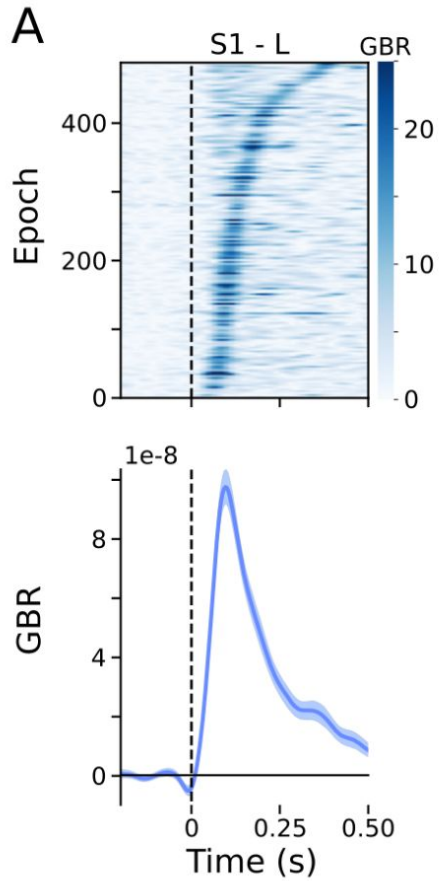
Mikulan et al, in preparation

Simultaneous HD-EEG and SEEG recordings

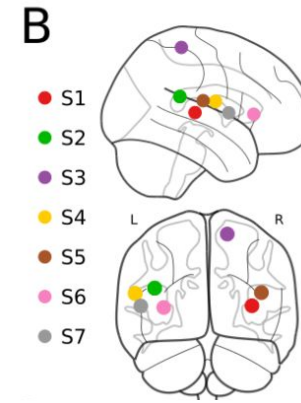
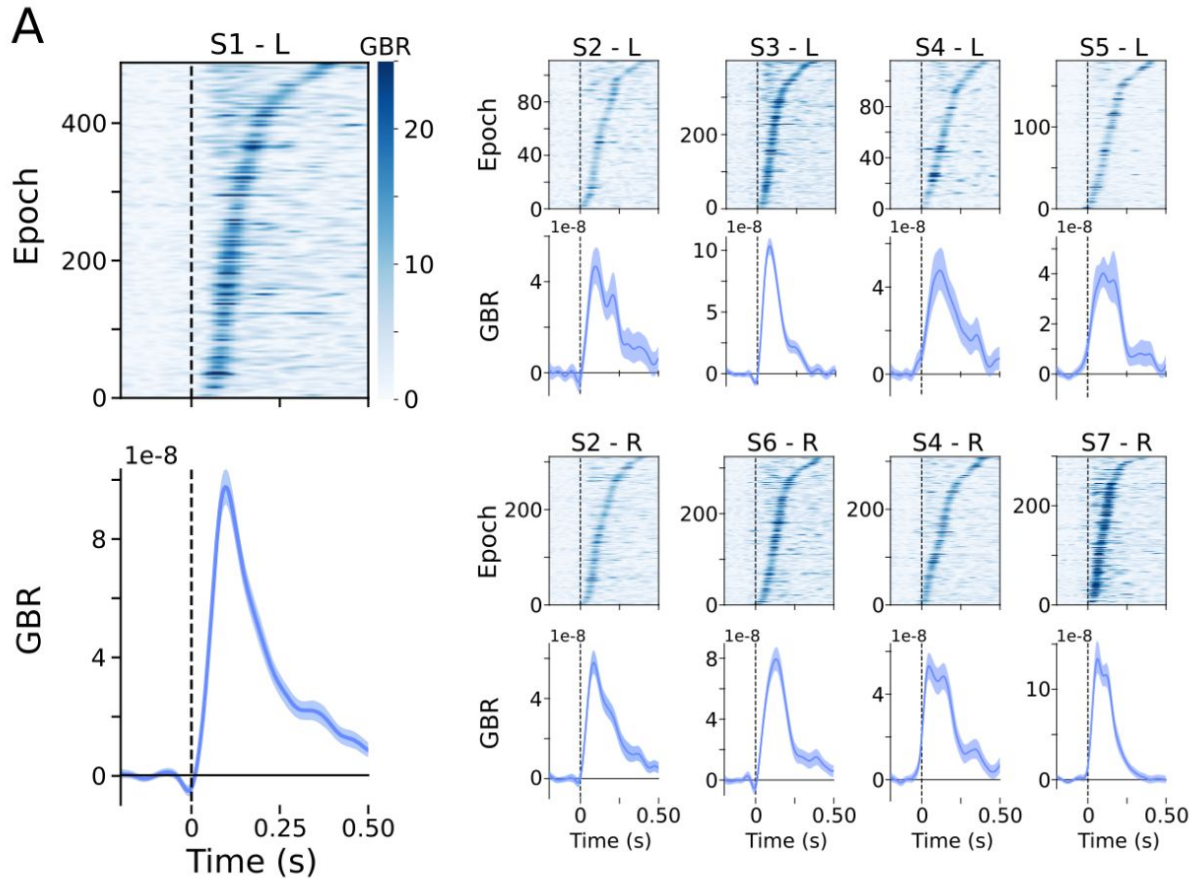


