SLEEP AND EMOTION

A MULTIDISCIPLINARY INVESTIGATION OF HUMAN HEALTH AND WELL-BEING

Istituto Svizzero

UNIVERSITÉ DE GENÈVE
SWISS CENTER FOR AFFECTIVE SCIENCES

FONDS GÉNÉRAL DE L'UNIVERSITÉ DE GENÈVE

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Photo: Davide Palmieri

DECEMBER 10th & 12th 2023

ROME SWISS INSTITUTE

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PRESENTATION

Sleep and emotion are two crucial aspects of human health and well-being. The interplay between sleep and emotion is complex, and recent research has shown that disruptions in sleep can have negative effects on emotional regulation, cognitive function, and physical health.

This conference on sleep and emotion will be held at the Swiss Institute in Rome on the 11th and 12th of December 2023 to bring together experts in this field from Switzerland and Italy to exchange ideas, discuss the latest advancements, and foster collaboration.

The objectives of the conference are to:

1. Provide a platform for researchers, clinicians, and practitioners to discuss the latest research findings on sleep and emotion.
2. Promote interdisciplinary collaboration and networking among researchers interested in sleep and emotion.
3. Encourage the translation of research findings into practical applications in the field of sleep and emotion.
4. Facilitate the dissemination of knowledge through oral presentations and discussions.

ORGANIZING COMMITTEE

- **Prof. Sophie Schwartz**, Chair and Professor of Basic Neuroscience at the University of Geneva, Switzerland.
- **Prof. Giulio Bernardi**, Co-chair and Professor of Neuroscience at the IMT School for Advanced Studies Lucca, Italy
- **Laura Riontino PhD**, Maître Assistante at the University of Geneva, Switzerland, Conference Coordinator and Expert in Sleep and emotions.
- **Guillaume Legendre PhD**, Post-Doc at the IMT School for Advanced Studies Lucca, Italy, Conference Coordinator and Expert in Sleep and emotions.
- **Guillaume Jacquemoud**, CISA IT Manager. Responsible for web infrastructure and design.

For enquiries please write to: sleep-emotion@unige.ch

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PROGRAM

DECEMBER 10TH

19:30	Social dinner at Ristorante al Cupolone - Via di porta Cavalleggeri, 145, Rome

DAY 1, DECEMBER 11TH

09:00 - 09:30	Registration

Session 1: Sleep and Emotion

09:30	Keynote speaker #1 Thomas Andrillon: Origins of sleep intrusions in wakefulness and their cognitive consequences.
10:00	Célia Lacaux: Wake up, sleeping muse! Investigation of sleep onset as a cognitive and neural state promoting creativity.
10:15	Giulia Avvenuti: Local sleep-like activity and emotion regulation failures.
10:30	Kevin Mammeri: Gender-specific Trends in Sleep Patterns and Memory Function in School-Aged Children: Insights from a Real-Life Setting with EEG Analysis
10:45 - 11:00	Coffee break
11:00	Francesco Pietrogiacomi: Experience-dependent modulation of sleep-related mental activity.
11:15	Demetrio Grollero: Brain reactivity to nonverbal emotional vocalizations during NREM sleep.
11:30	Alison Montagrin: Rewriting the Past: Reconsolidation of emotional episodic memories.
11:45	Kinga Igloi: Exploring exercise effects on memory and future research on elite athletes' sleep patterns and cognitive functions.
12:00 - 14:00	Lunch break at Il piccolo Mondo - Via Aurora, 39, Rome

Session 2: Dream and Emotion

14:00	Keynote speaker #2 Lampros Perogamvros: The Theater of Dreams.
14:30	Valentina Elce: The cartography of dreams: application of computational linguistics to the study of sleep conscious experiences.
14:45	Bianca Pedreschi: REMEDY: Memory REactivation during sleep as a tool to Modulate oneiric Experiences and investigate the role of Dreams in memorY processing and emotional regulation. Stage of work: odors selection pilot.
15:00 - 15:30	Coffee break
15:30 - 15:50	Short talks: • Laure Colin: Architecturally modified sleep and emotional episodic memory: an fMRI study. • Alice Clerget: Enhancing imagery rehearsal therapy for idiopathic nightmares with targeted memory reactivation. • Audrey Theux: Augmentation of Imagery Rehearsal Therapy with Targeted Memory Reactivation for Post-Traumatic Stress Disorder. • Saskia Czura: Imagery Rescripting and Targeted Memory Reactivation in Insomnia Disorder.
15:50	Giorgia Bontempi: Dream recall and content in RBD patients.
16:05	Davide Marzoli: Changes in brain activity upon stimulus-induced awakening predicts subsequent dream recall.
16:20	Q&D Moderator: Sophie Schwartz
17:30 - 19:00	*Art-Science presentation by Alexander Serechenko and* ***Екатерина Пряничникова*** *& Apero.*

DAY 2, DECEMBER 12TH

Session 3: Methods in Sleep research

09:30	Keynote speaker #3 Delphine Oudiette: Asleep and aware? Transient windows of behavioral responsiveness to the external world during sleep.
10:00	Adriana Michalak: The spectrum of conscious experiences during NREM sleep: there is more than what meets the eye.
10:15	Ruggero Basanisi: Source reconstruction on a sleeping brain.
10:30	Damiana Bergamo: Cortical and subcortical hemodynamic changes associated with slow wave occurrence.
10:45 - 11:00	Coffee break
11:00	Keynote speaker #4 Marzia De Lucia: Cardio-audio and sensory regularity encoding in conscious and unconscious states.
11:30	Andria Pelentritou: Cardio-audio regularity processing in human wakefulness and sleep.
11:45	Leila Salvesen: Lucid dream induction using wearable EEG and dream engineering toolbox: a multi-center study.
12:00 - 14:00	Lunch break at Il piccolo Mondo - Via Aurora, 39, Rome

Session 4: Sleep and Emotion: clinical aspects

14:00	Keynote speaker #5 Virginie Sterpenich: Sleeping on Rewards: Exploring Memory Reactivation in Healthy Individuals and Narcoleptic Patients.
14:30	Maeva Moyne: Impact of Motivation and Motor Function on Sleep Quality and Motor Learning in Post-Stroke Rehabilitation.
14:45	Isabella De Cuntis: Unraveling the sensory - deprived brain through the lens of sleep patterns.

15:00 - 15:15	Coffee break
15:15	Laura Riontino: Sleep deprivation alters affective and neural responses to erotic stimuli in heterosexual males.
15:30	Guillaume Legendre: Targeted neural fatigue applied to human perception.
15:45	Q&D Moderator: Giulio Bernardi.
16:30	Closing remarks

ARTISTIC EVENT

ART MEETS THE SCIENCE OF SLEEP AND EMOTION

PRESENTATION OF GRAY CAKE DUO

Art duo Gray Cake will present the results of their work on the «Dreams of the Machine» project, which was created in 2021 during the EOFA residency program, together with a group of scientists from the Sleep and Cognition Neuroimaging Laboratory, University of Geneva.

As a natural continuation of the project, based on research into how the visual cortex works and the opportunity to reconstruct images using fMRI, the artists now work on the idea of reconstructing dream images also using fMRI and neural networks. This idea formed the basis of their art project, which is currently in the work-in-progress stage.

Artists will present video art created using AI tools. The basis for it was a database of people's dreams recorded in text. The second part of the project is a book. The ongoing project based on research in the field of dream reconstruction using fMRI will also be presented.

BIOGRAPHY

Gray Cake is an art duo of Alexander Serechenko and Katya Pryanik. Katya graduated from the Rodchenko Art School of Photography and Multimedia. Works with experimental manual photo printing, video, photo, and installation. Sasha is a MEPI graduate software developer, as well as a musician and artist specializing in interactive environments and generative art practices. Both have Masters degrees in Digital Art from the Far Eastern Federal University. Winners and laureates of international art awards and festivals, works are in private and public collections such as MMAM and Flux Foundation.

CONTACT

Gray Cake (Alexander Serechenko, Ekaterina Pryanichnikova)

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SPEAKERS

THOMAS ANDRILLON

Paris Brain Institute - thomas.andrillon@icm-institute.org

DAY 1, DECEMBER 11TH – 09:30

PRESENTATION

My research aims at understanding how the activity of our brain (physiology) constrains our ability to interact with the external world (behaviour) and the sustainment of a stream of mental contents (phenomenology). To achieve this goal, I study different physiological, behavioural and mental states: sleep and wakefulness,responsive and non-responsive, dreaming and mind wandering. I use a combination of techniques and approaches to explore the physiology, cognition and consciousness of healthy individuals and clinical populations. I focus in particular on sleep (insomnia, narcolepsy, etc), attention (ADHD), and consciousness disorders with the firm conviction that basic and clinical research can jointly reach a better understanding of the brain and improved clinical care for patients.

