RESEARCH LINES

Master's Program in Behavior and Cognition

Faculty of Psychology

University of Barcelona

Stimuli Representations in Perceptual Learning Process

Antonio A. Artigas

Summary

William James in The Principles of Psychology (1890) pp. 509-10: "That practice makes perfect is notorious in the field of motor accomplishments. But motor accomplishments depend in part on sensory discrimination. Billiard-playing, rifle- shooting, tight-rope-dancing, demand the most delicate appreciation of minute disparities of sensation...The fact is so familiar that few, if any, psychologists have even recognized it as needing explanation. They have seemed to think that practice must, in the nature of things, improve the delicacy of discernment..." Actually, we refer to this sensory process as Perceptual Learning (see Mitchell & Hall, 2014, for a review).

Any two stimuli can be conceptualized as AX and BX, where A and B are the unique elements that would help discrimination, and X are the common elements that contribute to the ambiguity between them. Our research systematically asses the role played by both elements (unique and common) in the Perceptual Learning phenomena. To do so we will use a range of laboratory techniques: flavour aversion conditioning, sodium depletion, and Pavlovian appetitive conditioning using rats; and auditive discriminations in human participants.

Keywords: perceptual learning; stimulus representation; salience modulation.

Selected publications:

Artigas, A. A., & Prados, J. (2014) Percpetual learning tranfer: salience of the common element as factor contributing to the intermixed/blocked effect. Journal experimental of psychology: Animal learning and cognition, 40(4), 419-424.

Mitchell, C., & Hall, G. (2014). Can theories of animal discrimination explain perceptual learning in humans? Psychological Bulletin, 140, 283–307.

Mondragon, E. & Murphy, R. A. (2010). Perceptual learning in an appetitive Pavlovian procedure: Analysis of the effectiveness of the common element. Behavioural Processes, 83, 247-256.

Violence Risk Assessment and Prediction

Antonio Andrés-Pueyo (GEAV)

Summary

The recent advances in the psychological assessment techniques applied to the practice of criminology and criminal psychology have developed new and succeful techniques for violence risk assessment. First developed in the context of forensic psychiatry have become essential to the professional task in numerous people who work in legal and criminal law enforcement services or social and health services to prevent violence. Our research group, between criminology and psychology, the GEAV (www.ub.edu/geav) has specialized in the development and adaptation of risk assessment protocols to the spanish countries leading to violence. The GEAV has been adapted the HCR-20, SVR-20 and SARA RSVP and has also created new protocols, as the RVD-BCN and ETAPA (among others) for application in professional contexts. At present we are working with new protocols to assess the risk of harassment of women and violence against parents. These protocols allow assessing the risk of sexual violence, against women, against parents and that violence caused by people with serious criminal records or mental disorders. Our work is done in collaboration with various community services (correctional services, NGOs, police, penal, psychiatric hospitals, etc ..) that allow our research is conducted to address real problems of the first order. We also have a laboratory for the development of the experimental and quantitative studies (simulation) related to the technical problem of violence risk assessment.

Keywords: Violence risk assessment. Criminal recidivism. Actuarial vs. Clinical prediction.

Selected publications:

Pérez Ramírez, M., Redondo Illescas, S., Martínez García, M., García-Forero, C., & Pueyo, A. A. (2009). Assessing risk of recidivism in sex offenders. Psychology in Spain, (13), 55–61.

Gallardo-Pujol, D., Andrés-Pueyo, A., & Maydeu-Olivares, A. (2013). MAOA genotype, social exclusion and aggression: an experimental test of a gene--environment interaction. Genes, Brain and Behavior, 12(1), 140–145.

Arbach-Lucioni, K., Andrés-Pueyo, A., Pomarol-Clotet, E., & Gomar-Soñes, J. (2011). Predicting violence in psychiatric inpatients: a prospective study with the HCR-20 violence risk assessment scheme. Journal of Forensic Psychiatry & Psychology, 22(2), 203–222. http://doi.org/10.1080/14789949.2010.530290

Álvarez, M., Andrés-Pueyo, A., Augé, M., Choy, A., Fernández, R., Foulon, H., ... Serratusell, L. (2011). The RVD-BCN. Risk Assessment guida for violence against women perpetrated by their partner or former partner.

Arbach-Lucioni, Karin, Marian Martinez-García, and Antonio Andrés-Pueyo. "Risk Factors for Violent Behavior in Prison Inmates A Cross-Cultural Contribution." Criminal Justice and Behavior 39.9 (2012): 1219-1239.

Martínez, Víctor Company, and Antonio Andrés-Pueyo. "The Spanish version of the Criminal Sentiment Scale Modified (CSS-M): Factor structure, reliability, and validity." The European Journal of Psychology Applied to Legal Context 7.2 (2015): 67-72.

A.P.A.L. Group (Attention, Perception and Acquisition of Language)

Laura Bosch

Ferran Pons

Summary

Our research is focused on the study of infant speech perception abilities, attention development and early language acquisition processes, both in normally developing infants (monolingual and bilingual) and in infants at risk for language and neurocognitive disorders. Our methodological approach is mainly behavioural, with procedures that rely on attention, visual fixation and orientation latency measures. Classical habituation and familiarization-preference paradigms in infancy research are used, with settings that rely on video (offline coding) and eye-tracking recordings. Measures from standardized infant developmental scales and parental reports on expressive and receptive language and social behaviour are also used as tools in our research. Current research also involves EEG/ERP methodologies in very young infants to explore early speech segmentation abilities and phonetic discrimination (work in collaboration with Dr. C. François). Early language differentiation and native language recognition abilities, multimodal speech perception, phonetic categorization of native and non-native speech sounds, the beginnings of word segmentation, phonological encoding, word recognition and word learning processes are ongoing areas of research in our infant Lab (UB - Hospital Sant Joan de Déu).

Keywords: infant speech, perception, attention

Selected publications:

Pons, F., Bosch, L., & Lewkowicz, D. J. (2015). Bilingualism Modulates Infants' Selective Attention to the Mouth of a Talking Face. Psychological science, 0956797614568320.