Mikulan et al, in preparation

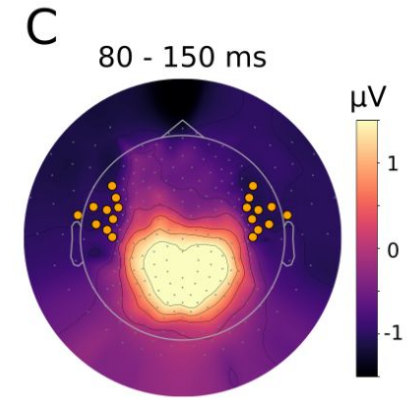
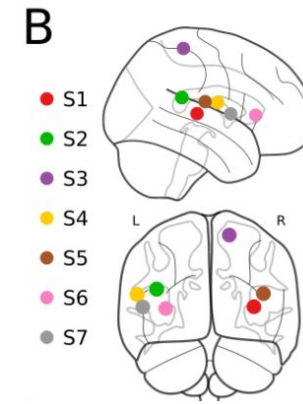
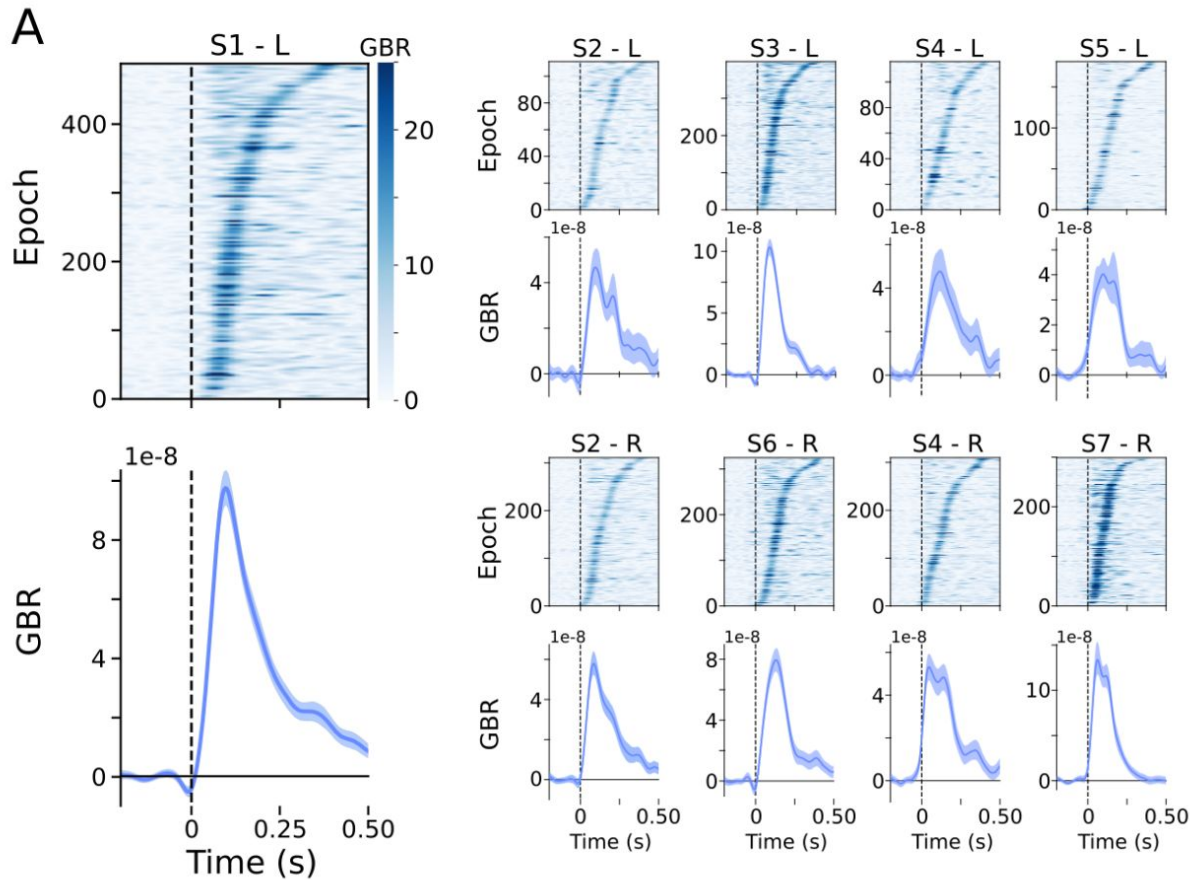
Temporal Correspondence