ABSTRACT

ORIGINS OF SLEEP INTRUSIONS IN WAKEFULNESS AND THEIR COGNITIVE CONSEQUENCES

Sleep and wakefulness are not mutually exclusive, all-or-nothing phenomena. Rather, both during sleep and wakefulness, regional brain activity can contrast with the global state of an individual. For example, individuals getting tired can show a pattern of brain activity reminiscent of sleep, sleep-like slow waves, while still behaviorally and physiologically awake. These sleep-like slow waves have been paired, in animals, with periods of neuronal silencing, which could explain their association with lapses of attention. These slow waves have also been associated with changes in subjective experience as they predict instances of mind wandering or even mind blanking. Here I will present a set of new studies that sought to better characterize these slow waves in wakefulness and their link with fluctuations of consciousness during the day.

CÉLIA LACAUX

Department of Basic Neurosciences (UNIGE), Campus Biotech - celia.lacaux@unige.ch

DAY 1, DECEMBER 11TH - 10:00

PRESENTATION

Célia Lacaux received her undergraduate degree from Aix-Marseille University/Imperial College London and her master's degrees from Ecole Normale Supérieure/University College London. She then completed a PhD in 2021 at the Paris Brain Institute under the supervision of Dr. Delpine Oudiette and Pr. Isabelle Arnulf. She now has a postdoctoral position in the lab of Pr. Sophie Schwartz in Switzerland. Her research focuses primarily on the impact of sleep on memory and creativity.

ABSTRACT

WAKE UP, SLEEPING MUSE! INVESTIGATION OF SLEEP ONSET AS A COGNITIVE AND NEURAL STATE PROMOTING CREATIVITY

Creativity is a critical skill that is needed more than ever to address pressing societal and environmental challenges. Yet, we have a limited understanding of how creativity operates: new ideas often seem to emerge out of nowhere in "Eureka!" moments. What if we could find a way to summon our creative muse at will? This is the overarching goal of the proposed project. In our previous work, we observed that sleep onset may represent a brain state conducive to problem-solving: it promoted the detection of a hidden solution in the task. Beyond a necessary replication of these promising results, the present project aims to: (i) extend these preliminary results to standardized measures of creativity (vs. problem-solving); (ii) explore the cognitive mechanism subserving these creative bursts; and (iii) elucidate why sleep onset, as a particular cognitive and brain state, might offer a unique, permissive environment for creativity. Overall, this work should help uncover the cognitive and neural factors driving creative inspiration.

GIULIA AVVENUTI

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DAY 1, DECEMBER 11TH - 10:15

PRESENTATION

I graduated in Psychology in 2015 and after the clinical internship I was enrolled in the Cognitive, Computational and Social Neurosciences PhD program in 2016. With the supervision of Professor Giulio Bernardi, during my PhD I developed a research project aimed to investigate the behavioral and cognitive correlates of the local sleep phenomenon. I got my PhD in 2020 and I am currently a Research Collaborator of the SPACE group.

ABSTRACT

LOCAL SLEEP-LIKE ACTIVITY AND EMOTION REGULATION FAILURES

Emotion self-regulation relies both on cognitive and behavioral strategies implemented to modulate the subjective experience and/or the behavioral expression of a given emotion. Although it is known that a network encompassing fronto-cingulate and parietal brain areas is engaged during successful emotion regula- tion, the functional mechanisms underlying failures in emotion suppression (ES) are still unclear. In order to investigate this issue, we analyzed video and high-density EEG recordings of 20 healthy adult participants during an ES and a free expression task performed on two consecutive days. Changes in facial expression during ES, but not free expression, were preceded by local increases in sleep-like activity (1–4 Hz) in brain areas responsible for emotional suppression, including bilateral anterior insula and anterior cingulate cortex, and in right middle/inferior frontal gyrus ($p < .05$, corrected). Moreover, shorter sleep dura- tion the night before the ES experiment correlated with the num- ber of behavioral errors ($p = .03$) and tended to be associated with higher frontal sleep-like activity during ES failures ($p = .09$). These results indicate that local sleep-like activity may represent the cause of ES failures in humans and may offer a functional explanation for previous observations linking lack of sleep, changes in frontal activity, and emotional dysregulation.

KEVIN MAMMERI

Department of Psychiatry, University of Geneva - Kevin.Mammeri@unige.ch

DAY 1, DECEMBER 11TH - 10:30

PRESENTATION

Kevin Mammeri is a dedicated young PhD student who holds a Bachelor's degree in Psychology and a Master's degree in Neurosciences from the University of Geneva. Concurrently, he is in the final stages of completing a Master's degree in Psychology, aligning perfectly with his career aspirations and research interests. His academic journey has been marked by a passionate exploration of the intersection between psychology and neuroscience, with a primary focus on understanding the development of sleep patterns in children and addressing sleep-related issues in adolescents and now in adults.

Kevin's current research, forming the basis of his PhD project, delves into the development and evaluation of a novel nonpharmacological treatment for insomnia disorders. His work embodies a holistic approach to the field of sleep science, aiming to bridge the gap between theoretical knowledge and practical solutions for those struggling with sleep-related challenges.

ABSTRACT

GENDER-SPECIFIC TRENDS IN SLEEP PATTERNS AND MEMORY FUNCTION IN SCHOOL-AGED CHILDREN: INSIGHTS FROM A REAL-LIFE SETTING WITH EEG ANALYSIS

Sleep plays a crucial role in our daily lives, influencing memory consolidation, emotional regulation, and alertness. The complexity of sleep patterns undergoes continuous changes during development and seems to display gender-specific trends. This research explores these dynamics among 61 school-aged children, aged 5 to 11, who participated in memory tasks both before and after a night of polysomnography recording in the comfort of their homes.

Frist, we investigated whether sleep-related parameters influence memory consolidation in children. Our observations revealed that memory performance was exclusively linked to the subjective duration of sleep. Children who had longer sleep durations demonstrated better memory retention of image pairs. However, we did not identify any other significant correlations with sleep macrostructure. Consequently, our study did not provide conclusive evidence to support a specific, memory-enhancing role of sleep in children, leaving the debate open for further exploration.

Next, we explored potential gender differences in sleep parameters during development. Our findings uncovered that, within this age range, sleep stages remained relatively stable for boys. In contrast, girls exhibited significant changes: the proportions of N3 and REM sleep decreased with age, while the proportion of N2 sleep increased. These results suggest that specific pre-pubertal and synaptic pruning mechanisms manifest during childhood, predominantly in girls.

This study sheds light on the intricate interplay between sleep and memory in children, with a particular focus on gender-related differences. It underscores the necessity for ongoing research in this domain.

FRANCESCO PIETROGIACOMI

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DAY 1, DECEMBER 11TH - 11:00

PRESENTATION

I am a second-year PhD student in Neuroscience at IMT School for Advanced Studies in Lucca. I graduated in Cognitive Neurosciences, and I collaborated as an intern in the Sleep Psychophysiology Laboratory in Rome La Sapienza, where I was involved in projects to deepen the role of K-complex in neurodegenerative disorders. Currently, I am part of the ERC project "Tweaking Dreams", in which I am investigating the experience-dependent neural changes of brain activity and its associations with alterations in mental activity during sleep.

ABSTRACT

EXPERIENCE-DEPENDENT MODULATION OF SLEEP-RELATED MENTAL ACTIVITY

Sleep is a locally regulated state in which wake- and sleep-like activity may coexist across distinct brain areas. Indeed, dreams seem to be associated with increased wake-like activity in mental-content-related areas, implying that they may result from 'local brain awakenings'. Moreover, previous work showed that the more a specific brain area is 'used' in the waking period, the deeper sleep will be in that area during subsequent sleep, as reflected in a higher amount of slow wave activity. However, this observation is in apparent contrast with evidence indicating that practicing with particular tasks prior to sleep is associated with a higher likelihood of dreaming about the task, as this would be expected to correspond with higher wake-like activity in task-related regions. To gain further insight into this matter, we developed an experimental protocol combining high-density EEG recordings, standardized tasks, and a serial awakening paradigm. Across four overnight sessions, participants completed an auditory, visual, or tactile version of a 2h-long task or a control condition. Changes in sensory content during sleep and potential local changes in brain activity within sensory areas will be investigated to understand the extent to which experience-dependent neural changes are associated with alterations in sleep mentation.

DEMETRIO GROLLERO

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DAY 1, DECEMBER 11TH - 11:15

PRESENTATION

I am a Ph.D. candidate in Cognitive, Computational, and Social Neuroscience at IMT School of High Studies Lucca. I am fascinated by how our brain implicitly processes both the signals we get from around us and from inside ourselves and how this shapes our actions.My initial studies investigated how the combination of multisensory information builds a sense of ownership over our bodies, testing healthy individuals and clinical populations such as Phantom Limb and post-stroke patients. My present work addresses non-verbal affective communication across different vigilance states. Given the subjective and multifaceted nature of emotions, current research aims to simplify their complex, high-dimensional aspects by identifying essential features that underlie emotions. Within this framework, I conducted three projects exploring the expression and perception of non-verbal affective information across two sensory modalities. The first project explored geometrical features in spontaneous facial expressions among subjects as they reacted to brief, naturalistic videos, employing data-driven machine-learning techniques. Two further projects investigated subjective perception and brain activity in response to affective information encoded in simple human vocalizations across wakefulness and sleep.Alongside my primary research, I have a keen interest in the study of sleep-like slow wave intrusions during wakefulness; hence, I collaborated on a longitudinal project testing morning-to-evening changes in sleep-like activity and assessing their relationship with behavioral performance. Currently, I am visiting the ICM Paris Brain Institute to refine a data-driven approach to explore further the electrophysiology of slow waves and their behavioral correlates in awake subjects.