Bosch, L., & Ramon-Casas, M. (2014). First translation equivalents in bilingual toddlers' expressive vocabulary Does form similarity matter? International Journal of Behavioral Development, 38(4), 317-322.

Skoruppa, K., Pons, F., Bosch, L., Christophe, A., Cabrol, D., & Peperkamp, S. (2013). The development of word stress processing in French and Spanish infants. Language Learning and Development, 9(1), 88-104.

Lewkowicz, D. J., & Pons, F. (2013). Recognition of amodal language identity emerges in infancy. International journal of behavioral development, 37(2), 90-94.

Bosch, L. (2011). Precursors to language in preterm infants: speech perception abilities in the first year of life. Progress in brain research, 189, 239-257.

Trying to Understand the Differential Use of Spatial Information in Male and Female Rats of Different Age, Juveniles and Adults

Victoria D. Chamizo

Summary

There is good evidence that male and female rats often rely on different cues to solve spatial problems. Males tend to use geometric information while females use more visual features or landmarks. The same claim has been made in the human literature, while using a variety of tasks. Are there specific conditions or requirements that determine this differential use of spatial information in males and females? Recent research shows that this seems to be the case (Torres et al., 2014, Chamizo et al., 2014). However, the initial claims are not confirmed with younger female rats (Rodríguez et al., 2013). Why is this?

Moreover, when male and female rats are reared under either enriched (environmental enrichment in combination with physical exercise) or control conditions, the beneficial effects of such an early stimulation, tested when adults, does not seem to affect the rats' performance in a qualitative way, only quantitatively (Chamizo et al., submitted), even though these beneficial effects are subsequently detected in both their cerebral cortex and hippocampus (Mármol et al., in press).

Keywords: spatial learning; sex; environmental enrichment

Selected publications:

Chamizo, V.D., Rodríguez, C.A., Torres, I., Torres, M.N., & Mackintosh, N.J. (2014). What makes a landmark effective?: Sex differences in a navigation task. *Learning and Behavior*, *42*, 348–356.

Chamizo, V.D., Rodríguez, C.A., Sánchez, J., & Mármol, F. (submitted). Environmental Enrichment and Physical Exercise in Rats when Solving a Navigation Task: the Role of Sex Differences.

Mármol, F., Rodríguez, C.A., Sánchez, J., & Chamizo, V.D. (in press). Anti-oxidative effects produced by environmental enrichment in hippocampal and cerebral cortex of male and female rats. *Brain Research*.

Rodríguez, Clara A., Chamizo, V.D., & Mackintosh, N.J. (2013) Do hormonal changes that appear at the onset of puberty determine the strategies used by female rats when solving a navigation task? *Hormones and Behavior*, *64*, 122-135.

Torres, M.N., Rodríguez, C.A., Chamizo, V.D., & Mackintosh, N.J. (2014). Landmark vs. geometry learning: Explaining female rasts' selective preference for a landmark. *Psicológica*, 35, 81-100.

Cognition, Welfare and Conservation

Montse Colell
Mercedes Mayo
Nereida Bueno

Summary

The aims of this group are:

1. Researching on behaviour, physical/social cognition and dental morphology in different species, from human and non-human primates to other mammals (ex. giraffes), birds (ex. parrots and ravens) and reptiles (ex. Komodo Dragon). We keep an evolutionary and comparative perspective.
2. Applying the resulting knowledge from our experiments to improve animal welfare and favor the development of conservation strategies in situ and ex situ as well as to improve the quality of relationships among children at schools.

The research of the group cover: self-recognition and self-consciousness; social difussion of information and imitation capacity; evolution of morality, justice, reciprocity and revenge; social behaviour; causality; hand laterality; behavioural rehabilitation; welfare and tooth wear. Research is conducted thanks to established agreements among the Faculty of Psychology of the University of Barcelona and several different institutions such as: Zoo of Barcelona, Psittacus Catalònia, Max-Planck Institut for Evolutionary Anthropology (MPI-EVA) and the Wolfgang Köhler Primate Research Center. (WKPRC). Our studies are done within the facilities of the institutions mentioned above as well as in other collaborator institutions: schools and high schools around Catalunya, Rainfer (Madrid), Zoo of Accra (Ghana).

Which research do we offer for eligible students this year?
1. Two stays at the MPI-EVA and WKPRC. Eligible candidates may contribute to classify and catalogue experimental set-up for great apes and/or designing and running experiments about morality and reciprocity with great apes.
2. Some stays at the zoo of Barcelona. Eligible candidates may contribute to run experiments about physical/social cognition and innovation with mammals. Moreover, the students may conduct studies about the impact of public on the primate welfare.
3. Some stays at schools/high schools of Catalunya. Eligible candidates may explore the morality and cross-cultural differences in children literature by testing children and teachers. This study is to be done also in Germany, Italy and China.
4. Some stays at Psittacus Catalònia. Eligible candidates may contribute to run experiments about physical/social cognition and innovation with different species of parrots.

Keywords: comparative ethology, primatology, physical cognition, laterality, social cognition, self-recognition, imitation, tool use, reciprocity, morality, justice, revenge, post-conflict behaviour, animal welfare, enrichment, conservation, dental ecology, diet, great apes, comparative studies, *Psittacus erythacus, Cercocebus, Pan, Gorilla, Pongo, Homo sapiens*

Selected publications:

Galbany J, Romero A, Mayo-Alesón M, Itsoma F, Gamarra B, Pérez-Pérez A, Willaume E, Kappeler PM & Charpentier MJE (2014) Age-Related Tooth Wear Differs between Forest and Savanna Primates. PLoS ONE 9(4):e94938.

Llorente, M., Riba, D., Palou, L., Carrasco, L., Mosquera, M., Colell, M., Feliu, O. (2011). Population-level right handedness for a coordinated bimanual task in naturalistic housed chimpanzees: replication and extension in 114 animals from Zambia and Spain. American Journal of Primatology, 73, 281-290.

