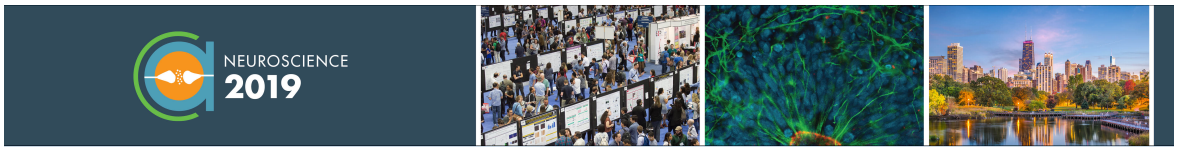

Session 418 - Attention and Neuromodulation

418.18 / Z5 - Effects of attention on Granger causal interactions between cortical layers and cortical areas V1 and V4

October 21, 2019, 1:00 PM - 5:00 PM | Hall A

Presenter at Poster
Mon, Oct. 21, 2019 2:00 PM - 3:00 PM

Session Type
Poster

Grant Support
Wellcome Trust 093104

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Disclosures
D. Ferro: A. Employment/Salary (full or part-time):; Center for Mind/Brain Sciences (CIMeC), University of Trento, Rovereto, Italy. **J. Van Kempen:** None. **M. Boyd:** None. **S. Panzeri:** None. **A. Thiele:** None.

Abstract
Visual attention improves sensory processing as well as perceptual readout and behavior. How attention shapes interactions between cortical layers within and between sensory areas is poorly understood [1-3].
To investigate this we trained macaque monkeys on a covert feature based spatial attention task, and recorded simultaneously from laminar electrodes in areas V1 and V4 (16 contacts, 150 µm inter-contact spacing). Electrodes were inserted normal to the cortical surface. Receptive Fields (RFs) between V1 and V4 were overlapping. Channel alignment relative to layer 4 was based on current source density and latency analysis.
For all analyses the LFP was locally re-referenced (bipolar LFP) offline. Spectral power in different frequency bands showed relatively small differences along cortical depths (V1 and V4). For V1 LFPs, attention to the RFs resulted in a shift of the low-gamma (~30-50Hz) spectral power peak towards higher frequencies (2-4Hz shift). For V4 LFPs attention to the RFs caused a decrease in power for frequencies <20Hz and a broad band increase for frequencies >20Hz.
Attention affected spectral coherence within V1 and within V4 layers similarly to the spectral power modulation reported above. Spectral coherence across V1 and V4 pairs was increased by attention in beta band (~15-30Hz) and the low-gamma range (30-50Hz).
Attention affected Granger causal interactions (GCI) in a layer and frequency dependent manner in complex ways. These often failed to follow predictions made by feed-forward and feedback models [1,4]. Within V1, attention increased feed-forward efficacy across different frequency bands (2-50 Hz). Within V4, attention mostly increased GCIs in the low and high gamma frequency in a 'downwards' direction within the column, i.e. from supragranular to granular and to infragranular layers. Increases were also evident in an upward direction from granular to supragranular layers. The dominant changes in V1-V4 CGIs were an increase in the gamma frequency range from V1 granular and infragranular layers to V4 supragranular and granular layers, as well as an increase from V4 supragranular layers to all V1 layers.
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