ABSTRACT

BRAIN REACTIVITY TO NONVERBAL EMOTIONAL VOCALIZATIONS DURING NREM SLEEP

I am a Ph.D. candidate in Cognitive, Computational and Social Neuroscience at IMT School of High Studies Lucca. My current research work focuses on non-verbal affective communication across different vigilance states. Given the subjective and multifaceted nature of emotions, current research aims to simplify their complex high-dimensional aspects into lower-dimensional spaces. In fact, by identifying essential features that underlie emotions, we can facilitate standardized communication and measurement, develop predictive and diagnostic computational tools, and gain insights into the underlying emotional processes.

Within this framework, I conducted three projects exploring the expression and perception of non-verbal affective information across two sensory modalities. The first project examined between-subjects commonalities of spontaneous facial expressions in response to short naturalistic videos using data-driven machine learning applications. Two further projects investigated subjective perception and brain activity in response to affective information encoded in simple human vocalizations across wakefulness and sleep.

Alongside my primary research, I have a keen interest in the study of sleep-like slow waves intrusions during wakefulness; hence, I collaborated on a longitudinal project testing morning-to-evening changes in sleep-like activity and assessing their relationship with behavioral performance. Furthermore, I am currently on a visit to the ICM Paris Brain Institute focusing on the development and testing of a data-driven methodology to further explore the electrophysiology of slow waves and their behavioral correlates in awake subjects.

ALISON MONTAGRIN

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DAY 1, DECEMBER 11TH - 11:30

PRESENTATION

Alison Montagrin is a Research and Teaching Fellow in the Basic Neurosciences department at the University of Geneva in Sophie Schwartz's Laboratory. She studies how the spatial and temporal dimensions of an individual's experiences can be mapped and coded independently in the human brain.

Alison completed her PhD thesis in Psychology with David Sander, a well-known affective scientist. She showed that the importance of an event's relevance to an individual's goals, rather than its inherent emotional valence, is the most important determinant of memory facilitation.

The Swiss National Science Foundation awarded her a postdoctoral fellowship to work with Daniela Schiller at Mount Sinai Hospital in New York. She investigated how mental representations of the past and future can influence decision-making and memory.

She continued her research at Mount Sinai, focusing on the hippocampus's deeper involvement in the temporal aspect of goal-relevant memory, on the premise that its role is not limited to spatial navigation. She has shown that memories of the present and distant times (both past and future) are encoded differently along the hippocampus's anterior-posterior axis.

ABSTRACT

REWRITING THE PAST: RECONSOLIDATION OF EMOTIONAL EPISODIC MEMORIES

Our memory is a living canvas that is constantly being updated with new information. The current studies look into the complex mechanism by which the human brain changes episodic memories upon reactivation. Is our memory malleable enough to be changed by both new emotional and neutral experiences?

We investigate the relationship between emotion and memory updating through a series of experiments. We replicate Hupbach's influential paradigm, demonstrating that neutral memories can integrate new, neutral information upon reactivation (Experiment 1). Further investigation reveals that emotional memories are also malleable, as they can integrate new, non-emotional elements during the reactivation process (as demonstrated in Experiment 2).

However, the process of memory transformation does not happen instantly. Experiment 3 demonstrated a temporal cognitive process in which memories undergo a phase of reconsolidation (i.e., 48 hours) prior to the integration of new information into the existing narrative. Finally, when learned after reactivation, emotional information has no effect on existing emotional episodic memories (Experiment 4) or neutral episodic memories (Experiment 5).

The current studies shed light on the dynamic nature of memory, revealing that our memories are flexible constructs that are constantly reshaped as a result of ongoing experiences.

KINGA IGLOI

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DAY 1, DECEMBER 11TH - 11:45

PRESENTATION

Kinga Igloi is a neuroscience researcher in the field of memory. She earned her Ph.D. at the College de France in Paris, where she conducted groundbreaking research on spatial memory and navigation strategies. Following her doctoral studies, she continued her research at the University of Geneva. Initially, her work centred on the influence of sleep on memory consolidation, with a particular emphasis on demonstrating the selective enhancement of memory for rewarded items. In recent years, her research focus has shifted towards the impact of physical exercise on cognitive functions and memory consolidation. Her current project represents an exciting convergence of these research areas, as it seeks to investigate the effects of rigorous training schedules on the sleep patterns of elite athletes.

ABSTRACT

EXPLORING EXERCISE EFFECTS ON MEMORY AND FUTURE RESEARCH ON ELITE ATHLETES' SLEEP PATTERNS AND COGNITIVE FUNCTIONS

Physical exercise has been demonstrated to enhance memory functions by promoting plasticity in the hippocampus and its surrounding regions, potentially through endocannabinoids. In our pursuit of this phenomenon, we conducted a series of studies involving two distinct groups: healthy young participants and young participants with a genetic predisposition for Alzheimer's disease (AD). The objective was to investigate the impact of a single exercise session on declarative memory.

Our comprehensive findings shed light on the fact that exercise has a significant positive effect on associative memory, a phenomenon closely linked to the activity in the hippocampus and the signalling of endocannabinoids. However, when we focused on participants with a genetic risk for AD, regardless of their exercise regimen, we observed a noticeable decline in their performance in associative memory together with reduced plasticity in medial temporal structures during memory retrieval.

Our current research endeavors involve planning a follow-up study to investigate the impact of training, sleep, and screen usage habits on the mental health and cognitive functions of elite athletes. Despite the rigorous demands of their schedules and the heightened stress levels they experience, there is a scarcity of quantitative data on insomnia symptoms in athletes. To address this knowledge gap, we intend to recruit competitive athletes and collect data concerning their sleep patterns, training routines, and overall mental well-being. Simultaneously, we will monitor their circadian rhythms, while collecting relevant saliva samples to measure biomarkers related to sleep pressure (melatonin) in their home or training environments.

LAMPROS PEROGAMVROS

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DAY 1, DECEMBER 11TH - 14:00

PRESENTATION

Lampros Perogamvros is a psychiatrist, sleep doctor and leader of the group 'Neuropsychiatry of Sleep and Dreams' in the Department of Psychiatry & Department of Basic Neurosciences, University of Geneva. A main goal of his research is to combine basic sleep/neuroscience research with clinical applications, notably for the study and treatment of psychiatric disorders. More specifically, the current projects combine the use of (1) neuroscientific methods, such as high-density electroencephalography, polysomnography and automatic sleep assessment at home, to study specific biomarkers of mental disorders, as well as the neural correlates of dreams, and the efficiency of psychotherapeutic techniques, (2) clinical/interventional approaches, such as imagery rescripting, targeted memory reactivation and rocking bed stimulation, in order to induce positive emotional states and enhance sleep in healthy individuals and psychiatric patients, and (3) the development of new methods for dream content analysis and phenomenology, which take into account cultural relativism, evolutionary aspects, philosophical methods, emotion regulation and personality traits. Such methods will allow a better description of the phenomenological properties and functions of the dreaming experience and of psychiatric symptoms across different individuals and cultures.

ABSTRACT

THE THEATER OF DREAMS

The function of dreams is a longstanding scientific research question. Simulation theories of dream function, which are based on the premise that dreams represent evolutionary past selective pressures and fitness improvement through modified states of consciousness, have yet to be tested in cross-cultural populations that include small-scale forager societies. Here, we analyze dream content with cross-cultural comparisons between the BaYaka (Rep. of Congo) and Hadza (Tanzania) foraging groups and Global North populations, to test the hypothesis that dreams in forager groups serve a more effective emotion regulation function due to their strong social norms and high interpersonal support. Using a linear mixed effects model we analyzed 896 dreams from 234 individuals across these populations, recorded using dream diaries. Dream texts were processed into four psychosocial constructs using the Linguistic Inquiry and Word Count (LIWC-22) dictionary. The BaYaka displayed greater community-oriented dream content. Both the BaYaka and Hadza exhibited heightened threat dream content, while, at the same time, the Hadza demonstrated low negative emotions in their dreams. The Global North Nightmare Disorder group had increased negative emotion content, and the Canadian student sample during the COVID-19 pandemic displayed the highest anxiety dream content. In conclusion, this study supports the notion that dreams in non-clinical populations can effectively regulate emotions by linking potential threats with non-fearful contexts, reducing anxiety and negative emotions through emotional release or catharsis (as in ancient Greek theater). Overall, this work contributes to our understanding of the evolutionary significance of this altered state of consciousness.

VALENTINA ELCE

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DAY 1, DECEMBER 11TH - 14:30

PRESENTATION

I am a PhD Candidate in Cognitive, Computational and Social Neurosciences. I have a background in theoretical and applied linguistics and currently I am working on the building of Somnieve, a multimodal, open-source database collecting dream reports along with demographic information and psychometric, cognitive, and electroencephalographic measures obtained from a representative sample of the healthy Italian adult population. My work is mainly focused on the application of computational linguistics methods for the objective analysis of dream content and on the study of the individual determinants of dream content and dream recall frequency in physiological conditions.