Carrasco, L., Colell, M., Calvo, M., Abelló, M.T., Velasco, M., Posada, S. (2009). Benefits of training/playing therapy in a group of captive Lowland Gorillas (Gorilla gorilla gorilla). Animal Welfare, 18 (1), 9-19.

Carrasco, L., Posada, S., Colell, M.(2009). New evidence on imitation in an encultured chimpanzee (Pan troglodytes). Journal of Comparative Psychology, 123(4), 385-390.

Executive Functions / Language Learning and Processing

Toni Cunillera

Summary

My main area of interest is cognitive neuroscience. More specifically, I work on two main topics, a) executive functions and, b) language learning and processing.

A. Executive Functions

1. *Inhibitory function*: I investigate how and when the cognitive brain is able to inhibit an action or how it reacts to withhold/withdraw a preponderant response. For this purpose, I use the approach of transcranial Direct Current Stimulation (tDCS), a well-known neuromodulatory technique, together with EEG/ERP methodologies, to see the effects of the engagement of certain brain networks on behavior. There is an applied part of this research focused on how the inhibitory function is altered in eating disorders.

2. *Negative bias*: The negative bias phenomenon refers to the notion of how unpleasant thoughts, emotions, and any action carrying a negative consequence have a greater effect on psychological state and processes than do actions carrying a neutral or positive consequence. Using ERPs, we are studying how decision-making is affected by negative bias while performing a gambling task.

B. Language Learning and Processing

3. *Statistical Language Learning*: I study the neural based and cognitive mechanisms recruited to success in the initial stages of learning a second language during the adulthood. My research is focused in the mechanism known as Statistical Learning. I have investigated different but related learning situations in which statistical learning can explain how we successfully learn the regularities embedded in the speech signal.

4. *Metaphors in Language*: Another research topic of my research is devoted to the investigation of linguistic metaphors and how they are processed in the brain.

Keywords: Executive Functions. Response inhibition. Negative Bias. Statistical learning.

Selected publications:

Cunillera T, Brignani D, Cucurell D, Fuentemilla L, Miniussi C. (2015). The right inferior frontal cortex in response inhibition: A tDCS-ERP co-registration study. Neuroimage, *in press*.

Cunillera T, Càmara E, Toro JM, Marco-Pallares J, Sebastián-Galles N, Ortiz H, Pujol J, Rodríguez-Fornells A. (2009). Time course and functional neuroanatomy of speech segmentation in adults. Neuroimage, 48, 541-553.

Marco-Pallarés J, Cucurell D, Cunillera T, García R, Andrés-Pueyo A, Münte TF, Rodríguez-Fornells A. (2008). Human oscillatory activity associated to reward processing in a gambling task. Neuropsychologia, 46, 241-248.

Brain Mechanisms of Language Learning

Ruth de Diego Balaguer

Summary

Language is the most amazing skill that humans possess. It allows social interaction, can make us cry, laugh and transmit our most complex thoughts. Comprehending the cognitive processes involved in language learning is of critical importance for our understanding of why under certain conditions language learning is impaired. Language learning research has often offered explanations bounded within the language domain, ignoring the importance of other cognitive functions. Our group uses an integrative approach at the edge of different research fields combining information from brain-damaged patients and imaging in healthy individuals to understand the neural and cognitive mechanisms engaged since the earliest stages of contact with a new language. We are particularly interested in (1) the role of the attentional system in the acquisition of different aspects of language; (2) the role of the striatum as a brain structure that could make the interface between language and other cognitive functions necessary in the learning process; (3) how is the acquired information consolidated and modified by additional new information.

Keywords: Language, Attention, Learning, Event-related potentials, Magnetic resonance, Neuropsychology

Selected publications:

López-Barroso D., Ripollés P., Marco-Pallarés J., Mohammadi B., Münte T., Bachoud-Lévi AC. Rodriguez-Fornells A., de Diego-Balaguer R. (2015). Multiple brain nerworks underpinning word learning from fluent speech revealed by independent component analysis. Neuroimage, 110: 182-193

López-Barroso, D., Catani, M., Ripollés, P., Dell'Acqua, F., Rodríguez-Fornells, A., De Diego-Balaguer, R. (2013). Word learning is mediated by the left arcuate fasciculus. Proceedings of the National Academy of Sciences, 110(32):13168-73

López-Barroso D., De Diego-Balaguer R., Cunillera T., Camara E., Münte T.F., Rodríguez-Fornells A. (2011) Language Learning under Working Memory Constraints Correlates with Microstructural Differences in the Ventral Language Pathway. Cerebral Cortex, 21(12): 2742-2750.

De Diego-Balaguer R., Fuentemilla L., Rodríguez-Fornells A. (2011) Brain dynamics sustaining rapid rule-extraction from speech. Journal of Cognitive Neuroscience. 23(10): 3105-20.

De Diego-Balaguer R., Couette M., Dolbeau G., Dürr A., Youssov K., Bachoud-Lévi A.-C. (2008) Striatal Degeneration impairs Language Learning: Evidence from Huntington's Disease. Brain, 131 (11), 2870-2881.

Contextualising Psychosocial Wellbeing and Mental Health within Sociocultural Dynamics

Francisco Jose Eiroá Orosa

Summary

The lack of contextualization of the science and applications of mental health and psychosocial interventions is the source of a large part of their criticisms. The fixation on experimental methodologies (such as clinical trials) to prove its efficacy, and the exportation of working methods manufactured in Western upper middle class contexts to developing countries and socially excluded populations, are some of the limitations of the body research in these disciplines.

Both social and cultural decontextualisation of mental health and psychosocial interventions currently contribute to the gap between research and practice. From the lack of research on how social dynamics influence the well-being and mental health of citizens, or the lack of clearly defined public mental health policies at the European level, to the gaps in research and implementation of coordination among different disciplines, there are many constraints which now surround the implementation of these interventions.

