



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2019

Turno de acceso general

Nombre: ESTEBAN CORNEJO, IRENE

Referencia: RYC2019-027287-I

Área Temática: Psicología

Correo Electrónico: ireneesteban@ugr.es

Título:

Exercise, cognition and brain throughout the lifespan: from childhood to aging

Resumen de la Memoria:

This candidate got her Bachelor in Physical Activity Sciences and Sport by the Autonomous University of Madrid (Spain), and she is currently studying the Bachelor in Psychology, National Distance Education University, Spain. The beginning of her PhD studies was supported by the Government with a grant from the National Sport Council (2012). In 2013/2014, she obtained different I+D+i contracts research in the Department of Physical Education, Sport and Human Movement in the Autonomous University of Madrid, Spain. Her predoctoral research was focused on examining the influence of lifestyle behaviors and health-related markers on academic and cognitive performance in children and adolescents. In 2013, and later in 2014, she did two predoctoral research stays in the University of California San Diego with James F. Sallis, and in 2014 got her International PhD for the Autonomous University of Madrid, (Spain).

She initiated her postdoctoral training in the Autonomous University of Madrid, Spain (2014-2015). At that time, the candidate expanded her research line from children and adolescents to older adults, and she started to work with aging, mainly involved in the IMPACT65+ project, a cross-sectional study to examine the influence of physical activity and sedentary behaviors on physical and cognitive frailty in older adults.

The applicant continued as Juan de la Cierva-Formación postdoctoral fellow at the University of Granada (2015-2017) and was involved in the ActiveBrains Project, an exercise-based randomized controlled trial to examine the effect of exercise on cognition, brain structure and brain function in overweight preadolescent children. During this postdoctoral period, the candidate expanded her research line from observational to intervention design, as well as from behavioral data to neuroimaging data, which both allows to better understand the interactions between exercise, brain and cognition.

During 2018, Irene Esteban worked as a postdoctoral fellow in the Center for Cognitive and Brain Health at Northeastern University (Boston, USA) under the supervision of Arthur F. Kramer and Charles H. Hillman. During that year, she also spent several weeks working with Kirk I Erickson at the Brain Aging and Cognitive Health lab, University of Pittsburgh (USA). In addition, during her postdoctoral period, Irene Esteban did many short research stays around the world. In 2019, at the University Pittsburgh, USA; in 2016 and later in 2017, at the Monash Institute of Cognitive and Clinical Neuroscience, Australia; in 2015, Research Center in Physical Activity, Health and Leisure, Porto, Portugal, and in 2014, in the WHO Center for Epidemiological Research, Brazil, USA.

Nowadays, Irene Esteban is performing her postdoctoral research (Juan de la Cierva-Incorporación) in the Research Institute of Brain, Mind and Behavior (CIMCYC) at the University of Granada (2019-2020). She recently got a national project as a Principal investigator, AGUEDA project (Active Gains in brain Using Exercise During Aging), funded by the Minister of Economy and Competitiveness (2019-2021, 210000) to start her own research line in the area of exercise neuroscience and aging in the University of Granada.

Resumen del Currículum Vitae:

Irene Esteban Cornejo published more than 70 papers indexed in JCR and she has at the moment more than 15 papers under review. In addition, she published more than 20 papers such as first author in JCR journals. All papers have been published in a relatively short period of five years (2014-2019), which indicates a fruitful scientific production. Even more important than number of publications in a short period of time, is her high personal implication and quality of the papers, being 55% of papers published in journals ranked in the 1st quartile of their field and nearly 85% in either the 1st or 2nd quartile. Additionally, Irene Esteban is first or second author in 80% of these papers published in the 1st quartile. The applicant participated in more than 15 research projects (more than 35 million euros), and currently acts as principal investigator in a recent funded project (AGUEDA project, 210,000). She participated such as speaker in more than 22 international and national congresses. Moreover, she participated in congress, symposium and national and international scientific meetings with more than 100 contributions (communications/posters). She supervised 8 Master's Theses and 1 PhD Thesis already defended, and is currently supervising 3 PhD Theses. She was external project reviewer for International Public Health organizations from Argentina and Switzerland, reviewer of high impact factor JCR journals and advisor of more than 10 national and international Thesis Committees, and she got several national and international research Awards, including the 2014 International Young Investigator Award (Acta Paediatrica, Sweden), the Research Quarterly for Exercise and Sport 2016 Writing Award (Society of Health and Physical Educators, Illinois) or European College of Neuropsychopharmacology 2019 Travel Award (32nd ECNP Congress, Copenhagen). Finally, Irene Esteban disseminated her research in schools, press releases (Reuters, ABC, El Universal, Antena 3, Agencia EF Salud...), radio interviews (Onda