ABSTRACT

THE CARTOGRAPHY OF DREAMS: APPLICATION OF COMPUTATIONAL LINGUISTICS TO THE STUDY OF SLEEP CONSCIOUS EXPERIENCES

The study of dreams represents a crucial intersection between philosophical, psychological, neuroscientific, and clinical interests. Given the high cost of sleep and dream research in terms of human effort and funding, open science will constitute a key for significant advances in the field. Based on these premises, we created Somnieve, a multimodal, open-source database collecting dream reports along with demographic information and psychometric, cognitive, and electroencephalographic measures obtained from a representative sample of the healthy Italian adult population. Here we used Somnieve to investigate the individual determinants of physiologic dream content and recall frequency (DRF). Somnieve currently includes 1324 dream reports obtained from 161 subjects (66M, 18-65y). Participants were asked to wear an actigraph and to record a report of their last dream experience each morning upon awakening for 14 days. Moreover, they completed a battery of questionnaires and cognitive tests. A multiple regression analysis was used to investigate the individual determinants of DRF. To quantify and analyze dream content, we trained an LSTM recurrent neural network on a subset of dreams (n=823), which were scored by 4 raters on 16 semantic dimensions of interest. A cluster analysis was then performed on the whole database and correlations between dream features and individual factors were explored. DRF was predicted by age, attitude toward dreaming, interference control, verbal memory, and mind wandering. The analysis of dream content revealed a correlation between trait anxiety levels and dream emotional valence, in line with evidence indicating a continuity between wake and dream emotions.

BIANCA PEDRESCHI

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DAY 1, DECEMBER 11TH - 14:45

PRESENTATION

I'm Bianca Pedreschi, a Neuropsychology master's graduate from the University of Turin. I'm a Ph.D. student at IMT School for Advanced Studies in Lucca, researching sleep, dreams, and memory.

ABSTRACT

REMEDY: MEMORY REACTIVATION DURING SLEEP AS A TOOL TO MODULATE ONEIRIC EXPERIENCES AND INVESTIGATE THE ROLE OF DREAMS IN MEMORY PROCESSING AND EMOTIONAL REGULATION. STAGE OF WORK: ODORS SELECTION PILOT

This presentation will cover a brief overview of the REMEDY project, focusing on the current stage of work: odors selection through a behavioral pilot and their chemical analysis. The project REMEDY aims to study sleep-dependent information reprocessing and memory consolidation, assessing the potential different roles of NREM, REM sleep, and concurrent conscious experiences (i.e., dreams) in this process. Specifically, the TMR technique with odor stimuli will be used to reactivate previously learned information at various time points, either during REM or NREM, thus allowing us to link the behavioral outcomes to specific reactivation times. We will also evaluate how NREM and REM dream contents recalled after each TMR period relate to specific changes in declarative memory performance and valence ratings of emotional information the following morning. Indeed, we propose to combine an odor-based TMR protocol, a serial awakening paradigm for dream assessment, high-density EEG recordings of brain activity, and behavioral tasks measuring memory and emotional responses to investigate the relationship between memory replay and dream content. Finally, the present project will also investigate whether modulability and functions of dreams differ significantly across NREM and REM dreams.

LAURE COLIN

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DAY 1, DECEMBER 11TH - 15:30

PRESENTATION

After graduating from a life science and humanities bachelor, Laure started in 2022 her master's degree in interdisciplinary Neuroscience. Passioned about human's affective behaviors, she integrated the Sleep and Cognition laboratory of Dr Sophie Schwartz, under Virginie Sterpenich supervision, to deepen her knowledge about emotional processes and the special link they share with sleep. Upon graduation, she desires to pursue a PhD in affective neuroscience to elaborate the strong connections between cognition and emotions, and how they can be used in the clinical field as well as for a better development.

ABSTRACT

ARCHITECTURALLY MODIFIED SLEEP AND EMOTIONAL EPISODIC MEMORY: AN FMRI STUDY

Emotional memory is preferentially consolidated during sleep, and benefits particularly of Rapid-Eye Movement (REM) Sleep in which dreaming occurs. Sleep disturbances induced by external factor or poor sleep quality lead to altered cognitive and emotional processing. The aim of this study was to disrupt sleep organization with 2 different drugs and to test the implication of the modified sleep stages in the consolidation of emotional episodic memory. The SNRI Reboxetine is known to decrease the amount of REM sleep while the GHB's salt Sodium Oxybate (Xyrem) enhances NREM sleep. Nineteen healthy right-handed men (age: 18-30 years old) participated in a memory task using neutral versus emotional pictures with a retrieval test the day after the modified sleep. Each drug was taken by all participants in a randomized, double-blind and placebo-controlled design. Behavioral, fMRI and polysomnography data were collected and analyzed in order to extract information about valence perception, memory performance and sleep modifications. Results show that while Sodium Oxybate impacted both emotion perception and memory acting on several brain regions, Reboxetine only modified memory consolidation during the night.

ALICE CLERGET

UNIGE Department of Psychiatry & Department of Basic Neurosciences - alice.clerget@etu.unige.ch

DAY 1, DECEMBER 11TH - 15:35

PRESENTATION

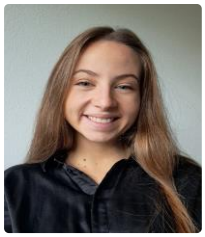
My name is Alice Clerget and I graduated from my master's in Neuroscience last summer. During my studies, I've tried to conjuguate psychology and neuroscience in order to discover more about the human mind and conscisouness. A lot of paths can lead to a better understanding of what consciousness is and among them, dreams and nightmares constitute an under-investigated field of research. For two years now, I work with patients suffering from nightmares, aiming to help them cope better with distressing scenarios they experience while sleeping.

ABSTRACT

ENHANCING IMAGERY REHEARSAL THERAPY FOR IDIOPATHIC NIGHTMARES WITH TARGETED MEMORY REACTIVATION

Nightmare disorder (ND) is characterized by dreams with strong negative emotions occurring during rapid eye movement (REM) sleep. ND is mainly treated by imagery rehearsal therapy (IRT), where the patients are asked to change the negative story line of their nightmare to a more positive one. We here used targeted memory reactivation (TMR) during REM sleep to strengthen IRT-related memories and accelerate remission of ND. Thirty-six patients with ND were asked to perform an initial IRT session and, while they generated a positive outcome of their nightmare, half of the patients were exposed to a sound (TMR group), while no such pairing took place for the other half (control group). During the next 2 weeks, all patients performed IRT every evening at home and were exposed to the sound during REM sleep with a wireless headband, which automatically detected sleep stages. The frequency of nightmares per week at 2 weeks was used as the primary outcome measure. We found that the TMR group had less frequent nightmares and more positive dream emotions than the control group after 2 weeks of IRT and a sustained decrease of nightmares after 3 months. By demonstrating the effectiveness of TMR during sleep to potentiate therapy, these results have clinical implications for the management of ND, with relevance to other psychiatric disorders too. Additionally, these findings show that TMR applied during REM sleep can modulate emotions in dreams.

AUDREY THEUX



UNIGE - audrey.theux@etu.unige.ch

DAY 1, DECEMBER 11TH - 15:40

PRESENTATION

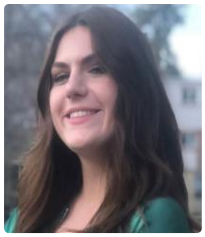
After my secondary school years in the canton of Valais, I went to Fribourg to obtain my Bachelor's degree in Psychology. During these 3 years, I began to develop a deeper interest in clinical psychology and psychotraumatology, which is why I went on to study clinical psychology at the University of Geneva. I joined Sophie Schwartz's team and am currently working alongside Dr Lampros Perogamvros on a study aimed at reducing the impact and the frequency of post-traumatic nightmares.

ABSTRACT

AUGMENTATION OF IMAGERY REHEARSAL THERAPY WITH TARGETED MEMORY REACTIVATION FOR POST-TRAUMATIC STRESS DISORDER

This research is based on a previous study that showed an augmentation in Imagery Rehearsal Therapy (IRT) with Targeted Memory Reactivation (TMR) for idiopathic nightmares. The aim of this new study is to verify whether IRT coupled with TMR can help post-traumatic nightmares. These nightmares are related to a traumatic experience and are affiliated with a disorder known as post-traumatic stress disorder (PTSD), they are known to be very intense and play an important role in maintaining the disorder. We postulate that the therapy coupled with TMR will have a beneficial effect not only on post-traumatic nightmares, but also on the other symptoms that are part of the PTSD.

SASKIA CZURA



University of Geneva, Faculty of Psychology - Saskia.czura@etu.unige.ch

DAY 1, DECEMBER 11TH - 15:45

PRESENTATION

My name is Saskia Czura, and I am a Master's student in Clinical Psychology with a cognitive orientation at the University of Geneva. I earned my bachelor's degree in psychology, with a minor in Japanese, from Colorado State University, where I first developed a passion for clinical psychology. I have recently deepened my understanding of sleep disorders and became particularly interested in the treatment of insomnia disorders throughout this project.