The objective of this project is to map and offer a bottom-up, source-embedded appreciation of the need to always seek to contextualise mental health and psychosocial interventions and the professional and institutional barriers to this process at the European level, using participatory action research methods with practitioners and users of psychological services as well as civil society groups. This will allow us to have an ecological approach while ensuring direct dissemination of the results. The project will be implemented integrating a website and a mobile application with face to face interviews, focus groups and continuing professional development workshops.

Selected publications:

Rodriguez-Urrutia, A., Eiroa-Orosa, F. J., Accarino, A., Malagelada, C., & Azpiroz, F. (2016). Incongruence between Clinicians' Assessment and Self-Reported Functioning Is Related to Psychopathology among Patients Diagnosed with Gastrointestinal Disorders. *Psychotherapy and Psychosomatics*, *85*(4), 244–245. http://doi.org/10.1159/000443899

Navarro Lashayas, M. A., & Eiroa-Orosa, F. J. (2016). Stressful life events, substance use and psychological distress is related with accommodation status among homeless immigrants: a convergent mixed methods exploration. *American Journal of Orthopsychiatry*.

Eiroa-Orosa, F. J., Rodriguez-Urrutia, A., Accarino, A., Santamarina-Perez, P., Parramon, G., & Azpiroz, F. (2015). An exploratory study comparing psychological profiles and its congruence with clinical performance among patients with functional or motility digestive disorders. *Journal of Health Psychology*. http://doi.org/10.1177/1359105315581069

Heim, D., & On behalf of 96 co-signatories. (2014). Addiction: Not just brain malfunction. *Nature*, *507*(7490), 40. http://doi.org/10.1038/507040e

Eiroa-Orosa, F. J. (2013). Psychosocial wellbeing in the Central and Eastern European transition: An overview and systematic bibliographic review. *International Journal of Psychology*, *48*(4), 481–491. http://doi.org/10.1080/00207594.2012.669481

Eiroa-Orosa, F. J. (2013). [Sociocultural change and psychosocial well-being: a proposal for research and action] Cambio sociocultural y bienestar psicosocial: una propuesta para la investigación y la acción. *Psicología Política, 47*, 39–53.

Brainlab – Cognitive Neuroscience Research Group (SGR2014-177)

Principal Investigator: Carles Escera

Other staff: Raffaele Cacciaglia, Jordi Costa-Faidella, Katarzyna Zarnowiec, Natàlia Gorina

Summary

The Brainlab is a small, multinational, interdisciplinary group, including psychologists, biologists, engineers, and physicists, that seeks to unravel the neural mechanisms of cognitive functions, including attention, auditory perception, and executive control. Also, we are interested in emotional and musical processing, and in cognitive dysfunction in a broad spectrum of neurological, neurodevelopment and psychiatric disorders. Our current projects address the specific mechanisms by which the auditory system can extract regularities from the ongoing acoustic background, to derive perceptual auditory objects, such in language and music. The work in the lab is carried out by recording the human electroencephalogram (EEG) to analyze evoked and event-related brain potentials (such as the complex Auditory Brainstem Response –cABR, the Middle Latency Response –MLR, or the Mismatch Negativity –MMN) and oscillatory brain activity (such as the gamma band response –GBR). Occasionally, we run magnetoencephalographic (MEG), functional magnetic resonance imaging (fMRI) and neurogenetic experiments. For example, our recent work has shown that temporal predictability enhances repetition suppression in the auditory system (Costa-Faidella et al., 2011) and that the human auditory brainstem implements predictive coding, suppressing responses to predictive (repetitive) stimuli, yielding prediction error signals to stimuli not conforming with such predictions (Slabu et al., 2012). We offer several positions to carry out the practicum/TFM in our lab. The work includes running a specific experiment within our research line, analyzing the data and writing a report (TFM) that eventually may lead to a scientific publication.

Keywords: Repetition suppression, predictive perception, auditory evoked potentials, brain waves and cognition

Selected publications:

Costa-Faidella, J., Baldeweg, T., Grimm, S., & Escera, C. (2011). Interactions between "what" and "when" in the auditory system: temporal predictability enhances repetition suppression. Journal of Neuroscience, 31, 18590-18597.

Slabu, L., Grimm, S., & Escera, C. (2012). Novelty detection in the human auditory brainstem. Journal of Neuroscience, 34, 1447-1452.

Escera, C. & Malmierca, M.S. (2014). The auditory novelty system: An attempt to integrate human and animal research. Psychophysiology, 51, 111-123.

Recasens, M., Leung, S., Grimm, S., Nowak, R., Escera, C. (2015). Repetition suppression and repetition enhancement underlie auditory memory-trace formation in the human brain: an MEG study. Neuroimage, 108, 75-86.

Cacciaglia, R., Escera, C., Slabu, L.S., Grimm, S., Sanjuán, N., Ventura-Campos, A., Ávila, C. (2015). Subcortical detection of auditory regularity violations in humans: direct evidence from functional magnetic resonance imaging. Neuropsychologia, 68, 51-58.

Construing Self and Others: Interventions in Clinical and Health Psychology

Guillem Feixas

Summary

Our research group (SGR2014-717) is aimed at advancing the knowledge in the areas of personality and psychotherapy. We pay particular attention to the study of identity processes, cognitive conflicts, and their role in the change process. To this aim, personal construct and self-regulation theories (both based on constructivist epistemology) have been important sources of inspiration, for both research and practice.

Our work is conducted using methods derived from these approaches, such as textual analysis and the Repertory Grid Technique (RGT), with which we can identify conflicts in the cognitive structure of interviewees. These conflicts (or dilemmas) often become a hindrance for the progress either in personal development or in psychotherapy. With these methods we have studied the cognitive structures of people of different conditions (e.g., depression, eating disorders, fibromyalgia, victims of partner violence) and compared them to community and student samples. We have also created some therapy manuals for innovative interventions targeting identity processes and cognitive conflicts, and tested their efficacy and utility in randomized clinical trials. We have adapted and validated instruments for the assessment of the outcome of psychological interventions which can now be used by other researchers and practitioners (e.g., www.ub.edu/terdep/core). Currently, we are conducting a trial comparing the efficacy of systematic case formulation based in personal construct therapy with formulations based in cognitive behavioral therapy for the improvement of depressive symptoms of patients with fibromyalgia.