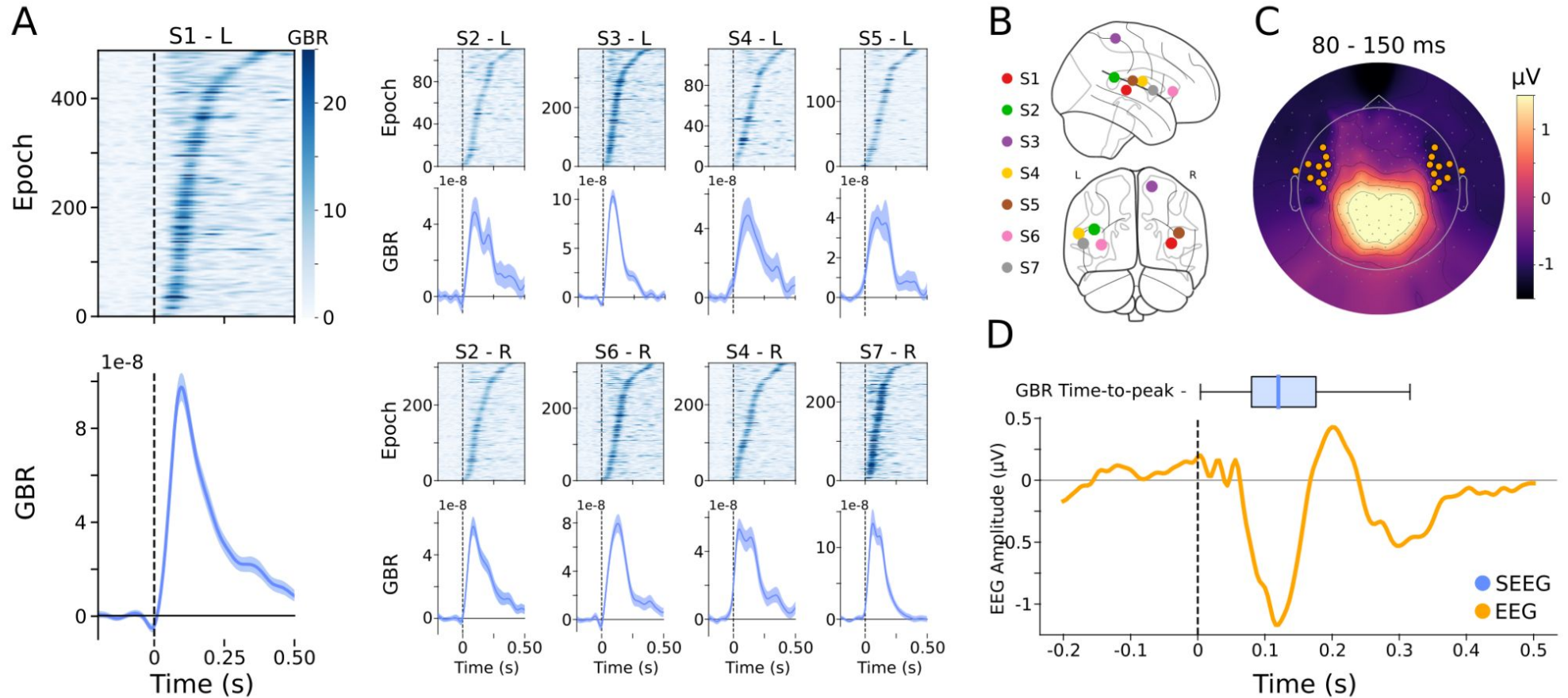
Temporal Correspondence



Temporal Correspondence

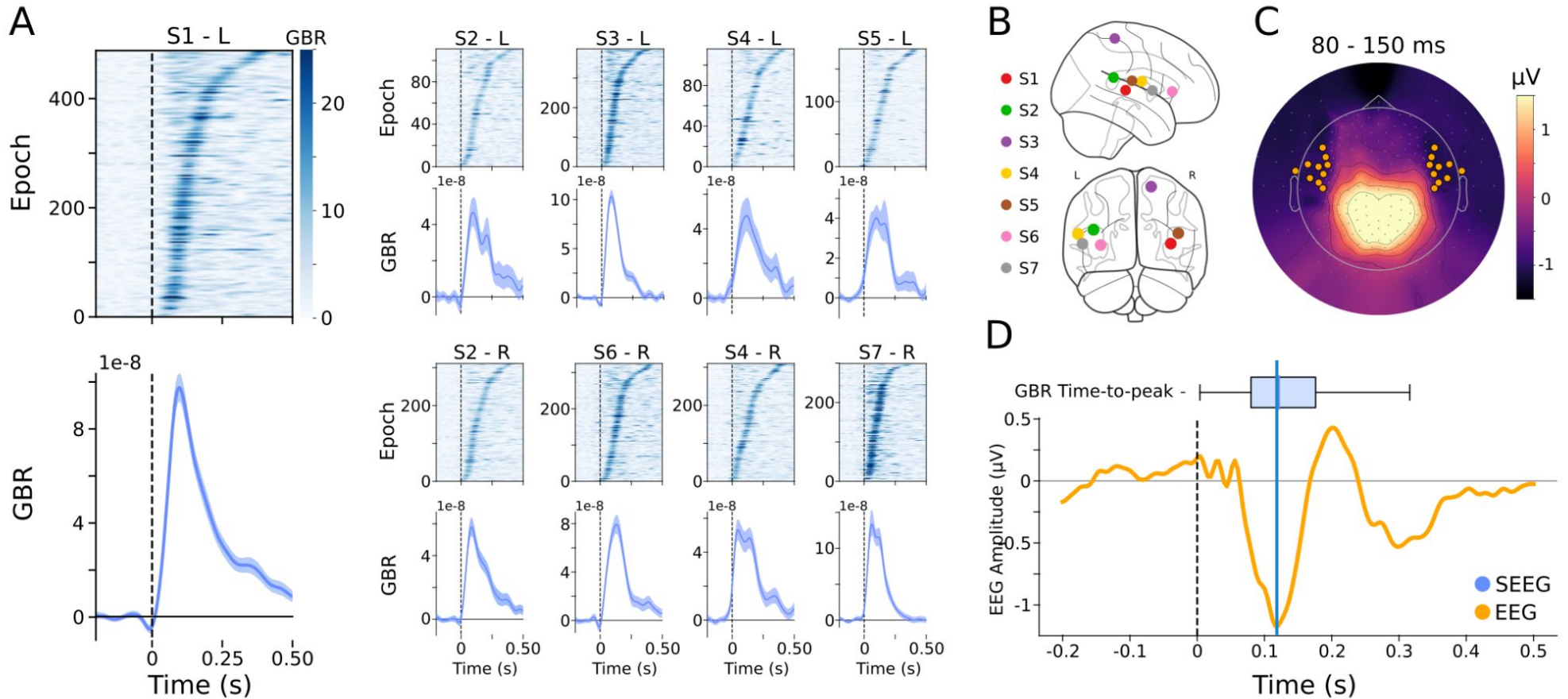


Temporal Correspondence



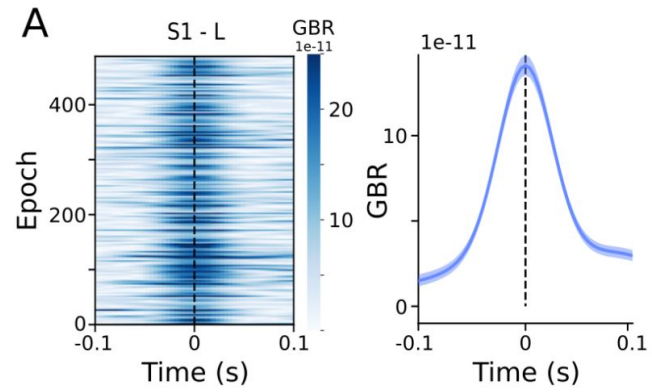
Mikulan et al, in preparation

Temporal Correspondence

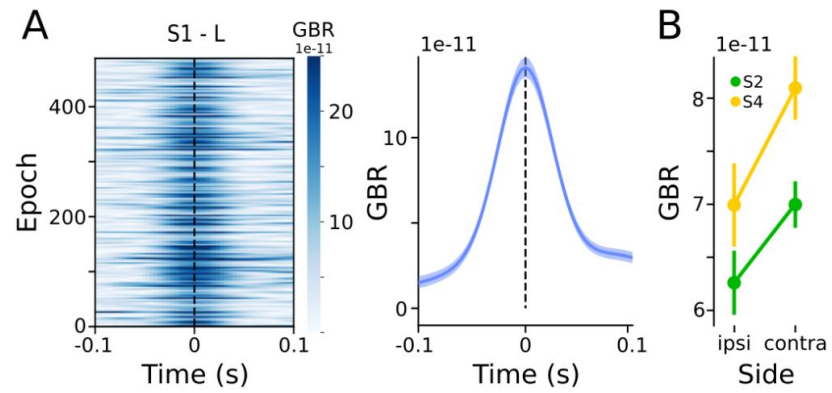


Mikulan et al, in preparation

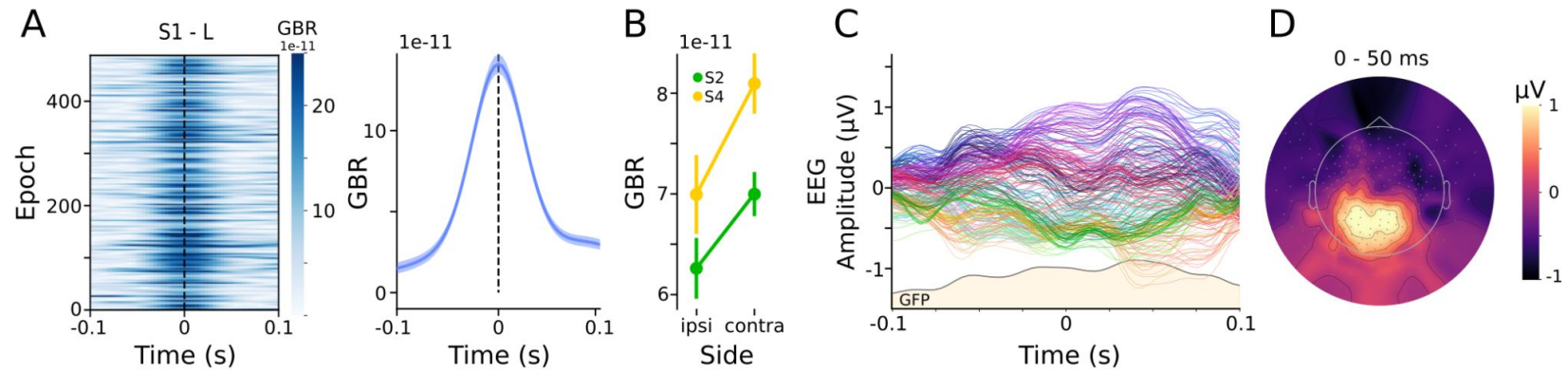