ABSTRACT

IMAGERY RESCRIPTING AND TARGETED MEMORY REACTIVATION IN INSOMNIA DISORDER

The aim of this research is to reduce arousal of the brain during the night and the severity of insomnia disorders through mental imagery rescripting (IR) and targeted memory reactivation (TMR) during sleep. Insomnia is a sleep disturbance that often extends into the day, with an annual prevalence of 10% in the general adult population. Cognitive-behavioral therapy for insomnia (CBT-I) is widely used for treatment, but is ineffective for 30% of patients with insomnia disorders.

We will recruit 90 patients aged 18-60 diagnosed with DSM-5 sleep-maintenance insomnia. Patients with severe psychiatric disorders, significant medical issues, and conditions explaining insomnia will be excluded. Patients will be randomly assigned to four groups.

- IR Group: Weekly in-center sessions for four weeks with home-based daily mental imagery rescripting, using an odor-emitting diffuser during sleep.
- IR + TMR Group: Weekly in-center sessions for four weeks, combining mental imagery rescripting with odor association, and home-based daily sessions with odor-emitting diffuser during sleep.
- SH Group: Weekly in-center sessions for four weeks focused on sleep hygiene education, along with daily use of sleep and dream diaries.
- And fourth group with odor only.

Our primary hypothesis predicts that patients with sleep-maintenance insomnia in the IR Group and IR + TMR Group will have significantly lower insomnia severity compared to the SH group post-treatment. We also anticipate that patients in the IR + TMR Group will have lower ISI scores post-treatment compared to the IR Group without TMR, and three months after treatment.

GIORGIA BONTEMPI

IMT School for Advanced Studies Lucca - giorgia.bontempi@imtlucca.it

DAY 1, DECEMBER 11TH - 15:50

PRESENTATION

After I graduated in Humanities at the University of Milan, I joined the Linguistics Master's degree program at the University of Bologna. During my Master's program, I deepened my interest in the field of Neurolinguistics by carrying out a research internship at the Center for Mind/Brain Sciences (CIMeC) of the University of Trento. Thanks to this experience, I was able to graduate with a thesis for which I carried out a meta-analysis correlating between brain lesions and morphosyntactic impairment in people with aphasia. After my graduation, I joined the II level Master's in Neuroimaging of the University G. d'Annunzio of Chieti-Pescara. Currently, I am a PhD Student in Cognitive, Computational and Social Neurosciences at the IMT School for Advanced Studies in Lucca.

My main research project concerns the analysis of dream content and recall frequency in REM Sleep Behaviour Disorder (RBD) patients, through the collection of oral dream reports. These reports will be analyzed using Natural Language Processing methods to identify specific indices characterizing patients' oneiric experiences, as well as to investigate the possible correlation between these indices and individual symptoms. Finally, I am currently collaborating in the building of Somnieve, a multimodal, open-source database collecting dream reports along with demographic information and psychometric, cognitive, and electroencephalographic measures obtained from a representative sample of the healthy Italian adult population.

ABSTRACT

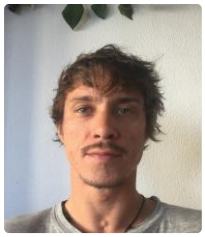
DREAM RECALL AND CONTENT IN RBD PATIENTS

Several studies showed an alteration of dream content in subjects with preclinical stages, such as REM Sleep Behavior Disorder (RBD), and established forms of synucleinopathies, such as Parkinson's Disease, namely an increase in aggressive themes, physical activities, and negative emotions. Moreover, specific alterations in dream content have been correlated with an increased risk of progression toward neurodegeneration. However, literature lacks a univocal picture regarding the effect of these pathologies on dreaming, due to several limitations, such as small sample sizes, the collection of only few reports per participant, and the reliance on arbitrary scales.

Aim of our study is to identify potential differences in dream content and recall frequency between idiopathic RBD, Mild Cognitive Impairment-Alzheimer's Disease patients and healthy control individuals and to investigate possible correlations between neurolinguistic features, clinical profile, and severity of the pathology. Participants will be asked to wear an actigraph for 15 days and to orally recall their dream experiences every morning right after the awakening. At the end of this experimental stage, participants will also undergo a neuropsychological assessment. The reports will be analyzed by means of Natural Language Processing (NLP) tools to identify potential indices characterizing patients' and controls' oneiric experiences, as well as to investigate the possible correlation between these indices and individual symptoms.

Within this presentation, I will discuss the preliminary results of our study. If successful, further protocols on larger populations could be employed to test potential practical applications in clinical settings or population screening.

DAVIDE MARZOLI



IMT School for Advanced Studies Lucca - davide.marzoli@imtlucca.it

DAY 1, DECEMBER 11TH - 16:05

PRESENTATION

I am a PhD student at IMT currently working on the effect of sensory evoked K-Complexes on sleep mentation.

ABSTRACT

CHANGES IN BRAIN ACTIVITY UPON STIMULUS-INDUCED AWAKENING PREDICTS SUBSEQUENT DREAM RECALL.

Upon waking up from sleep, we may recall having had some particular conscious experiences (CE) - ranging from simple thoughts or perceptual snapshots to movie-like narratives -, or no experience at all (NE). Previous work has shown that EEG activity patterns in the few seconds before an alarm-induced awakening can predict whether the sleeper will report a conscious experience or not. Given that the response of the sleeping brain to sensory stimuli may vary according to its ongoing functional state and activity pattern, here we investigated whether the alarm sound used to induce the awakenings could lead to distinct EEG changes depending on whether the sleeper was having a subjective experience or not. Our observations demonstrate that differences in subjective experience before the awakening are associated with specific changes in brain activity following an abrupt, stimulus-induced awakening. These differences may reflect distinct modalities of interaction between arousal-related structures and the cortex depending on whether the sleeper was (or was not) in a state associated with an ongoing subjective conscious experience.

ALEXANDER SERECHENKO

Art-duo Gray Cake - skabbit@gmail.com

DAY 1, DECEMBER 11TH - 17:30

PRESENTATION

Alexander Serechenko is a media artist specializing in technological and scientific fields of art. Graduated from the Moscow Engineering Physics Institute, Faculty of Information Security, and graduate school in the Department of Cryptography. The experience and knowledge gained have become the basis for the opportunity to dive deeply into interdisciplinary projects at the intersection of aesthetics and engineering complexity.

Currently works in various artistic mediums – generative audio/video, web, AR, VR, 3D, AI, etc – taking interactivity as an aesthetical instrument, aleatoric as an unlimited source of inspiration, and social networks as a communication strategy, believing it is a root system of human knowledge. Building and testing different improvisation systems, supposed or not to be interactive with the audience, environment, and social background.

His artistic method is the intersection of the physical and digital worlds. Somewhere on the border of these areas, new meanings and unexpected images arise, which he uses as material for constructing artistic expression.

Artworks were exhibited in the Multimedia Art Museum, Garage Museum of Contemporary Art, Moscow ElectroMuseum, New Tretyakov Gallery, CYLAND, ART4RU, and many others. An active participant in the free jazz scene in Moscow, released on Kotä, TOPOT, Noisy Forecast, and NewNewWorld. A resident of OneBeat Russia, Pro Helvetia, Boiler Room, Red Bull Music, and Embassy of Foreign Artists.

ABSTRACT

ART PROJECT "DREAMS OF THE MACHINE"

As part of the SLEEP AND EMOTION conference, art duo Gray Cake will present the results of their work on the «Dreams of the Machine» project, which was created in 2021 together with a group of scientists from the Sleep and Cognition Neuroimaging Laboratory, University of Geneva https://neurocenter-unige.ch/research-groups/sophie-schwartz/.

Based on research into how memory works and the possibility of reconstructing memories using fMRI, the artists worked on the theme of reconstructing dreams also using fMRI and neural networks. This idea formed the basis of their project, which is currently in the work-in-progress stage.

The work, created in collaboration with scientists, attempts to answer the question: can «strong artificial intelligence» imitate the characteristics of human consciousness? What about the unconscious? What mediums and technologies can artists and scientists use to answer these questions?

Artists present video art created using AI tools. The basis for it was a database of people's dreams recorded in text. The second part of the project is a book. A part of the project based on research in the field of dream reconstruction using fMRI will also be presented.

EKATERINA PRIANICHNIKOVA

Art-duo Gray Cake - pryanikate@gmail.com

DAY 1, DECEMBER 11TH - 17:30

PRESENTATION

Ekaterina Pryanichnikova, 1989. Born in the city of Pushkino, Moscow Region.

Graduated from the Rodchenko Art School and earned a Master's degree in ""Digital Art"" in FEFU.

Focuses on experimental manual printing techniques and unconventional image creation. Uses different materials and tools, combining old media and technologies.

«I like to create an environment, that can be unpredictable, eccentric, extraordinary, exciting. I don't get stuck in one medium of expression, I like bold and unexpected solutions.

She works as a solo artist and also collaborated with Alexander Serechenko. Their duet is called Gray Cake.

Topics are nature, time, death, opposition to humans & machines, and transformation of social roles.

Works are in the collection of MAMM, Mytishchi Art Gallery, and in private collections. She has participated in many group and international exhibitions since 2009. Winner of the competition ""RISE"" in the direction of ""Contemporary Art"". Member of the Creative Union of Artists in the section ""Newest Trends"".