Keywords: Personality psychology, constructivism, psychotherapy and counseling, cognitive therapy, systemic therapy, cognitive conflict, self and identity, depression.

Selected publications:

Feixas, G., et al. (2014). Cognitive conflicts in major depression: Between desired change and personal coherence. *British Journal of Clinical Psychology, 53*, 369-385. doi: 10.1111/bjc.12050

Montesano, A., López-González, M. A., Saúl, L. A., & Feixas, G. (2015). A review of cognitive conflicts research: A meta-analytic study of prevalence and relation to symptoms. *Neuropsychiatric Disease and Treatment, 11*, 2997-3006.

Trujillo, A., Feixas, G., et al. (2016). Psychometric properties of the Spanish version of the CORE-OM: Clinical Outcomes in Routine Evaluation-Outcome Measure. *Neuropsychiatric Disease and Treatment, 12*, 1457–66. doi: 10.2147/NDT.S103079

Feixas, G. et al. (2016). Dilemma-focused intervention for depression: A multicenter randomized controlled trial with 3-month follow-up. *Depression and Anxiety*. Early view. DOI: 10.1002/da.22510.

Feixas, G., & Compañ, V. (2016). Dilemma-focused intervention for unipolar depression: a treatment manual. *BMC Psychiatry, 16*: 235. DOI 10.1186/s12888-016-0947-x

Dynamics of Memory Formation

Lluís Fuentemilla

Summary

How do we form lasting memories of our everyday experiences? We want to understand how experiences are initially encoded, undergo further consolidation and are later retrieved. We use behavioural (including Eye movements), psychophysiological (Skin Conductance) and neural (fMRI, EEG, iEEG) measures to help us learn more about the cognitive and neural operations that contribute to episodic memory. We further extend our investigation to neurological patients, in special those with lesions in medial temporal lobe regions.

In concrete, current topics of interest, and examples of related projects, include:

>1) Brain mechanisms of how discrete episodic memories are formed

>2) Brain mechanisms of how prior knowledge influences the formation of new memories

>3) How memory reactivation supports memory formation and memory retrieval

>4) The study of memory processes for autobiographical events collected individually through portable cameras

Keywords: memory, hippocampus, EEG, neural oscillations

Selected publications:

Fuentemilla L, Miró J, Falip M, Ripollés P, Juncadella M, Castañer S, Rodríguez-Fornells A (2013). Hippocampus-dependent strengthening of targeted memories via reactivation during sleep in humans. Current Biology 23:1769-75

Jafarpour, A., Fuentemilla, L., Horner, A., Penny, W.D., Düzel, E. (2014). Replay of very early encoding representations during recollection. The Journal of Neuroscience. 1:242-8

Packard PA, Rodríguez-Fornells A, Stein LM, Nicolás B, Fuentemilla L (2014).Tracking explicit and implicit long-lasting traces of fearful memories in humans. Neurobiol Learn Mem. 116:96-104

Fuentemilla L, Penny WD, Bunzeck N, Cashdollar N, Düzel E (2010). Theta coupled periodic replay in working memory. Current Biology 20:606-612.

Person-Environment transactions and Individual Differences

David Gallardo-Pujol

Summary

Why we behave in a certain way or another? It is an axiom in behavioral sciences that behavior is a function of personal characteristics and the environment [B=f(P,E)]. However, little research has been conducted taking into account both elements of the equation for over hundred years. We aim to understand how individual differences operate and cause behavior depending on specific contexts. To this end, we conduct different experiments and collect data at multiple levels (genes, brain function, individual differences in personality and cognitive abilites, social and cultural). We combine these data with the latest analytic approaches within the framework of person-environment transactions. This academic year we are specifically interested in 1) how personality characteristcs and values are geolocated across the Iberian peninsula; 2) what are the differences in brain structure between enterpreneurs and non-enterpreneurs according to psychometric differences; and 3) how situations are differentially perceived across cultures.

Keywords: Personality, Individual Differences, Culture, Brain Structure, Geolocation, Structural Equation Models, Person-Environment Transactions.

Selected publications:

Guillaume, E., Baranski, E., Todd, E., Bastian, B., Bronin, I., Ivanova, C., Cheng, J.T., de Kock, F.S., Denissen, J.J.A., Gallardo-Pujol, D., Halama, Pl, Han, G.Q., Bae, J., Moon, J., Hong, R.Y., Hřebíčková, M., Graf, S., Izdebski, P., Lundmann, L., Penke, L., Perugini, M., Costantini, G., Rauthmann, J., Ziegler, M., Realo, A., Elme, L., Sato, T., Kawamoto, S., Szarota, P., Tracy, J.L., van Aken, M.A.G., Yang, Y., & Funder, D.C. (2015, May 7th). The world at 7: Comparing the experience of situations across 20 countries. Journal of Personality. DOI: 10.1111/jopy.12176

Rauthman, J.F.; Gallardo-Pujol, D.; Guillaume, E.M.; Todd, E.; Nave, C.; Sherman, R.A.; Ziegler, M.; Jones, A.B. & Funder, D.C. (2014). The Situational Eight DIAMONDS: A taxonomy of major dimensions of situation characteristics. Journal of Personality and Social Psychology, 107(4), 677-718.

