UNIVERSITÉ DE GENÈVE
CENTRE INTERFACULTAIRE EN SCIENCES AFFECTIVES

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Workshop

EEG-iEEG-NIRS methods and emotion research

April 25th 2017 – 14:00 to 17:00 – Room 144.165

Swiss Center for Affective Sciences - Campus Biotech

Invited: Prof. Annekatherin Schacht (University of Goettingen)

During this workshop we will discuss how EEG and NIRS methods can be informative to study emotional processes at different levels. We will have six presentations and discussions of empirical studies using both surface and intracranial recordings EEG as well as fNIRS for the investigation of emotional processing.

Abstracts:

Visuomotor integration of angry facial expressions revealed by the mu rhythm

Selim Coll

Our brain codes the features of perceptual events in a distributed fashion, raising the question of how information belonging to one event is processed without any interference of features from other events. Hommel (1998) suggested the "event file" concept to elucidate these mechanisms: an episodic memory trace binding perceptual features and actions related to an object.
By adapting Hommel's paradigm to emotional faces in a previous study (Coll & Grandjean, 2016), we discovered that emotion, like perceptual features, could take part in an "event file" with motor responses when relevant and irrelevant for a task.
Using an EEG-adapted version of this paradigm, we investigated the emotion-action binding by comparing the mu rhythm related to the reactivation of the previously associated motor response depending on our experimental conditions.

Temporal dynamics underlying the processing of vocal threat in humans

Leonardo Ceravolo

It has been posited that emotional vocalizations, especially when spoken in a threatening tone, elicit a preferential spatial attentional deployment, although there is no clear evidence of the temporal dynamics underlying such process. Using a target-detection task in a binaural presentation paradigm, we found that attentional deployment was influenced by threatening as opposed to happy or neutral vocal signals at early and later stages of attentional processing through the attentional-capture N2ac (200-300ms post stimulus onset) and the attentional-reorienting LPCP (lateral posterior-contralateral positivity: 300ms-600ms post stimulus onset) evoked components. Behavioral facilitation was stronger (faster reaction times) for detecting happy as compare to angry voices when they were in competition while the opposite effect was observed when stimuli were presented one at a time. Our data highlight the spatio-temporal attentional dynamics related to angry vocalizations as reflecting a fundamental preference of the human attentional system to threat, in addition to highlighting the importance of attentional disengagement from threat signals.

Electrophysiological responses to emotional auditory stimuli during sleep and wakefulness

Maëva Moyne

Emotional sounds elicit enhanced cortical responses in conditions of wakefulness. However, it is unknown whether this effect is similarly present during sleep. Even in deep sleep, evidence shows that the brain is not fully disconnected from its acoustic environment. On the other hand, sleep is characterized by an over-activation of limbic regions, related to emotion encoding, but by a hypo-activation of executive function regions, compared to wakefulness. In the present study, we examined event-related potential (ERP) responses to angry and neutral voices in 17 healthy subjects, both during wakefulness and sleep. We observed an early modulation of N1 auditory responses around 120-200ms post-stimulus in response to the emotional voices, compared to the neutral voices, only during wakefulness and rapid-eye-movement (REM) sleep. Furthermore, results showed a consistent modulatory effect by emotion across all awake and sleep (stage 2, 3 and REM) stages, around 500-600ms after-onset. These results demonstrate that emotion encoding and detection from external stimulation is preserved even in conditions of altered consciousness.

A neural oscillatory code for emotional prosody decoding in the parkinsonian subthalamic nucleus

Damien Benis

A critical contribution of the subthalamic nucleus (STN), in the recognition of emotional prosody has been demonstrated by deep brain stimulation and event related potential studies. However, the oscillatory correlates in this structure of emotional prosody decoding in different frequency bands remain to date unclear. In this study, we recorded local field potentials in the STN of sixteen patients that had just undergone deep brain electrode implantation while they listened to angry, happy and neutral voices. To control whether the activations observed were specific to human voices, acoustically matched synthesized stimuli were also included in the experiment. Results show a differential pattern of STN oscillatory activities during emotional prosody decoding in different frequency bands. STN activity dissociated angry from happy and neutral voices in the theta (2– 6 Hz) and beta (20–35 Hz) bands, while an emotion-specific activation of the STN was observed in the alpha band (6–13 Hz). Interestingly, local field potential activity in the STN was lower for human voices compared to acoustically matched nonhuman synthesized stimuli in the beta band. Altogether, these results suggest a finely tuned pattern of oscillatory activity in the subthalamic nucleus during emotional prosody decoding at the time and frequency scale.

Social Threat Processing in Humans Relies on Functional Amygdalo-Orbitofrontal Connectivity

Andy Christen

Social threat processing and flexible behavioral adjustments rely on widespread and complex neural network activity, anchored by the amygdala and the orbitofrontal cortex. Although anatomical and imaging studies suggest a potential interplay between these areas, the mechanisms and nature of this interaction remain unknown. By analyzing intracranial recordings in humans, we show selective enhancement in low-frequency phase-locking synchronization and long-range phase-amplitude coupling between low-frequency signals in the amygdala and gamma signals in the orbitofrontal cortex during processing of angry relative to neutral facial or vocal expressions. Behaviorally, enhanced amygdalo-orbitofrontal cortex coupling was linked to faster reaction times for angry relative to neutral stimuli. These results provide unique evidence of a direct functional communication within the amygdalo-orbitofrontal network, supporting rapid social threat processing and behavioral adjustment.

Evolutionary approach to emotion using affective prosody: a fNIRS study

Coralie Debracque

From an evolutionary point of view, humans are primates, belonging to the hominid family together with other great apes. Because of this close genetic proximity, the human brain should be able to recognize emotions other apes' vocalizations, possibly displaying variation of activation in the bilateral IFC (frontal regions involve in emotion processing) according to the phylogenetic tree.
In our study, the goal is to investigate via a new non-invasive technique of brain imagery, functional Near Infrared Spectroscopy, how humans categorize and discriminate emotions in ape's vocalizations within implicit or explicit modalities.
All participants are exposed to the same stimuli, consisting for human voices of onomatopoeias and calls produced by chimpanzees, bonobos and macaques for other primates' vocalizations. These stimuli were expressed in an angry, fearful or happiness tone for human voices. Equivalent calls for primate vocalizations expressed: anger (aggressors screams), fear (victim screams) and happiness (food grunts). 36 different stimuli were presented during a mini-block design with two tasks: "emotion categorization" and "emotion discrimination". We predicted that the emotion task would induce an increase of the OxyHemoglobin (component of the Hemodynamic Response function) in the Bilateral IFG more or less important according to the species that produced the vocalizations (Human>Chimpanzee>Bonobo>Macaque).