ABSTRACT

ARTISTIC PROJECT "DREAM OF THE MACHINE"

As part of the SLEEP AND EMOTION conference, art duo Gray Cake will present the results of their work on the «Dreams of the Machine» project, which was created in 2021 together with a group of scientists from the Sleep and Cognition Neuroimaging Laboratory, University of Geneva https://neurocenter-unige.ch/research-groups/sophie-schwartz/.

Based on research into how memory works and the possibility of reconstructing memories using fMRI, the artists worked on the theme of reconstructing dreams also using fMRI and neural networks. This idea formed the basis of their project, which is currently in the work-in-progress stage.

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DELPHINE OUDIETTE

Paris Brain Institute - delphine.oudiette@gmail.com

DAY 2, DECEMBER 12TH - 09:30

PRESENTATION

I am a tenured researcher at the Paris Brain Institute (Mov'it/DreamTeam) in Paris.

Does sleep transform the way we think and act while awake? I study how sleep (and associated dreams) impacts major cognitive functions such as memory, creative problem solving, and perception. I am particularly interested in 'hybrid states' mixing features of wakefulness and sleep (e.g. sleep onset period, lucid dreaming), which have long been overlooked. My strategy is to combine behavioral tasks with experience sampling (dream reports), EEG, and innovative approaches in cognitive research (gesture recognition algorithm, graph theory for semantic networks, targeted memory reactivation). I use this approach both in healthy participants and in clinical populations whose unique sleep peculiarities open a window into the sleeping mind: lucid dreamers who can signal in real-time that they are dreaming and sometimes control their dream scenario during rapid-eye-movement (REM) sleep, and sleepwalkers whose overt behaviors allow to visualize ongoing cognitive processes happening during non-REM sleep.

ABSTRACT

ASLEEP AND AWARE? TRANSIENT WINDOWS OF BEHAVIORAL RESPONSIVENESS TO THE EXTERNAL WORLD DURING SLEEP

Sleep has long been considered as a state of behavioral disconnection from the environment, without reactivity to external stimuli. We questioned this 'sleep disconnection' dogma by directly investigating behavioral responsiveness in 49 napping subjects (27 with narcolepsy and 22 healthy volunteers) engaged in a lexical decision task. Participants were instructed to frown or smile depending on the stimulus type. We found accurate behavioral responses, visible via contractions of the corrugator or zygomatic muscles, in most sleep stages in both groups (except slow-wave sleep in healthy volunteers). Across sleep stages, responses occurred more frequently when stimuli were presented during high-cognitive states than during low-cognitive states, as indexed by pre-stimulus EEG. Our findings suggest that transient windows of reactivity to external stimuli exist during bona-fide sleep, even in healthy individuals. Such windows of reactivity could pave the way for real-time communication with sleepers to probe sleep-related mental and cognitive processes.

ADRIANA MICHALAK

IMT School for Advanced Studies Lucca, MoMiLab Research Unit, Lucca, Italy - adriana.michalak@imtlucca.it

DAY 2, DECEMBER 12TH - 10:00

PRESENTATION

I am a cognitive scientist specializing in sleep research since 2014. I earned my BSc in Cognitive Science from the University of Nicolaus Copernicus (Poland) and an MSc in Cognitive Neuroscience from the Centre for Mind and Brain Sciences (CIMeC) at the University of Trento (Italy). During my early career, I completed internships at various sleep laboratories, including those at the University of Salzburg (Austria), the University of Edinburgh (Scotland), and the University of Amsterdam (the Netherlands). My focus during these internships was primarily on sleep-dependent memory consolidation and neural oscillations associated with the processing of emotional and self-relevant auditory stimuli during sleep. In 2022, I obtained my PhD from the Sleep and Brain Research Unit (SBRU) at the University of East Anglia (England). My doctoral research centred on early cognitive, sleep, and circadian markers of Alzheimer's Disease.

Currently, I hold the position of Post-Doctoral Researcher in Dream Engineering at the Sleep, Plasticity, and Conscious Experience (SPACE) group at IMT Lucca (Italy). I am involved in the ERC TweakDreams project, under the mentorship of Prof. Giulio Bernardi. Our research explores the spectrum of conscious experiences during NREM sleep. Starting in September2022, I also serve as an elected member of the European Sleep Research Society (ESRS) Early Career Researcher Network (ECRN), where I hold the role of Sustainability Lead. Beyond my research interests, I have a passion for enjoying food (particularly tacos), in picturesque locations, ideally surrounded by mountains, kind people, and the company of dogs (cats are also welcome).

ABSTRACT

THE SPECTRUM OF CONSCIOUS EXPERIENCES DURING NREM SLEEP: THERE IS MORE THAN WHAT MEETS THE EYE

Upon awaking from sleep, individuals may report having had a conscious experience (CE) or indicating a lack of any subjective experience (NE) during their sleep. In some instances, they may report that they had an experience but are unable to recall its content (CEWR). However, it has been suggested that this three-level classification may fail to capture the full spectrum of conscious experiences that one may have during sleep. For instance, CEWR could result either from forgetting a rich and complex dream (rCEWR) or from an unsuccessful encoding of a simple dream lacking in saliency (sCEWR). Furthermore, NE instances may not necessarily indicate unconsciousness (UNC), as states similar to mind blanking during wakefulness (consciousness without content; CWC) might also occur during sleep. The presented study involved twenty-five healthy adults who underwent four overnight high-density EEG recordings (256 electrodes) in combination with a serial awakening protocol. Awakenings were performed during stable N2 sleep using a loud alarm sound played 4-6 seconds after auditory, tactile, visual, or sham stimulation. Upon awakening, participants were asked a series of pre-recorded questions related to their oneiric experience and subjective sleep depth. The aim of this abstract was to investigate the relative frequency of CE, rCEWR, sCEWR, CWC, and UNC instances during N2 sleep and to explore their relationship with subjective sleep depth.

Acknowledgements: ERC Starting Grant "TweakDreams" #948891

RUGGERO BASANISI

IMT School for Advanced Studies Lucca - ruggero.basanisi@imtlucca.it

DAY 2, DECEMBER 12TH - 10:15

PRESENTATION

Ruggero Basanisi, PhD in computational neuroscience

ABSTRACT

SOURCE RECONSTRUCTION ON A SLEEPING BRAIN

During this presentation, I will show some aspects and tools, and present preliminary results, about source reconstruction on evoked K-complexes.

DAMIANA BERGAMO

IMT School for Advanced Studies - damiana.bergamo@imtlucca.it

DAY 2, DECEMBER 12TH - 10:30

PRESENTATION

I am a psychologist and a PhD student at IMT School for Advanced Studies Lucca. I earned my bachelor's degree in Cognitive Psychology and Psychobiology from the University of Padova in 2016 and subsequently completed my Master's degree in Neuroscience and Neuropsychological Rehabilitation in 2018. During my Master, I spent 5 months of my undergraduate internship at the NAPS lab of Cardiff University, under the supervision of Prof. Penny Lewis, to gather data for my thesis on memory effects of slow-wave closed-loop stimulation, and I immediately got passionate about the field of sleep research. After the Master, I completed my post-graduate internship at the sleep lab of the Psychology Department (University of Padova), supervised by Prof. Nicola Cellini. In 2019 I started my PhD in Cognitive, Computational, and Social Neurosciences (CCSN) at IMT School, with Professors Monica Betta and Giulio Bernardi as supervisors. Here, I'm investigating the electroencephalographic, hemodynamic, and autonomic correlates of sleep slow waves in both adults and children, through combined EEG-fMRI data and other physiological signals.

ABSTRACT

CORTICAL AND SUBCORTICAL HEMODYNAMIC CHANGES ASSOCIATED WITH SLOW WAVE OCCURRENCE

Literature suggests that large and widespread NREM slow waves (0.5-4 Hz) result from the synchronization of subcortical structures with the cortex, while smaller, local slow waves may primarily reflect cortico-cortical synchronization. Among subcortical structures, the thalamus plays a role in regulating slow waves, as shown by evidence in both animals and humans. To better investigate these phenomena, twelve healthy adults participated in two overnight sessions where EEG, fMRI, and photopletismographic signals were simultaneously recorded. Automated algorithms were applied to detect slow waves and spindles in EEG, while pulse wave amplitude drops identified in photopletismographic recordings were used as an index for autonomic activity changes. We used a voxel-wise regression analysis to detect brain hemodynamic changes associated with slow waves and applied a k-means algorithm to thalamic BOLD profiles to explore potential slow wave clusters. Results showed that slow waves were linked to negative BOLD-signal changes in various cortical areas and positive changes in subcortical structures. We identified two slow wave clusters based on thalamic BOLD-signal profiles: Cluster 1 slow waves exhibited an early positive thalamic response, while Cluster 2 slow waves showed a delayed response. Moreover, Cluster 1 slow waves occurred more frequently in isolation, had larger amplitude, and were more frequently associated with autonomic activity variations compared to Cluster 2 waves. This study supports the existence of two distinct synchronization mechanisms for slow waves during NREM sleep, indicating potential differences in regulation, functions, and implications for pathological conditions.