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Cero, Kítaro...) and television interviews (Televisión Internacional NTN24 and Canal Sur). Irene Esteban's articles have had a high impact in the scientific community, as indicated by more than 400 total citations in Web of Science (WOS) and 893 in Google Scholar. The applicant's h-index is 15 and 9 in Google Scholar and WOS, respectively, and a cumulative impact factor higher than 140. More importantly, her Crown indicator or Normalized Impact is of 2.06; a Crown indicator > 1.5 is one of the most relevant criteria for being a guarantor researcher in the programmes for Severo Ochoa Centers of Excellence and María de Maeztu Units of Excellence, one of the axes of the Spanish scientific policy.



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Nombre: KLEBER , BORIS ALEXANDER
Referencia: RYC2019-027548-I
Área Temática: Psicología
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Título:

Predictive coding of vocal motor control, sensory integration, and emotion

Resumen de la Memoria:

Speech and music are some of humanity's most distinctive characteristics. During my PhD at University of Tübingen (Germany) and my post-doc at Montreal Neurological Institute McGill University (Canada), I investigated the speech-sensorimotor network within the context of music production by combining singing tasks with neuroimaging paradigms to reveal the neural basis of vocal motor control, which has since been replicated world-wide. This approach allowed me to answer basic research questions about top-down regulation of complex motor control. Currently, as assistant professor at University of Aarhus in Denmark (Center for Music in the Brain), I develop the predictive coding of music (PCM) model and integrate it with predictive coding models of speech motor learning. Such models propose that perception, action, emotion, and learning involve an integrative, recursive Bayesian process, by which the brain attempts to minimize the prediction error between lower-level sensory input and the brain's top-down predictions. I have furthermore demonstrated that trained singers provide an excellent model for understanding how vocal experience impacts upon the motor control of human vocalizations. This has emerged as a promising field for testing and developing PCM. My results confirm a hierarchically organized brain system, which builds from the basic levels of vocalization in the lower brainstem via emotion and motor centers in the mid-brain, and revealed distinct effects of singing expertise on the mechanisms underlying vocal sensorimotor control and cognitive performance monitoring at the cortical level. For investigating the speech-sensorimotor system with singing, I received the International Klein-Vogelbach Prize for research on human motor control (2018) and a higher doctorate degree (Habilitation) from the University of Tübingen (2016). My goal is to develop a comprehensive integrative model of the predictive coding of music and speech motor learning, encompassing both sensory feedback integration and emotion processes, thereby benefitting basic science, patients with voice disorders, and people who use their voices professionally, such as teachers.

Resumen del Currículum Vitae:

Speech and music are some of humanity's most distinctive characteristics. During my PhD in Psychology/Neuroscience at University of Tübingen (Germany, with Prof. Niels Birbaumer) and my post-doc at Montreal Neurological Institute McGill University (Canada, with Prof. Robert Zatorre), I investigated the speech-sensorimotor network within the context of music production by combining singing tasks with neuroimaging paradigms to reveal the neural basis of vocal motor control, which has since been replicated world-wide. This approach allowed me to answer basic research questions about top-down regulation of complex motor control. Currently, as assistant professor at University of Aarhus in Denmark (Center for Music in the Brain, with Prof. Peter Vuust), I develop the predictive coding of music (PCM) model and integrate it with predictive coding models of speech motor learning. Such models propose that perception, action, emotion, and learning is an integrative, recursive Bayesian process, by which the brain attempts to minimize the prediction error between lower-level sensory input and the brain's top-down predictions. I have furthermore demonstrated that trained singers provide an excellent model for understanding how vocal experience impacts upon the motor control of human vocalizations. This has emerged as a promising field for testing and developing PCM. My results confirm a hierarchically organized brain system, which builds from the basic levels of vocalization in the lower brainstem via emotion and motor centers in the mid-brain, and revealed distinct effects of singing expertise on the mechanisms underlying vocal sensorimotor control and cognitive performance monitoring at the cortical level. For investigating the speech-sensorimotor system with singing, I received the prestigious International Klein-Vogelbach Prize for research on human motor control (2018) and earned a higher doctorate degree (Habilitation) in Psychology from the University of Tübingen in 2016. My goal is to develop a comprehensive integrative model of the predictive coding of music and speech motor learning, encompassing both sensory feedback integration and emotion processes, thereby benefitting basic science, patients with voice disorders, and people who use their voices professionally, such as teachers.