Spatial Correspondence



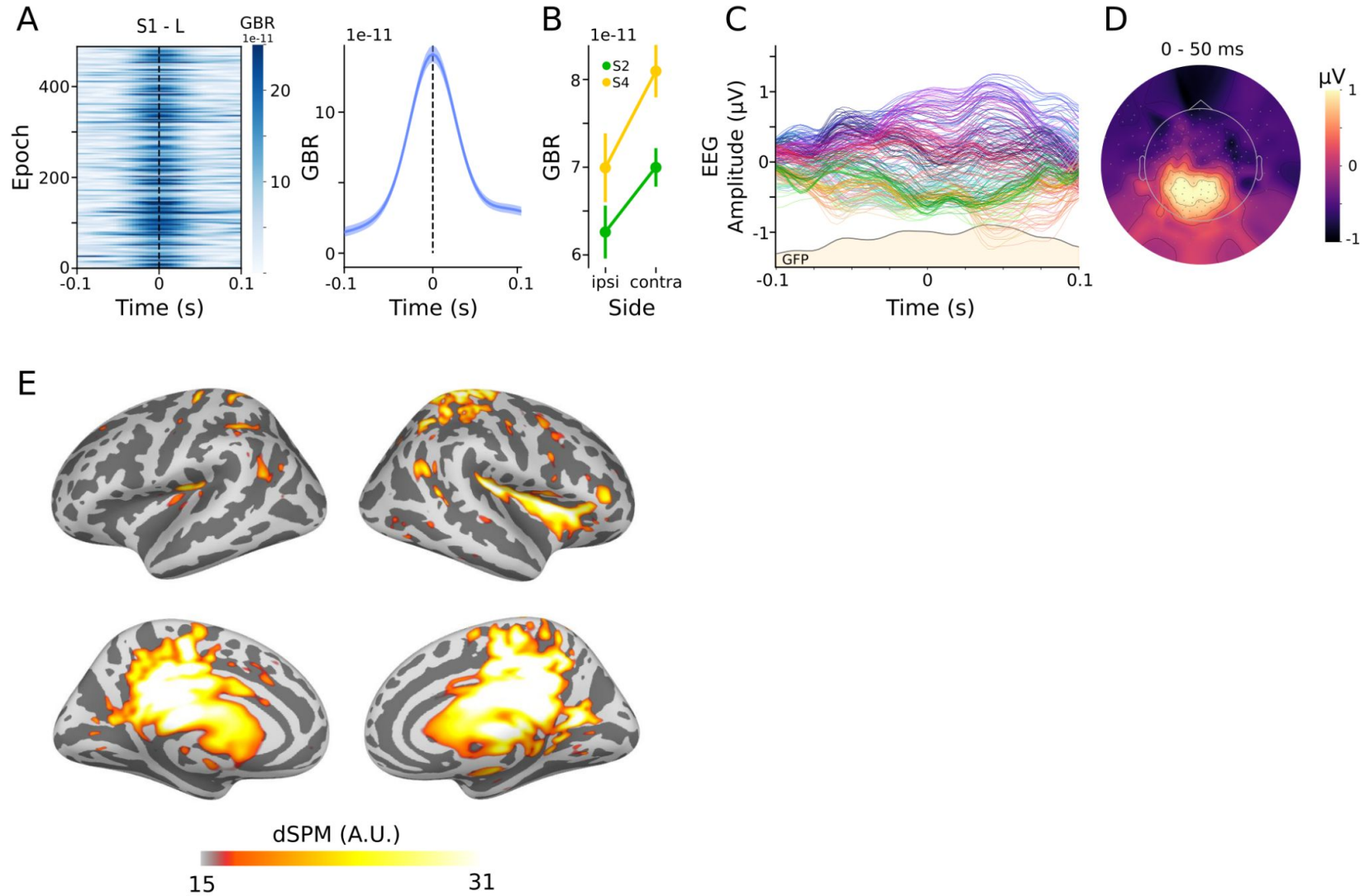
Spatial Correspondence



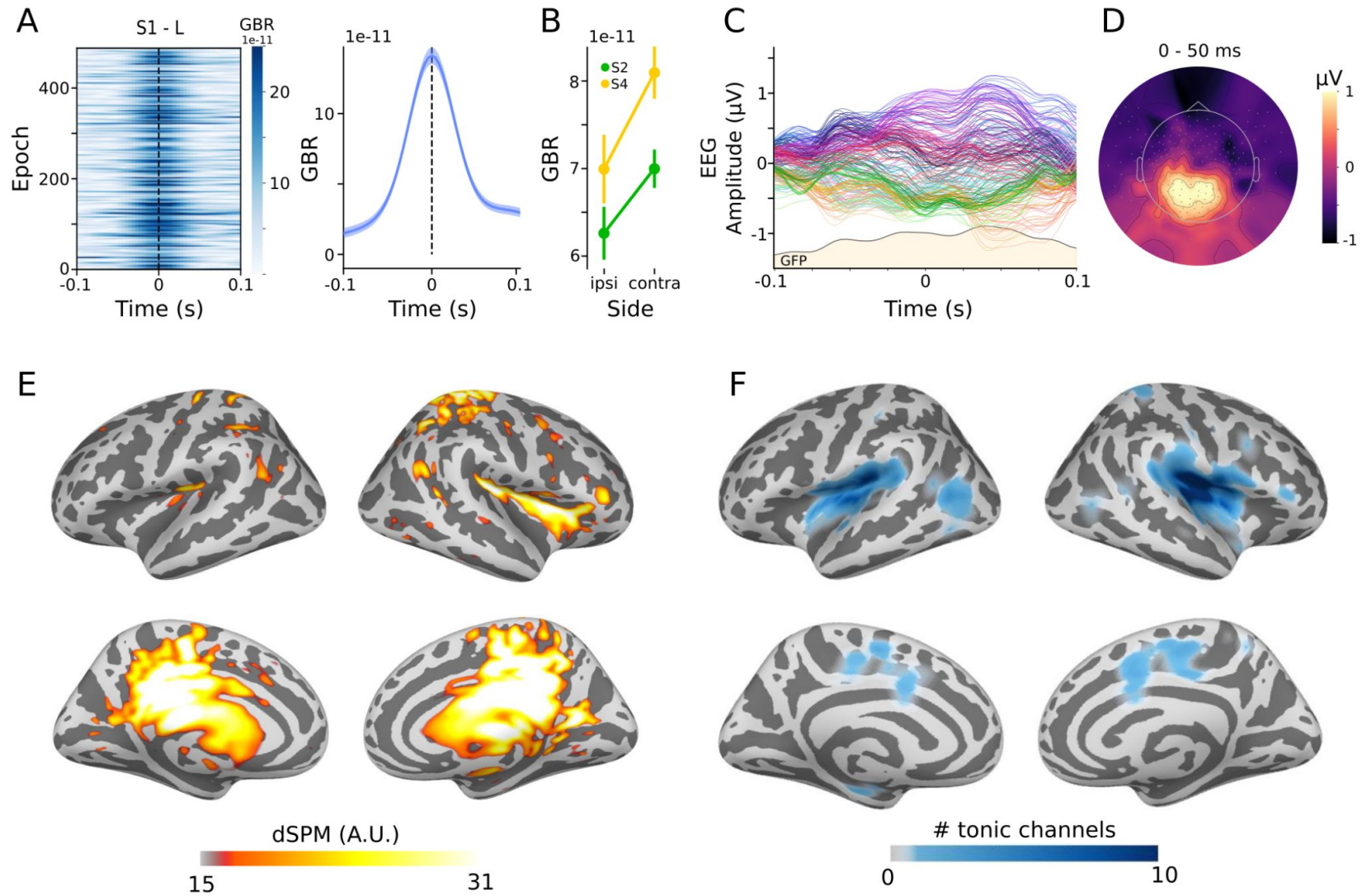
Spatial Correspondence



Spatial Correspondence



Spatial Correspondence



Mikulan et al, in preparation

Prediction of Tonic Responses

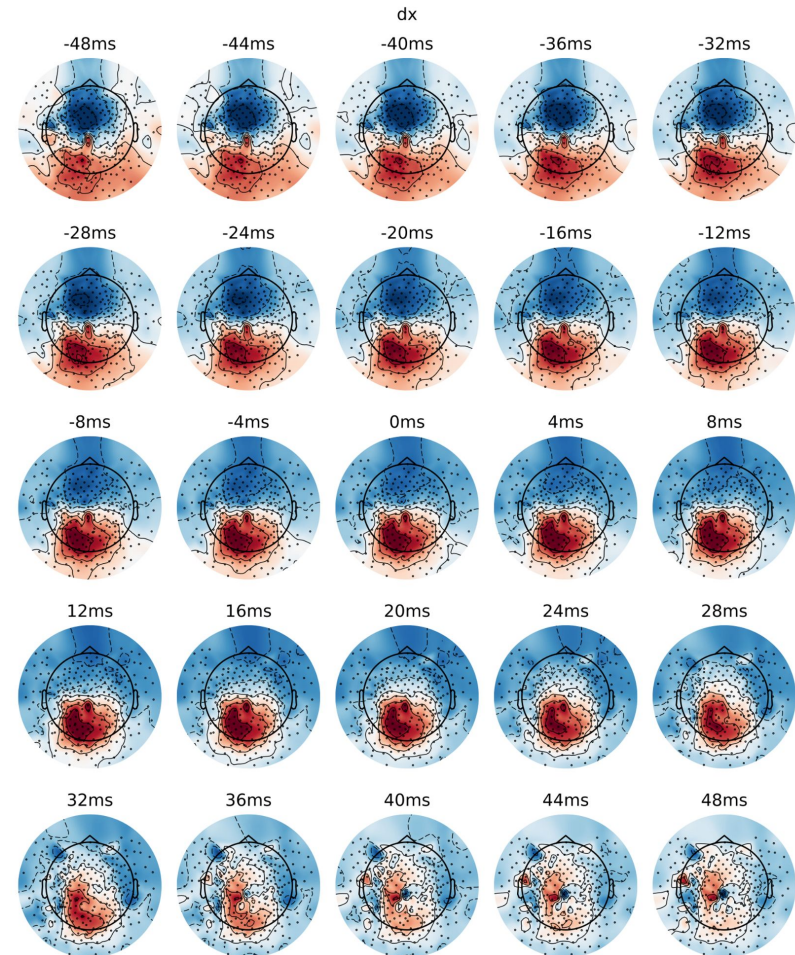
$$\hat{s}(t) = \sum_n \sum_\tau r(t + \tau, n)g(\tau, n),$$

$$\mathbf{R} = \begin{bmatrix} r(i - \epsilon_{\min}, 1) & \dots & r(i, 1) & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ r(T, 1) & \vdots & \vdots & \vdots & \vdots \\ 0 & r(T, 1) & \vdots & \vdots & \vdots \\ \vdots & 0 & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \dots & r(T, 1) & r(T - 1, 1) & \dots & r(T - \tau_{\max}, 1) \end{bmatrix},$$