MARZIA DE LUCIA

Lausanne University Hospital and University of Lausanne - marzia.de-lucia@chuv.ch

DAY 2, DECEMBER 12TH - 11:00

PRESENTATION

Marzia De Lucia is a neuroscientist at the Lausanne University Hospital and the University of Lausanne in Switzerland. She studied Physics at the University of La Sapienza in Rome and was a research fellow at the Institute of Cognitive Neuroscience, University College London. After obtaining her PhD in 2004, she worked at the Medical Physics Department, University College London. In 2006, she joined the Center for Biomedical Imaging in Lausanne, Switzerland, and in 2016, she was appointed as a senior scientist and lecturer at the University of Lausanne and the University Hospital. Marzia De Lucia's work focuses on investigating the neural bases of human cognition in altered states of consciousness (coma and sleep) and on developing methods for the analysis of electrophysiological signals in humans.

ABSTRACT

CARDIO-AUDIO AND SENSORY REGULARITY ENCODING IN CONSCIOUS AND UNCONSCIOUS STATES

Electroencephalographic studies in humans have demonstrated the preservation of rudimentary sensory stimulus processing in altered states of consciousness, including sleep and coma. In particular, during the acute coma, patients exhibits the preservation of differential responses to regularly repeated sounds in comparison to infrequent ones. Across different levels of consciousness, the human brain continuously receives inputs from the body, including cardiac stimuli, representing another source of sensory input that may interact with auditory processing. Here we investigate the role of cardiac signals in shaping auditory regularity encoding in healthy awake participants and comatose patients during the first day after cardiac arrest. We administered sounds synchronized with the ongoing heartbeat, interspersed with unexpected sound omissions, while simultaneously recording electroencephalographic and electrocardiographic responses. Comatose patient outcomes were collected at three months, categorized as favorable (N=31) if they survived without major neurological sequelae or unfavorable (N=17).

In both healthy participants and comatose patients with favorable outcomes, a sound omission triggered a deceleration in heart rate and a neural prediction error signal, suggesting the preservation of cardio-audio regularity encoding. Comatose patients with unfavorable outcomes did not exhibit neural or cardiac responses to auditory omissions, suggesting that the extent of preservation of cardiac and auditory integration can serve as a biomarker for coma outcome prognostication. This research complements ongoing studies in healthy individuals during sleep and highlights a general mechanism for enhancing the detection of unexpected stimuli by leveraging the continuously monitored cardiac signals across different levels of consciousness in humans.

ANDRIA PELENTRITOU

University of Lausanne and Lausanne University Hospital - andria.pelentritou@gmail.com

DAY 2, DECEMBER 12TH - 11:30

PRESENTATION

Andria Pelentritou completed her undergraduate and Masters' studies in Natural Sciences at UCL. Her Master's thesis, under the supervision of Professor Neil Burgess, investigated a prediction error hypothesis for the extinction of fear memories. Andria completed her PhD at SUT in Melbourne under Professor David Liley's supervision on a project that investigated the effects of gaseous NMDA-based anaesthesia in healthy participants by acquiring simultaneous MEG and EEG during Xenon and Nitrous Oxide administration and performing sensor and source level imaging. She is currently a post-doctoral researcher in Marzia De Lucia's lab at the University of Lausanne and the University Hospital where she is looking at the role of interoceptive (cardiac) signals on auditory regularity processing using a variety of electrophysiological signals in different consciousness states (wakefulness, sleep and coma).

ABSTRACT

CARDIO-AUDIO REGULARITY PROCESSING IN HUMAN WAKEFULNESS AND SLEEP

Recent work has outlined an important contribution of bodily signals in stimulus processing. Specifically, the comparison of auditory evoked responses occurring in synchrony or asynchrony with the ongoing heartbeat suggests that regularities established across interoceptive and exteroceptive signals can induce temporal prediction of incoming sounds. Here, we investigated whether heartbeat-based auditory regularity processing depends on conscious awareness of stimulus regularity. We acquired electroencephalography and electrocardiography in healthy volunteers (N = 26) during wakefulness and overnight sleep while administering three auditory regularity types interspersed with unexpected sound omissions. In the synchronous sequence, sound onsets were temporally locked to the ongoing heartbeat, in the isochronous sequence, sound-to-sound intervals were fixed, and in the asynchronous sequence there was no specific regularity. We investigated the neural and cardiac correlates of violated auditory prediction in wakefulness and sleep. In healthy volunteers during wakefulness, we observed a neural surprise response to unexpected omissions within the isochronous sequences at 114-159ms and within the synchronous sequences at 113-166ms, following omission onset. During N2 sleep, omissions induced a neural differential response within the isochronous sequences at 83-226ms and within the synchronous sequences at -49-67ms and 272-450ms, indicating temporal prediction via a modulation of background slow oscillations. In healthy volunteers across wakefulness and all sleep stages, cardio-audio regularity encoding was further observed as a heartbeat deceleration upon omissions in the synchronous condition. Our results suggest that the brain integrates cardiac and auditory signals upon encoding regularities, a mechanism aiding the anticipation of changes in the environment, including dangers and threats.

LEILA SALVESEN

IMT School for Advanced Studies Lucca / Donders Institute - leila.salvesen@imtlucca.it

DAY 2, DECEMBER 12TH - 11:45

PRESENTATION

I am a doctoral candidate currently finishing a joint PhD at IMT Lucca and the Donders Institute. As an experimental cognitive neuroscientist working in the field of sleep, I mainly focus on dream engineering and lucid dream induction.

ABSTRACT

Lucid dream induction using wearable EEG and dream engineering toolbox: a multi-center study

Lucid dreaming refers to a state in which individuals become aware that they are dreaming while remaining asleep. Although only about 20% of the general population experiences lucid dreaming regularly (Erlacher et al., 2022), it is a skill that can be learned. In fact, a variety of lucid dream induction techniques have been proposed over the years (Stumbrys et al., 2012; Tan and Fan, 2022). However, previous investigations often lacked physiological measures or restricted participation to experienced lucid dreamers. Moreover, most relied on small sample sizes and lacked reliable replication. To address these limitations, we designed an innovative multi-centre preregistered study across three laboratories (Italy, Canada, and the Netherlands) to include 60 participants overall. Our protocol relies on a combination of sense-initiated lucid dreaming (SSILD; Aspy, 2020) and targeted lucidity reactivation (TLR; Carr et al., 2020) techniques with sensory stimulation to induce lucidity during morning nap sessions. We record and monitor sleep using a wearable EEG system (Zmax) and an open-source dream engineering toolbox (Dreamento). We will present preliminary results for the data collected in Italy and show how such multi-centre efforts may pave the way towards validating effective, robust, and scalable dream engineering methods.

VIRGINIE STERPENICH

Department of Neuroscience, Unige - Virginie.Sterpenich@unige.ch

DAY 2, DECEMBER 12TH - 14:00

PRESENTATION

Virginie Sterpenich is a biologist who completed her studies at the University of Liège in Belgium. She earned her PhD while working in Pierre Maquet's laboratory, focusing on the role of sleep in emotional memory consolidation. Following her doctoral work, she relocated to Geneva, Switzerland, where she embarked on a post-doctoral research position in Sophie Schwartz's lab, concentrating on the regulation of emotions during sleep.

In 2022, she was awarded a Privat-docent at the Faculty of Medicine of the University of Geneva. In addition to her academic achievements, she serves as the manager of Clinical and Sleep Research at Campus Biotech. Her research endeavors revolve around unraveling the brain mechanisms through which sleep reactivates emotional memory traces, employing a combination of EEG and fMRI techniques.

Furthermore, Virginie's interests extend to the study of the quality of sleep in adolescents, a critical developmental period. She conducts classroom-based studies to investigate the impact of screen usage on sleep patterns among adolescents, contributing to our understanding of this vulnerable phase of life.

ABSTRACT

SLEEPING ON REWARDS: EXPLORING MEMORY REACTIVATION IN HEALTHY INDIVIDUALS AND NARCOLEPTIC PATIENTS

This study investigates the role of sleep in reactivating and consolidating memories associated with rewards and punishments, crucial for our daily decision-making and behavior. Sleep is found to prioritize the reactivation of neural patterns linked to rewarded events. This process can be disrupted in individuals with sleep disorders like narcolepsy and neurological conditions such as Parkinson's disease.

we test whether neural representations of rewarded (compared to non-rewarded) events have priority for reactivation during sleep. Using functional MRI and a brain decoding approach, we show that patterns of brain activity observed during waking behavior spontaneously reemerge during slow-wave sleep with a specific focus on patterns associated with rewarded tasks, such as winning a complex game.

Comparing narcoleptic patients, Parkinson's disease patients, and healthy controls in a reinforcement learning task, our study revealed differences in how these groups process rewards and punishments. Healthy controls showed higher sensitivity to positive prediction errors, while narcoleptic and Parkinson's patients were more sensitive to negative prediction errors. Brain activity in regions like the striatum, the anterior cingulage cortex, the amygdala, and anterior insula underlies these differences, suggesting distinct learning profiles among these groups, which may impact their daily functioning and well-being.