Gallardo-Pujol, D.; Maydeu-Olivares, A.; & Andrés-Pueyo (2013). An experimental test of a gene-environment interaction: MAOA genotype, social exclusion and aggression. Genes, Brain & Behavior. 12(1);140-145. DOI: 10.1111/j.1601-183X.2012.00868.x

Pascual, L.; Rodrigues, P.; & Gallardo-Pujol, D. (2013). How does morality work in the brain? A structural perspective of moral behavior. Frontiers in Integrative Neuroscience, 7;65. DOI: 10.3389/fnint.2013.00065

Perceptual, decisional and motor processes

in complex environment

Joan López-Moliner

Summary

An ubiquitous process in human daily-life behaviour is deciding between competing actions within complex and rich environments. First, optimal decisional processes depend on people representing different states of the world accurately and reliably. By means of tools rooted in the Statistical Decision Theory, we analyse how human encode different states and whether this encoding is optimal, that is, minimizes the uncertainty. Second, the range of sensory stimulation out there often exceeds by far the operating range of our senses. The nature's solution to overcome this limitation is adaptation to the changing conditions of stimulation. This allows people to operate optimally across many different sensory conditions. We then study the underlying processes of adaptation in sensory and sensorimotor domains. Third, our actions have consequences on the states of the world. The brain predicts these consequences (forward models) and these predictions can be integrated with the actual sensory feedback to improve the precision with which we perceive the consequences of our actions on the world. We then study how humans combine these predictions with the incoming feedback in the control of our actions. Finally, these action consequences have an associated gain (or reward) or cost. We are interested in the processes that lead to optimal actions or decisions (i.e. maximize expected gain), mainly in changing environmental conditions. We use different methodologies to tackle these problems including psychophysics, modelling, virtual reality, motion tracking and neuroimage.

Keywords: perception and action; sensory prediction; adaptation; uncertainty & decision making

Selected publications:

de la Malla, C., and López-Moliner, J. (2015). Predictive plus online visual information optimizes temporal precision in interception, Journal of Experimental Psychology: HPP. DOI: 10.1037/xhp0000075

Cameron, B. D., de la Malla, C., and López-Moliner, J. (2015). Why do movements drift in the dark? Passive versus active mechanisms of error accumulation, Journal of Neurophysiology, DOI: 10.1152/jn.00032.2015.

de la Malla, C., López-Moliner, J., and Brenner, E. (2014). Dealing with delays does not transfer across sensorimotor tasks. Journal of Vision, 14(12).

Tubau, E., Hommel, B., and López-Moliner, J. (2007). Modes of executive control in sequence learning: from stimulus-based to plan-based control. Journal of Experimental Psychology: General, 136:43–63.

Single-case designs data analysis

Rumen Manolov

Summary

The research line is focused on testing, comparing, and proposing analytical techniques for data obtained through single-case experimental designs. Several aspects define this field of research. First, due to the longitudinal nature of the data and the usual shortness of the data series classical statistical procedures cannot be employed. Second, applied researchers using single-case designs (e.g., behavioral interventions in special education, developmental disabilities) have commonly relied only on visual analysis, not using statistical tools. Third, the amount of data features that can be modeled (initial level, change in level, baseline trend, change in trend, autocorrelation, variation across the cases within a study) has triggered a myriad of proposals. One of the challenges of the field that we are trying to tackle are: to bring the statistical proposals closer to applied researchers, by identifying easily understood, but statistically sound procedures and developing software implementations. Other challenges include the continuous development and testing of already existing or newly proposed analytical techniques, as well as summarizing the evidence on their performance. For that purpose, the research can be formalized in different kinds of papers: proposals, illustrations with published behavioral data, tests via Monte Carlo simulation, discussions. Despite the fact that single-case data analysis is currently a very active field, there is still skepticism directed toward the capacity of these design structures to provide solid basis for the interventions studied. Therefore, another challenge is to convince the scientific and professional community of the goodness of the method.

Keywords: single-case designs; effect size, trend, autocorrelation

Selected publications:

Manolov, R., Gast, D. L., Perdices, M., & Evans, J. J. (2014). Single-case experimental designs: Reflections on conduct and analysis. *Neuropsychological Rehabilitation, 24*, 634-660.

Manolov, R., Jamieson, M., Evans, J. J., & Sierra, V. (2015, July 5). Probability and visual aids for assessing intervention effectiveness in single-case designs: A field test. *Behavior Modification*. Advance online publication. doi: 10.1177/0145445515593512

Manolov, R., & Solanas, A. (2012). Assigning and combining probabilities in single-case studies. *Psychological Methods, 17*, 495-509.

Manolov, R., & Solanas, A. (2013). A comparison of mean phase difference and generalized least squares for analyzing single-case data. *Journal of School Psychology, 51*, 201-215.

Learning from Reward

Josep Marco-Pallarés

Summary

Learning, Reward and Executive Functions

In our everyday live we adapt our behavior on the bases of the results of our actions. Therefore, we repeat those actions that have yielded to a positive outcome or a reward and avoid those actions that lead to negative consequences or punishments. In this research line we are interested in understanding the neural mechanisms underlying these processes. In concrete, we are interested in how the brain is computing the difference between real and expected outcomes (the prediction error) and how this computation is used to change the behavior. We are especially interested in brain oscillatory activity, which seems to play a key role in all these processes. Using different gambling and learning paradigms we aim to understand the role of these oscillatory components in those situations involving learning from external feedback.

Individual Differences in Music Reward

Music has been present in all human cultures since prehistory, although it is not associated with any apparent biological advantages (such as food, sex, etc.) or utility value (such as money). However the exact mechanisms explaining why we do like music are still unknown. In this line of research we are interested in the individual differences associated to music reward. In concrete, we are interested in a condition called "music specific anhedonia" which describes people who do not find music pleasurable, but have interest in other forms of reward (food, sex, money, exercise).

Keywords: reward, music, executive functions,oscillatory activity, EEG, fMRI

Selected publications:

Mas-Herrero, E., Zatorre, R,J., Rodríguez-Fornells, A., Marco-Pallarés, J. (2014). Dissociation between musical and monetary reward responses in specific musical anhedonia. Current Biology. 24:699-704

Alicart H, Cucurell D, Mas-Herrero E, Marco-Pallarés J. in press. Human oscillatory activity in near-miss events. Social Cognitive and Affective Neuroscience. 2015 Mar 25. pii: nsv033. [Epub ahead of print]

Marco-Pallarés J, Münte TF, Rodríguez-Fornells A. (2015). The role of high-frequency oscillatory activity in reward processing and learning. Neuroscience and Biobehavioral Reviews. 49:1-7.

