Postdoctoral Opportunities – EXPERIENCE

CEA NeuroSpin - INSERM Cognitive Neuroimaging Unit
Cognition & Brain Dynamics Lab
Keywords: M/EEG, virtual reality, temporal cognition, multisensory perception, AI, machine learning

Applications are invited for **two full-time post-doctoral cognitive neuroscientists** in the European consortium **"Extended-personal reality: augmented recording and transmission of virtual senses through artificial-intelligence"** (see abstract p.2). **EXPERIENCE** involves eight academic and industrial partners with complementary expertise in artificial intelligence, neuroscience, psychiatry, neuroimaging, MEG/EEG/physiological recording techniques, and virtual-reality. The postdoctoral positions will be fully dedicated to the ***Scientific foundation for the Extended-Personal Reality***, a work package lead by the CEA (Virginie van Wassenhove) in collaboration with Univ. of Pisa (Gaetano Valenza, Mateo Bianchi), Padova (Claudio Gentilli), Roma Tor Vergata (Nicola Toschi) and others…

The candidates will have significant experience using time-resolved neuroimaging techniques (EEG, MEG), a solid research record in cognitive neurosciences, psychology and/or related fields, and some knowledgeable interest in exploring (spatio)temporal cognition in virtual reality. The selected postdoctoral fellows will be located at Neurospin and work collaboratively on two different but complementary lines of research with the experts of the consortium. The postdoctoral fellows will be responsible for the development and transfer of knowledge, will contribute to the validation of novel experimental protocols, their implementation with combined virtual reality and neuroimaging, and state-of-the art analyses approaches. They will benefit from the interdisciplinary collaboration, and will be scientifically central to the advancement of the project. They will be involved in the organizational and managerial aspects of the project, including the supervision of students, the organization of meetings and project reports.

Requirements for the candidates:

- hold a PhD in cognitive neurosciences, neurosciences, psychology, and/or related fields;
- solid record of internationally peer-reviewed scientific work;
- expertise or strong interest in time perception, multisensory perception, temporal and/or spatial cognition;
- solid understanding of statistics or machine learning skills;
- prior experience with EEG or MEG methods ;
- signal processing and programming skills (matlab; python a plus);
- autonomy and capacity to lead one's project independently as well as collaborate with others
- be an overall good lab citizen;
- fluid mastery of both oral and written English

Expected Starting date: TBD [Preferences: Project 1 early 2021; Project 2 late 2021 or 2022]

Salary: commensurate with experience; positions will be funded for up to 3 years.

Application package

- **CV** (incl. a list of publications)
- **A reprint of what you consider to be your best work**
- **A letter of intent with a statement of research interests**
- **Two letters of recommendation** (or contacts from which those could be obtained)

Please specify which the project in the email subject line (e.g. "Experience Project 1") and send your application package to Virginie.van.Wassenhove@gmail.com

European Commission Horizon 2020 - Research and Innovation Framework Programme

[EXPERIENCE]

Extended-Personal Reality: augmented recording and transmission of virtual senses through artificial-intelligence

Social media has transformed the way we communicate through text, images, and videos. Despite recent technological avenues, virtual reality (VR) has not been incorporated in social platforms, hence limiting the comprehensive sharing of an experience. This project makes real the complex interplay between multisensory perception, emotional responses, past experiences, and perspective of the future also by disentangling the mental representation of self in space and time. The new Extended-Personal Reality technological and scientific paradigms will move Europe to the future generation of extended social interactions by allowing the public at large to i) create their own VR environments as they do photos and videos without the need for technical skills, ii) create virtual simulations eliciting unique psychological, cognitive, neurophysiological, and behavioural responses, iii) automatically generate VR environments from neurophysiological data, iv) easily manipulate VR environments to communicate and elicit specific emotions, v) manipulate perceived reality to effectively treat psychiatric disorders. EXPERIENCE embeds advanced artificial intelligence routines merging information from a person's Extended-Personal Reality to inform manipulation tools including neuromodulation, multisensory biofeedback (audio, video, haptics), and subjective perception of time-space. EXPERIENCE will produce extremely realistic reproductions of the user's past and may re-administer it by modulating the associated emotional states on demand. Within a large number of research and innovation avenues, EXPERIENCE will prioritise novel diagnosis and treatment of affective disorders commonly associated with altered multisensory perception like depression, anxiety, and eating disorders. A plethora of innovative technological paradigms including gaming, e-learning, and neuroeconomics will be in the commercial exploitations, including the opening of a new market for actually selling EXPERIENCEs.

Partners:

- Università di Pisa (UNIPI) (COORDINATOR)
- Centre Suisse d´Electronique et de microtechnique (CSEM)
- Università di Roma "Tor Vergata" (UNITOV)
- Comissariat à l´Energie Atomique et Aux Energies Alternatives (CEA) - France
- University of Padua (UNIPD)
- Karolinkska Institutet (KI)
- Quatechnion (QU)

Within the EXPERIENCE consortium, the goal of the scientific foundation for extended-personal reality work package is to investigate the functional correlates of known and novel temporal illusions in perception and cognition. The interferences between time and space, both at low-levels (e.g. kappa effect, temporal dilation; Project 1) and higher levels (e.g. mental distances; Project 2) are of particular interest in this project.

Both projects will use human psychophysics, VR, physiological recordings (EKG, GSR) and time-resolved neuroimaging techniques (MEG, EEG). State-of-the-art statistical techniques will be used to assess oscillatory coupling in brain activity as well as decoding and machine learning techniques.

• Post-Doctoral Project 1 •

Multisensory Illusions of Time Perception in Virtual Reality

Following a thorough literature review on perceptual, cognitive, and neuroimaging findings of temporal distortions in multisensory contexts and evaluating the replicability of selected findings, we will adapt new experimental protocols to auditory, visual, and tactile perception. The elicitation of robust multisensory illusions will capitalize on Bayesian processing of multisensory information. Real-time subjective time distortions affecting individuals' psychometric data will be tested. The calibration of temporal illusions based on perceptual, emotional, physiological and neurophysiological recording will be tested from one person to another using virtual reality (VR). All experimental protocols will be extended and adapted to VR with the use of novel wearable and personable technologies developed within the project.

• Post-Doctoral Project 2 •

Spatiotemporal Interferences in Prospective and Retrospective Experiences of Time

The human spatial navigation system (the so-called 'GPS' of the brain) encompasses hippocampal brain structures and provides a flexible internal mapping of a subject's spatial position with respect to its environmental landmarks. These structures are involved in spatial navigation and episodic memory. However, very little is known regarding how time is perceived during navigation and episodic encoding: are temporal experiences (e.g. order, duration, speed) compressed in memory like any other informational content? Is time lost and reconstructed *a posteriori*? Does this reconstruction also support our experience of time in real-time? We will bring temporal distortions to VR, explore spatio-temporal interferences and see how they affect mental mapping.