Prediction of Tonic Responses

$$\hat{s}(t) = \sum_n \sum_{\tau} r(t + \tau, n) g(\tau, n),$$

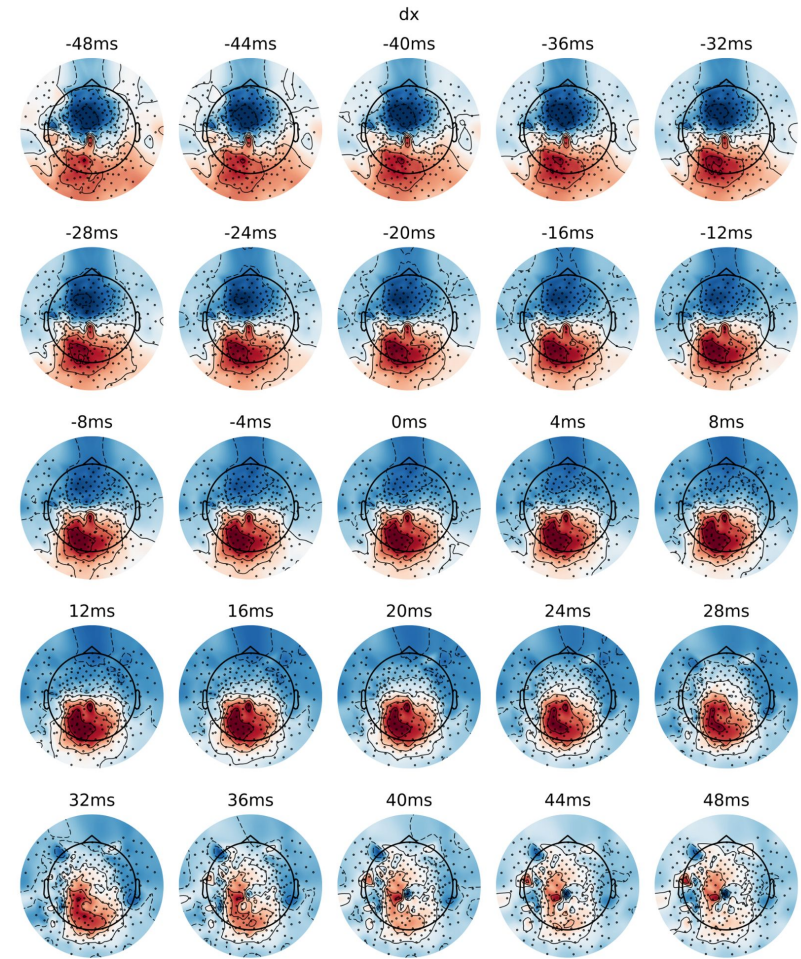
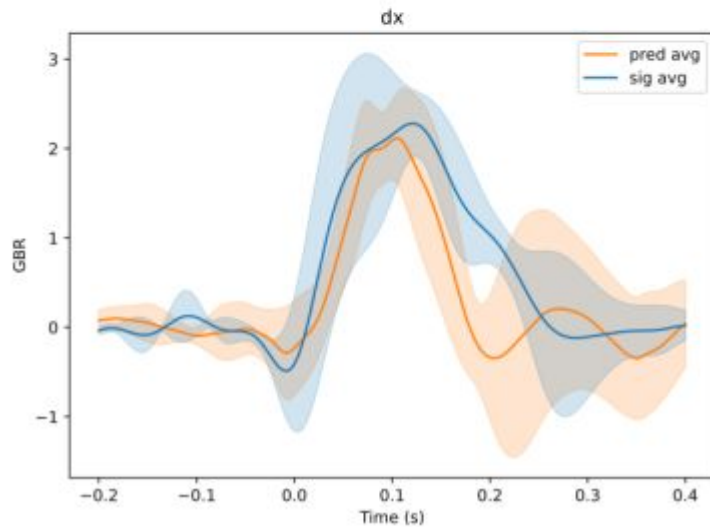
$$\mathbf{R} = \begin{bmatrix} r(i - \epsilon_{\min}, 1) & r(i - \epsilon_{\min}, 2) & \dots & r(i, 1) & \dots & \dots \\ \vdots & \vdots & \dots & \vdots & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots & \dots & 0 \\ \vdots & \vdots & \dots & \vdots & \dots & r(1, 1) \\ r(T, 1) & \vdots & \dots & \vdots & \dots & \vdots \\ 0 & r(T, 1) & \dots & \vdots & \dots & \vdots \\ \vdots & 0 & \dots & \vdots & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots & \dots & \vdots \\ 0 & 0 & \dots & r(T, 1) & r(T - 1, 1) & \dots & r(T - \tau_{\max}, 1) \end{bmatrix}$$



Prediction of Tonic Responses

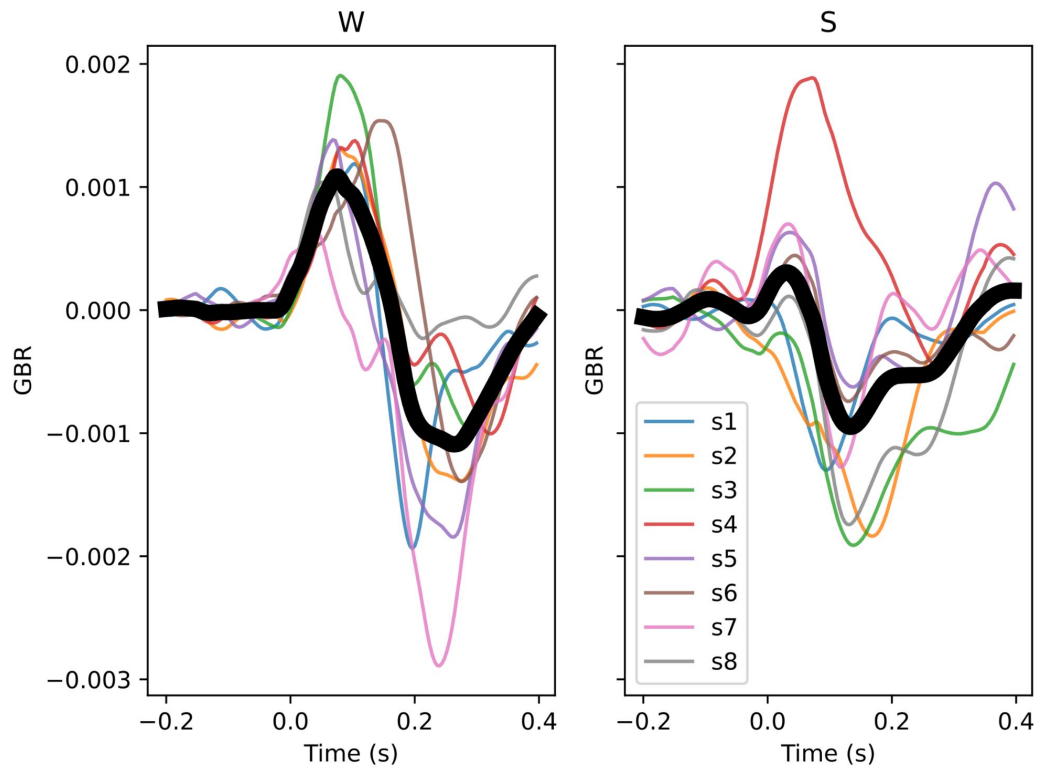
$$\hat{s}(t) = \sum_n \sum_\tau r(t + \tau, n) g(\tau, n),$$