Structural Equation Modeling

Alberto Maydeu

Summary

Alberto Maydeu's research interest focus on structural equation modeling and item response theory (IRT), and more generally in developing new quantitative methods. His latest research has focused on developing goodness of fit statistics, and on IRT methods for forced-choice items.

Keywords: structural equation modeling, quantitative methods, item response theory

Selected publications:

Maydeu-Olivares, A. (in press). Assessing the size of model misfit in structural equation models. Psychometrika.

Steenkamp, J.B.E.M., & Maydeu-Olivares, A. (2015). Stability and change in consumer traits: evidence from a twelve-year longitudinal study, 2002-2013. Journal of Marketing Research, 52, 287-308.

Maydeu-Olivares, A. & Liu, Y. (2015). Item diagnostics in multivariate discrete data. Psychological Methods, 20, 276-292.

Brown, A. & Maydeu-Olivares, A. (2013). How IRT can solve problems of ipsative data in forced-choice questionnaires. Psychological Methods, 18, 36-52.

Developmental victimology: polyvictimization, psychopathology and resilience

Noemí Pereda

Summary

The master student will be working in the Research Group on Child and Adolescent Victimization (GReVIA). The GReVIA is a research group focused particularly on child and adolescent victimization. The experience of multiple victimization events in childhood has been associated with severe emotional and behavioral problems as well as has important effects on adaptation and social integration. The study of polyvictimization has been largely neglected until recently. A primary goal of this line of research is to analyze the psychological effects of multiple victimization experiences in adolescence and to detect protective factors configuring resilience in at risk children. Its ultimate aim is to contribute towards an increasing knowledge on violence against children and promoting research on this area. We are also interested in the role of positive individual, family and social resources in the psychological functioning of child victims. The group is involved in several national and international projects focusing on the study of developmental victimology, psychopathology and resilience factors in children and adolescents. The candidate must have a degree in psychology or criminology. A background in child and adolescent studies is desirable. Accredited expertise in advanced statistical analysis related to social sciences is required. Self-motivation, independence and flexible working attitude are positively evaluated. See: www.ub.edu/grevia

Keywords: developmental victimology; victimization; polyvictimization; developmental psychopathology; resilience

Selected publications:

Álvarez, S., Pereda, N., Guilera, G., & Abad, J. (2014). Polyvictimization and its relationship to symptoms of psychopathology in a southern European sample of adolescent outpatients. Child Abuse & Neglect, 38, 747-756.

Guilera, G., Pereda, N., Paños, A., & Abad, J. (2015). Assessing resilience in adolescence: The Spanish adaptation of the Adolescent Resilience Questionnaire. Health and Quality of Life Outcomes, 13 (1), 1-9.

Pereda, N., Abad, J., & Guilera, G. (2014). Victimisation et poly-victimisation dans un échantillon d'adolescents espagnols patients ambulatoires. Criminologie, 47 (1), 167-186.

Pereda, N., Guilera, G., & Abad, J. (2014). Victimization and polyvictimization of Spanish children and youth: Results from a community sample. Child Abuse & Neglect, 38, 640-649.

Pereda, N. y Tamarit, J.M. (2013). Victimología teórica y aplicada. Barcelona: Huygens. ISBN: 978-84-15663-25-6.

Medición y valoración del estrés y la capacidad de adaptación a la cautividad en grandes simios y primates en general

Carles-Enric Riba Campos

Summary

Este proyecto está financiado por BSMSA, sociedad municipal que alberga al Zoo de Barcelona. Se enmarca dentro de los estudios de "bienestar animal" (wellbeing) promocionados por este mismo zoo, en el seno de EAZA, la European Association of Zoos and Aquaria, que promueve amplios programas cuyo fin es la conservación de especies en peligro de extinción.

https://www.fundaciobarcelonazoo.cat/index.php?id=2979&no_cache=1&L=0

El modelo de análisis que se utiliza se basa en la relación entre cortisol, conducta y comunicación vocal. El cortisol es una hormona suprarrenal que constituye un indicador fisiológico del constructo del estrés, aunque también puede informar sobre el grado de arousal o de excitación en distintos contextos sociales.

En nuestro enfoque el cortisol de extrae de heces secas, lo que permite relacionar el nivel hallado con los acontecimientos ocurridos entre 24 y 48 horas antes, pero no con los acontecimientos del mismo día. Los valores de cortisol se relacionan estadísticamente con los datos conductuales recogidos mediante observación sincronizada con el registro de la hormona, sobre la base del etograma de género (en grandes simios, Gorilla, Pan o Pongo) y, principalmente, sobre categorías de interacción que, a su vez, pueden informar sobre el grado de salud fisiológica y psicológica del grupo.

Desde 2013 hasta hoy el modelo se ha aplicado a gorilas, aunque pronto se aplicará a orangutanes. En gorilas el modelo parece discriminar adecuadamente, en términos de bienestar, los diferentes grupos estudiados en el zoo de Barcelona y en otros zoos de España y del extranjero, en función de variables como su composición y la estructura de roles, permitiendo una buena aproximación a la evaluación del bienestar de dichos grupos. El diseño actual de este proyecto fue aplicado a partir de septiembre de 2013, por lo que aún no ha dado lugar a publicaciones significativas.

Keywords: Primate wellbeing, cortisol, primate behavior, primate captivity, primate conservation.

Selected publications:

Martín, M.; Riba, C.; Abelló, M. T.; López-Béjar, M. (en preparación). Relation between Social Grouping and Cortisol in Captive Lowland Gorillas (Gorilla Gorilla Gorilla)

Riba, C.; Martin, M.; López-Béjar. M.; Abelló, M. T. (2015). Elaboración de un instrumento de evaluación del bienestar de gorilas en cautividad. Documento interno, Zoo de Barcelona.