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Nombre: RUZZOLI , MANUELA
Referencia: RYC2019-027538-I
Área Temática: Psicología
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Título:

Proactive self-regulation of cognition based on real-time brain-computer interface (BCI)

Resumen de la Memoria:

I am an Experimental Psychologist employed as a Marie Skłodowska-Curie postdoctoral fellow at the Institute of Neuroscience and Psychology, at the University of Glasgow (UK).

My main contributions are in the cognitive sciences (perception, visuo-spatial attention and cognitive control) with a focus on the physiological correlates of behaviour. My methodological expertise lies in combining behavioural measures (psychophysics and neuropsychology) with non-invasive brain stimulation (mainly Transcranial Magnetic Stimulation - TMS), electroencephalogram - EEG (both evoked and spontaneous electrical activity), and, more recently, through closed-loop brain-computer interface (BCI).

During my PhD, I worked with TMS: a way to test causality in the brain to understand cognition better, and ultimately to augment cognition. However, TMS is artificial and might activate larger interconnected areas than needed. Instead, what if we could stimulate the brain by its own activity, capitalising on optimal brain states and aiming for self-regulation of cognition? This is my actual research direction. To reach it, I am working on two research lines: The first tries to identify patterns of brain states reliably predictive of behaviour (and the related endogenous or exogenous influencing factors). This line of research can be dated back to the 60s when the oscillatory activity in the alpha band (8-13 Hz), before stimulus appearance, was suggested to gate information into perception. It is still attractive because it opens to the possibility of influencing behaviour proactively, by leverage optimal brain states, which is the second line of research I am currently exploring.

In the future, I would like to extend these lines of research and focus on reading-out brain state in real-time to generate proactive systems for self-regulation of cognition to be used in rehabilitation and educational programs, or occupational safety and health. Indeed, in contrast to the standard procedure, which relies on post-collection data analyses and tests cognition retrospectively, in real-time testing, the perspective is reversed. Knowing and monitoring one (or more) neural expression(s) of a cognitive function, critical brain states (and our knowledge about them) continuously affect the flow of the experiment, which in turn will affect brain responses (self-regulation). Proactive closed-loop systems can also be used to bring neuroscience outside the laboratory and to advance neuro-technology, a desirable outcome of basic research and a point of connection with the industrial sector, to widen opportunities for students and funding.

Resumen del Currículum Vitae:

I have developed my career working in distinguished Universities in Italy (University of Padua and Verona), Australia (University of Sydney), Germany (Heinrich-Heine-Universität), and Spain (University Pompeu Fabra). Last year, I joined the University of Glasgow, running a Marie Skłodowska-Curie funded project (still active) on the interplay between real-time controlled brain oscillations, attention and cognitive conflict. My main contributions are in the cognitive sciences (perception, visuo-spatial attention and cognitive control) with a focus on the physiological correlates of behaviour. My methodological expertise lies in combining behavioural measures (psychophysics and neuropsychology) with non-invasive brain stimulation (mainly Transcranial Magnetic Stimulation - TMS), electroencephalogram - EEG (both evoked and spontaneous electrical activity), and, more recently, through closed-loop brain-computer interface (BCI).

I have always been committed to a high level of internationally recognised research (h-index = 11; N. citations 670, according to Scopus). I find my productivity considerable (18 peer-reviewed articles and 2 book chapters). In my works, I have mostly taken a leading position covering all aspects of research (which predominantly counts of original experimental works, including more than one experiment). Leading research means to be successful in grant applications (8 grants or personal fellowships as Principal Investigator, totalling 720.000 €), to design and code the experiments, to collect and analyse the data, to write the final reports, as well as to supervise and mentor students, who have collaborated along the process. Being the leader of my research also speaks in favour of my management skills, including budget formulation and administration, goals setting and time scheduling, risks analysis and data management.

I am decidedly committed to open & reproducible science. Since 2017, all my works follow a pre-registration procedure before data collection (either in the Open Science Framework or submitted as registered reports).

Besides my research, I have also developed a considerable teaching experience delivering core lectures, tutorials and hand-on about Cognitive Psychology, Experimental Research Methods, and Neuroimaging Techniques, including EEG and TMS. My responsibilities also covered students' evaluation in their final grade or final thesis. Mentoring is a task I particularly enjoy. I have advised (or co-advised) several students in their bachelor or master's final projects and I have closely supported various PhD dissertations in my previous positions.

I take over Editorial and Revision duties, I was responsible for the management of the TMS-lab and in the organization of international seminars at the CBC in Barcelona, and I participated in several activities of science dissemination.

In sum, the different indexes of my CV speak in favour of scientific productivity, the capability to attract resources, and engagement to all



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aspects of research activities.