$$\mathbf{R} = \begin{bmatrix} r(i - \epsilon_{\min}, 1) & r(i - \epsilon_{\min}, 2) & \dots & r(i, 1) & \dots & \dots & \dots \\ \vdots & \vdots & \dots & \vdots & \dots & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots & \dots & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots & \dots & \dots & \vdots \\ r(T, 1) & \vdots & \dots & \vdots & \dots & \dots & \vdots \\ 0 & r(T, 1) & \dots & \vdots & \dots & \dots & \vdots \\ \vdots & 0 & \dots & \vdots & \dots & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots & \dots & \dots & \vdots \\ 0 & 0 & \dots & r(T, 1) & r(T - 1, 1) & \dots & r(T - \tau_{\max}, 1) \end{bmatrix},$$



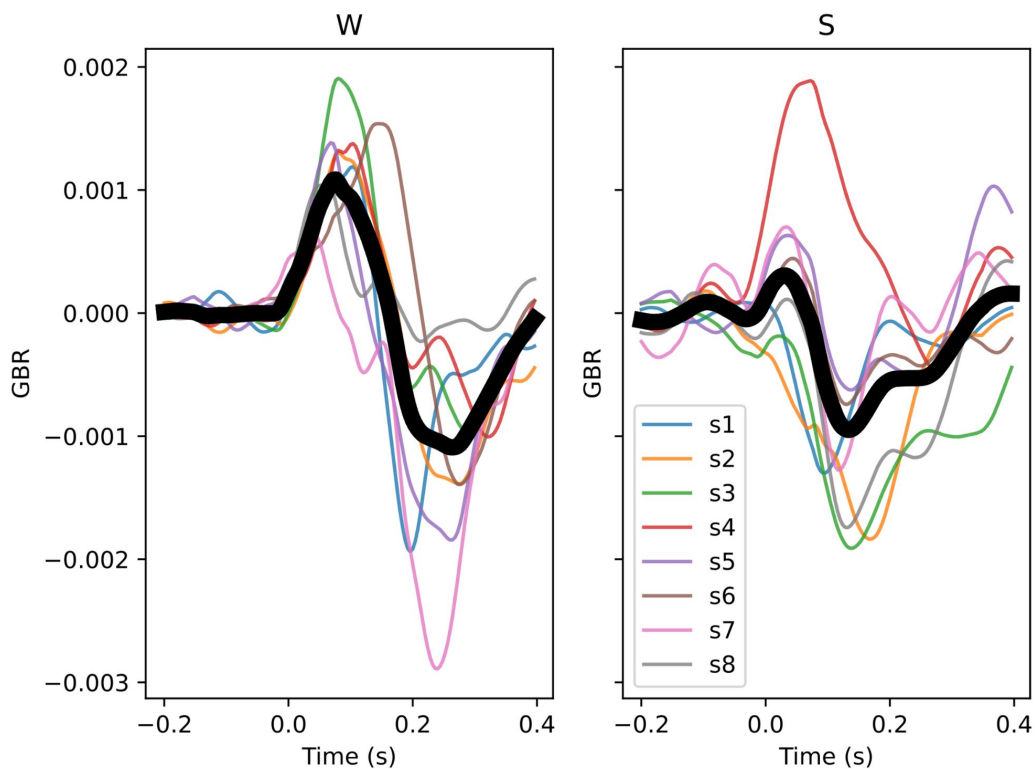
Prediction of Tonic Responses

Wake vs Sleep

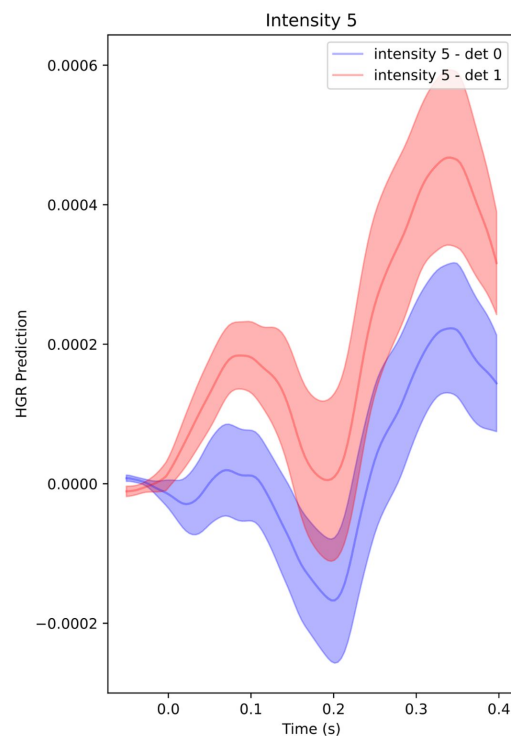


Prediction of Tonic Responses

Wake vs Sleep



Perceptual Report



Data from Schröder et al. 2021

Prediction of Tonic Responses

Tactile Extinction

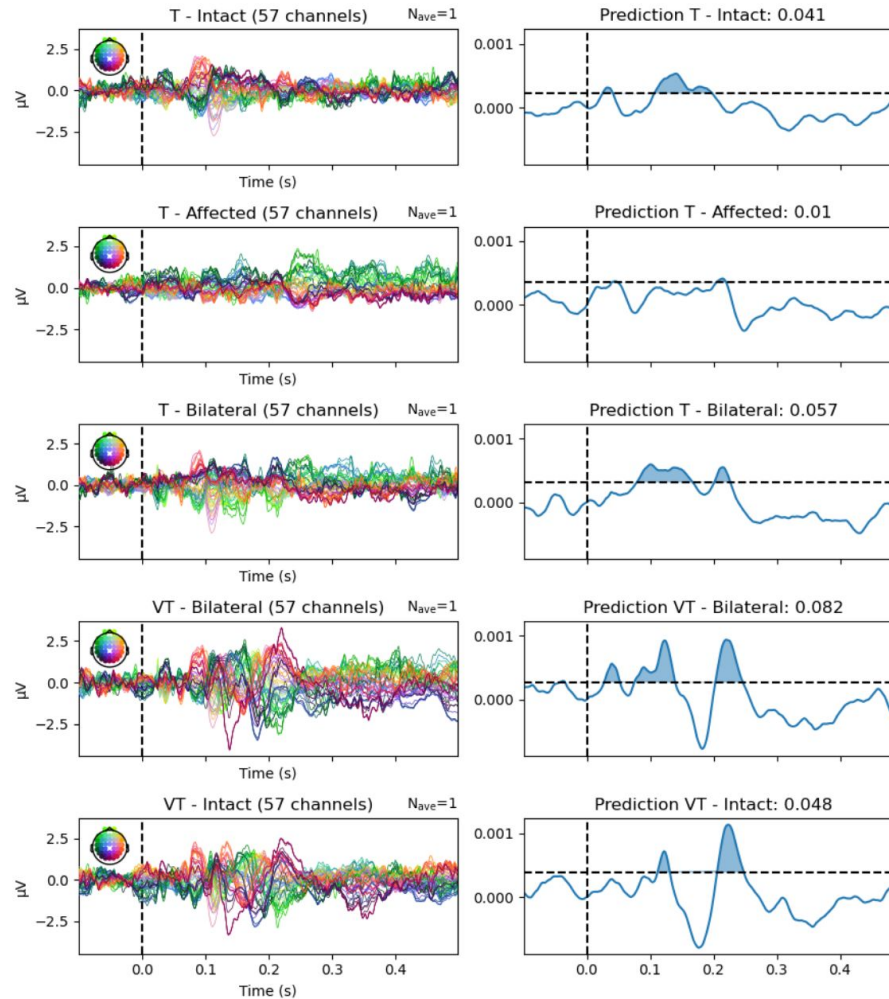
● T - Intact

● T - Affected

● T - Bilateral

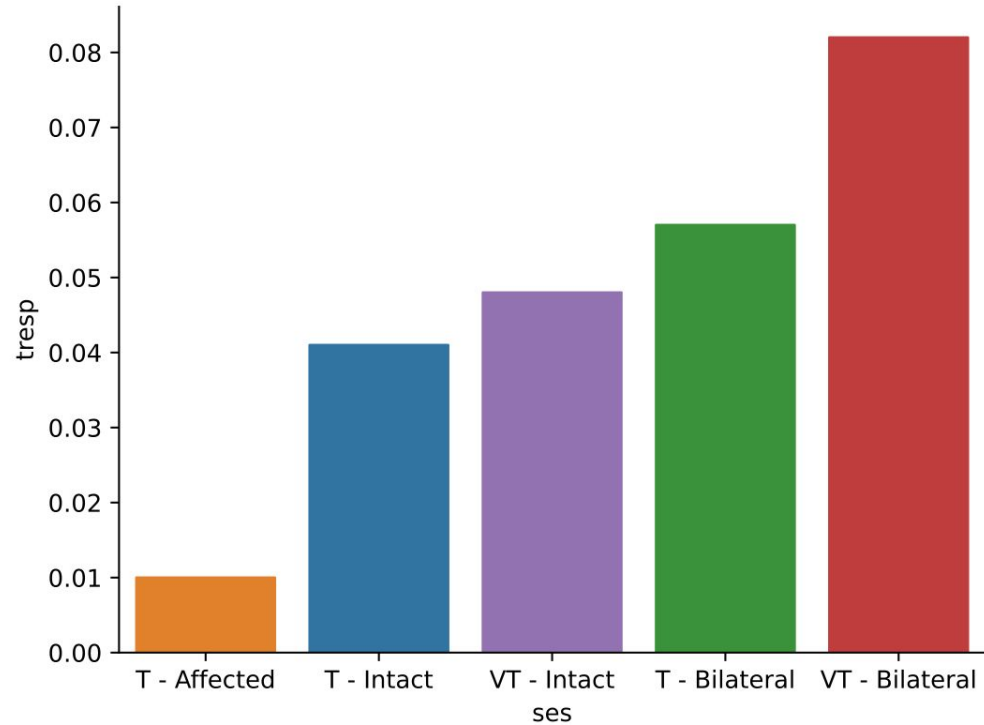
● VT - Bilateral

● VT - Intact



Prediction of Tonic Responses

Tactile Extinction



Data Sharing



DATASET



Sensory and intracortical stimulations with simultaneous IEEG and EEG recordings and subjective reports (v1)

Overview

Get data

Custodians: ⓘ Massimini, M.