In summary, this research unveils a neural mechanism where sleep prioritizes the reactivation and consolidation of memories associated with rewarding life experiences. It also highlights how this process is disrupted in populations with sleep disorders, shedding light on the connection between sleep, the learning of reward.

MAËVA MOYNE

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DAY 2, DECEMBER 12TH - 14:30

PRESENTATION

I studied the perception of emotions in voices during sleep during my Master in Neuroscience at UNIGE in the laboratory of Patrik Vuilleumier. Then I pursued a PhD in Neurosciences with Friedhelm Hummel at EPFL and Sophie Schwartz at UNIGE where I studied sleep and motor learning in older adults and stroke patients.

ABSTRACT

IMPACT OF MOTIVATION AND MOTOR FUNCTION ON SLEEP QUALITY AND MOTOR LEARNING IN POST-STROKE REHABILITATION

Background: Stroke stands as the primary source of adult disability, with predictions suggesting an increase in prevalence alongside rising life expectancies. Recovering stroke patients often encounter psychosocial challenges, including diminished motivation, which may impinge upon their sleep, learning capabilities, and overall rehabilitation process.

Objectives: Our research aims to elucidate the relationships between motivation, motor function, and their combined effect on sleep quality and motor learning in individuals with chronic stroke.

Methods: We conducted a comprehensive evaluation on chronic stroke survivors (post-stroke period exceeding six months), utilizing various assessment tools. These included the Pittsburgh Sleep Quality Index for subjective sleep assessment, the Fugl-Meyer Assessment for motor recovery, and maximal grip force and 9-hole peg tests for muscular strength and dexterity, respectively. Motor learning was gauged through a grip force modulation task. Sleep patterns were monitored using polysomnography to assess sleep architecture during naps. Our analysis encompassed descriptive statistics, frequency distribution, and Pearson correlation assessments to explore the impact of motor impairments and motivation on sleep and learning post-stroke.

Findings: The interplay between sleep quality and motor learning emerges as a pivotal element in stroke rehabilitation strategies. The study sheds light on influential factors, suggesting that a more nuanced approach, integrating psychological considerations, is essential for enhancing the efficacy of rehabilitation programs.

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DAY 2, DECEMBER 12TH - 14:45

PRESENTATION

I am currently a PhD Candidate of IMT School for Advanced Studies of Lucca. I am specifically completing a PhD in Cognitive Neuroscience, focused on analyzing the world of sensory-deprivation from different perspectives. On one side, I am interested in assessing, through innovative methodologies, the connectivity pathways characterizing cross-modal plasticity in humans after early and late sensory- deprivation, mainly in conditions of sight loss. To this regard I am applying a protocol of high-density EEG recording of spontaneous sleep on blind individuals, either in a domestic and sleep-laboratory environment, in order to gain insights about the plastic reorganization of their thalamocortical and cortico-cortical system. On the other side, my investigation is not only centered on the anatomical dimension of plasticity following deprivation, but also on the functional one. Therefore, I am assessing, together with 'University of Milan- La Statale', the cortical excitability of blind individuals using the TMS-EEG technique and together with the 'Center for Sleep and Consciousness' of UW Madison I have performed a study aimed at disentangle the neural substrates of spatial consciousness in the sighted, peripheral and cortical blind population. Coherently with these interests, I am also acquiring qualitative reports from visually-impaired individuals to obtain a systematic depiction of their dream experiences. My general goal is to understand the extremely fascinating neural and phenomenological characterization of sensory-deprivation.

ABSTRACT

UNRAVELING THE SENSORY – DEPRIVED BRAIN THROUGH THE LENS OF SLEEP PATTERNS

Cross-modal plasticity describes brain's adaptability to compensate for early sensory loss through morpho-functional modifications. Since there is still lively debate on the primary driver of these heteromodal changes (whether it is thalamo-cortical and/or cortico-cortical) we approached the question using the properties of the thalamocortical system during sleep to gain insights into experience-dependent plasticity phenomena. Indeed, NREM sleep spontaneous slow waves, SWs and evoked K-complexes are reliable markers of brain local and long-range connectivity, respectively reflected in their synchronization efficiency and cortical propagation. We developed a protocol of domestic high-density EEG recordings of spontaneous sleep of sighted, early blind, and late blind participants with a battery-powered, minimally invasive 64 channel EEG system, provided with peripheral sensors. Practical and theoretical challenges of developing such experimental design will be discussed, together with deepening of profiles of difficulty represented by sleep-scoring data collected from blind individuals. Overnight data recordings preprocessing will be presented. Incoming analyses will examine origin and propagation patterns of spontaneous SWs to assess the potential presence of a notable change in the quantity of SWs emerging from or passing through unimodal, deprived areas. The value of this innovative protocol is to exhaustively assess the physiology of the blind brain while acquiring high-resolution data within a completely ecological sleep environment, proving the benefit of utilizing sleep SWs propagation patterns as an indicator of brain cross-modal plasticity.

LAURA RIONTINO

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DAY 2, DECEMBER 12TH - 15:15

PRESENTATION

Laura Riontino is a senior researcher in the Basic Neuroscience department and a lecturer in the Faculty of Psychology at the University of Geneva. Her research aims at deciphering the cerebral bases of the impact of sleep deprivation on cognition, motivation, metacognition, emotional regulation, and pain judgments. Furthermore, she teaches several courses: Cognitive Neuroscience, Psychophysiology and application in Biofeedback, Multilevel Models.

ABSTRACT

SLEEP DEPRIVATION ALTERS AFFECTIVE AND NEURAL RESPONSES TO EROTIC STIMULI IN HETEROSEXUAL MALES

Sex and sleep represent two fundamental human needs. Recent data have highlighted the impact of sleep loss on reward-related brain functions. In this study, we investigate the interaction between these two essential aspects of human life by exploring the effects of sleep deprivation on behavioural and neural responses to erotic images, something that has never been addressed thus far. Twenty healthy young heterosexual men underwent functional neuroimaging (fMRI) while they were exposed to erotic pictures of women and men (as well as heterosexual couples, and non-erotic pictures) after a night of normal sleep (Baseline, BL) and following 24h of total sleep deprivation (SD). We collected subjective valence/arousal judgments and brain activations elicited by these pictures. We found that SD decreased emotional ratings across all stimuli, with less arousing and more negative subjective experiences. At the neural level, SD led to decreased activity at the level of medial prefrontal cortex, nucleus accumbens, and extrastriate body area. Most critically, by exploiting an independently validated model of brain response to erotic images (BASIC), we found that SD alters neural representation sexual pictures of women (but not men), suggesting a disruption in typical response to preferred stimuli in heterosexual males. Overall, the observed alterations in brain regions involved in reward processing and emotion regulation provide first insights into the complex relationship between sleep, erotic stimuli and cognitive function.

GUILLAUME LEGENDRE

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DAY 2, DECEMBER 12TH - 15:30

PRESENTATION

After successfully defending my thesis under the supervision of Sophie Schwartz at the University of Geneva, I recently joined the SPACE team led by Giulio Bernardi at the IMT School for Advanced Studies in Lucca. My thesis focused on investigating how the brain processes the affective dimensions of stimuli during sleep. In particular, I examined the relationship between typical sleep cerebral activities, such as sleep spindles and slow-waves, and this affective processing.

In general, my research interests revolve around the intricate interplay between cerebral and autonomic activities related to sleep and arousal and their impact on cognition. I employ electroencephalography with dense electrode coverage to explore this relationship and simultaneously record physiological signals such as electrocardiography and breathing pressure.

At the IMT, I am currently studying the intrusion of slow waves into awake cerebral activity and analyzing their effects on cognition. These neural activities are most prominent during sleep and are related to the sensory disconnection we experience. Therefore, my aim is to observe their manifestation during wakefulness in fatigued participants and assess how these slow waves will impact their cognitive performances on perceptual tasks.

ABSTRACT

TARGETED NEURAL FATIGUE APPLIED TO HUMAN PERCEPTION

Sleep slow-waves serve as the primary indicator of sleep depth during non-rapid eye movement sleep and are associated with both impaired sensory processing and sleep restorative processes. In the last two decades, several compelling studies have revealed that slow-waves are local processes, meaning they mostly occur in restricted cortical areas, and are markers of local sleep pressure.

Throughout the day, sleep pressure accumulates in a use-dependent manner, such as when engaging in prolonged activities with high cognitive demands (e.g., extended driving will accumulate sleep pressure predominantly in attentional brain networks), leading to an increased likelihood of slow-wave generation. Consequently, slow-waves can manifest during wakefulness, albeit to a lesser extent, and impact cognition in states of heightened fatigue.

Despite the well-defined nature of slow-waves generation and their impact on cognition, several challenges persist within the scientific framework. Firstly, the extent to which slow-waves can be 'local' remains unclear. Previous experiments examining slow-waves in humans during wakefulness pinpointed them in large executive networks, leaving uncertainty about whether slow-waves can occur in specific perceptual areas, for example.

Secondly, the ability to induce sleep pressure within a limited timeframe, such as an hour, is a subject of ongoing debate. In this context, I will introduce the paradigm of an experiment currently underway at the IMT. The experiment aims to induce slow-waves in awake participants, specifically targeting a perceptual area, within a limited timescale.

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