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Nombre: RICHTER , CRAIG GEOFFREY
Referencia: RYC2019-026638-I
Área Temática: Psicología
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Título:

Hierarchical oscillatory cortical networks: invasive and non-invasive investigations during health and dysfunction

Resumen de la Memoria:

My research focus deals broadly with the acquisition of knowledge at a neural network level, and how this knowledge is deployed in a task-specific manner in real-time. The mechanistic underpinning that I pursue is based on cortical oscillations, which appear to 1) bind distributed cortical areas together into task-specific information processing systems, 2) control the direction of information transfer across neurocognitive networks, 3) allow bidirectional information transfer via multiplexing of information across different oscillatory frequencies, and 4) delineate endogenous (internally generated) and exogenous (environmentally driven) information sources via differential processing streams, at different frequencies.

I study these processes using both invasive imaging in monkeys, and non-invasive electroencephalography (EEG) and magnetoencephalography (MEG) in humans with a focus on developing experimental hypotheses and new methodological tools to assist in my investigations, making significant contributions to and establishing collaborations with leaders in the field. My experimental focus attempts to capture the embodiment of knowledge in large-scale neural networks, and the deployment of this knowledge in a task-specific manner. Example top-down phenomena that I study include predictive processing, selective attention and statistical learning. Using a framework developed to identify and characterize large-scale hierarchical oscillatory networks, I track the targeted transfer of endogenous information (knowledge) from higher-level cortical structures and how these influences impact the function of areas lower in the sensory hierarchy that are largely driven by exogenous environmental input. I further characterize the nature of this interaction, and relate this interface to behavioural metrics. More recently, I ve been focusing on linking this research to language processing disorders such as dyslexia with the goal of motivating new theories and therapies for language disorders.

Thus far, my research activities have spanned over 6 countries at internationally renowned institutions, which have fostered numerous international collaborations with world leading academics, and provided enriching and fruitful opportunities to mentor developing researchers.

Resumen del Currículum Vitae:

Dr. Richter has had a very international career completing his undergraduate degree in psychology and neuroscience in his native Canada, and then receiving his Ph.D. from the Center for Complex Systems and Brain Sciences at Florida Atlantic University in the United States. In Europe, he has worked at elite institutions as a postdoctoral scientist, such as the Ernst Strüngmann Institute, a division of Germany's Max Planck Institute; The École Normale Supérieure, in Paris; and the Basque Center on Cognition, Brain and Language (BCBL) in Donostia, Spain.

Dr. Richter's research investigates the interface between the cognitive process of top-down control, and the neurophysiological mechanisms of oscillatory phase synchronization. Top-down control refers to the critical capacity of the brain to anticipate, predict, and deploy attention in an adaptive fashion to appropriate stimuli. Thus, Dr. Richter's work has focused on the processes of anticipation/prediction and attention in the visual domain. To investigate these processes, he has contributed to and built on emerging evidence that specific brain oscillations play distinct roles in prediction and attention. In recent work ("Top-down beta enhances bottom-up gamma", JNS), he has shown that beta oscillations convey top-down control during attention, while gamma oscillations convey stimulus information in a bottom-up fashion.

Most critically, this analysis revealed that these oscillations interact, supporting the conceptual framework that beta-frequency synchronization provides a substrate for the control of the propagation of incoming sensory information. Dr. Richter's current work investigates how cortical oscillations, specifically low-frequency oscillations, convey top-down contextual information during the encoding and maintenance of spatiotemporal predictions. Methodologically, his work seeks to develop new statistical methods to assess the interactions of cortical areas, and to use these methods to advance our understanding of attention and prediction. He has developed methods and new theoretical advances using data from non-human primates in addition to studies with humans using magnetoencephalography (MEG). His current work at the BCBL seeks to extend methodology used in non-human primates to non-invasive MEG imaging techniques opening new opportunities to conduct more statistically powerful studies on higher-level cortical processes only accessible in humans.



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Throughout his career, Dr. Richter has been developing his leadership skills, beginning with the mentorship of predoctoral researchers at the Center for Complex Systems and Brain Sciences. At present, he is supervising Master's student Magda Altman, and mentoring Sanjeev Nara and Piermatteo Morucci in their doctoral pursuits at the BCBL.

He maintains collaborations with leading researchers at universities in the USA, Europe, and with the Hebrew University in Israel. The latter has been supported by a scholarship that allowed him to join the lab of Dr. Ayelet Landau in Israel for 3 months in 2017. He is now participating in a second collaboration with the Hebrew University and the BCBL, applying his methodological expertise to the study of statistical learning. Dr. Richter recently received funding as a principal investigator at the BCBL. He was awarded over 90,000 euros over 2 years from the Ministerio de Ciencia e Innovación.