Somatosensation has been associated with a specific pattern of brain responses to tactile stimulation that comprises an early and fast phasic activation and a later and slower tonic component; both measured as modulations in the gamma band (50 – 150Hz) [[Avanzini, PNAS 2016](); [Del Vecchio Brain 2022]()]. The later component has been proposed to be linked to tactile awareness, as the areas responsible for it are compromised in patients suffering from tactile extinction. However, up to date, explorations of this tonic component have been carried out exclusively with intracranial invasive recordings, as it is the only technique that allows for reliable and localized estimation of the gamma band response. This dataset comprises simultaneously acquired SEEG and HD-EEG recordings both during median nerve stimulation and during electrical stimulation of intracranial contacts that showed tonic responses.

Preparation: in vivo

Experimental approach:
electrophysiology

Technique:

- stereoelectroencephalography
- high-density electroencephalography

Please alert us at curation-support@ebrains.eu for errors or quality concerns regarding the dataset, so we can forward this information to the Data Custodian responsible.



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Matteo Feccchio

Renzo Comolatti
Giulia Ferragoni
Alessandro Viganò
Michele Colombo
Silvia Casarotto
Mario Rosanova
Marcello Massimini

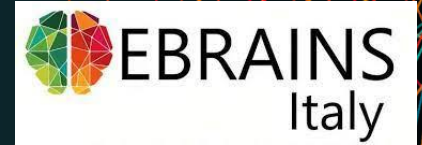
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Roberto Mai
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Laura Castana
Stefano Francione
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