Riba, C.; Martin, M.; López-Béjar. M.; Abelló, M. T. (2015).Gorilla Welfare Indicators. Póster presentado al Midyear Meeting Gorilla, Europäische Erhaltungszuchtprogramme, Leipzig, 2015

Tallo-Parra O.1, Albanell E.1, Carbajal A.1, Monclús L.1, Sabes-Alsina M.1, Riba C. 2, Martin M. 2, Abello M.T.3, Lopez-Bejar M.1 (2015). Prediction of faecal cortisol metabolites from western lowland gorilla (Gorilla gorilla gorilla) by near infrared reflectance spectroscopy (NIRS). 5th ISWE Conference (International Society of Wildlife Endocrinology. 12th - 14th October 2015 - Berlin, Germany.

Cognition and Brain Plasticity

Antoni Rodríguez-Fornells

Summary

A. Language learning and acquisition in adults and neonates: neurophysiological evidences. We investigate two important processes in word-learning: speech segmentation and contextual learning of the meaning of new words (Mestres-Misse et al., 2007). The most innovative aspect of our research was that we used ERPs to map "on-line" the learning process as it was occurring. Currently, we have been recording EEG in 2-day infants to better understand the learning mechanisms in place in neonates for language learning.

B. Language learning and acquisition in aphasic patients. As a result of the current collaboration with Dr. M. Laine and Dr. N. Martin), we began a research program trying to investigate preserved language learning abilities in aphasic patients.

C. Music processing, reward and learning as neurorehabilitation tools. During the last years we conducted innovative research on neurorehabilitation in chronic stroke patients with motor problems using a new music learning paradigm (Music-Supported Therapy) (in collaboration with Dr. T. Münte, Univ- Lübeck and Dr. E. Alternmüller, Univ. Hannover). During the development of this project we became also aware of the large individual differences in how music is perceived as a rewarding experience.

D. Neurophysiological signatures related to reward processing and action monitoring. I have always been specially interested in how our brain orchestrate and controls behaviour, specially in those cases in which actions become slips. In my first study, I was interested in understanding if error monitoring (or its ERP signature, ERN - Error-related negativity) preceded fast error-correction processes (Rodriguez-Fornells et al., 2002).

E. Cognitive control in Bilingualism. I was specially interested in trying to understand how our cognitive system handles interference across languages and how it is possible that bilinguals switch so fast and effortlessly between languages.

Keywords: language learning, music processing, neurorehabilitation, reward processing, action monitoring, Bilingualism

Selected publications:

Mestres-Misse, A., Rodriguez-Fornells, A., Münte, TF. (2007). Watching the brain during meaning acquisition. Cerebral Cortex, 17, 1858-1866.

Ripollés P, Marco-Pallarés J, Hielscher U, Mestres-Missé A, Tempelmann C, Heinze HJ, Rodríguez-Fornells A, Noesselt T. The role of reward in word learning and its implications for language acquisition. Curr Biol. 2014 24, 2606-11.

Peñaloza, C., Benetello, A., Tuomiranta, L., Heikius, IM, Järvinen, S., Majos MC., Cardona P., Juncadella M., Laine M., Martin N., Rodriguez-Fornells A. (2015). Speech segmentation in aphasia. Aphasiology, 29, 724-743.

Mas-Herrero E, Zatorre RJ, Rodríguez-Fornells A, Marco-Pallares J. Dissociation between musical and monetary reward responses in specific musical anhedonia. Current Biology. 2014; 24: 699-704.

Camara E, Rodríguez-Fornells A, Münte TF. (2010). Microstructural brain differences predict functional hemodynamic responses in a reward processing task. J Neurosci. 2010; 30: 11398-402.

Rodríguez-Fornells A, Rotte M, Noesselt T, Heinze HJ, Münte TF. Brain potential and functional MRI evidence for how to handle two languages with one brain. Nature. 2002; 415: 1026-9

Grupo de investigación en conducta adaptativa e interacción (investigación en primatología y etología)

[Adaptive Behavior and Interaction Research Group (Research on Primatology and Ethology)]

Francesc Salvador
Vicenç Quera
Elisabet Gimeno
Ruth Dolado

Summary

Los objetivos principales de nuestro grupo de investigación en el ámbito de la etología se centran en:

1. Estudio de los sistemas sociales en sociedades de primates. A través de la modelización de la conducta social en cercopitécidos, se pretende desarrollar un instrumento de predicción eto-ecológico con el objetivo de preservar especies amenazadas residentes en áreas no protegidas.

2. Obtención de los patrones conductuales que determinan el movimiento colectivo coordinado en especies gregarias. Se investigan los mecanismos conductuales que gobiernan las interacciones individuales en cardúmenes de peces.

Estructura social en las sociedades de primates. Un modelo basado en la conducta adaptativa.

La conducta adaptativa (adaptive behavior), que puede considerarse una rama de la vida artificial (ALife), supone que la complejidad de la conducta que se observa en los organismos emerge de reglas de conducta simples en respuesta a las demandas del entorno. Por otra parte, la estructura social es uno de los factores fundamentales en el estudio de los sistemas sociales de los primates. Tradicionalmente, la estructura social se define como el patrón de interacciones resultante de todas las relaciones existentes entre los distintos miembros de una comunidad. En las sociedades de primates, los miembros de una comunidad interaccionan entre sí a través de comportamientos de competición (conductas agonísticas), que pueden derivar en sistemas jerárquicos, y a través de comportamientos de afiliación (por ejemplo, conductas de aloaseo), que pueden derivar en redes de cooperación mutua. El resultado es un entramado complejo de interacciones que determina la conducta de la comunidad y que puede ser explicado a partir de un conjunto de conductas sociales que determinarán la jerarquía del grupo, las redes de cooperación entre individuos y la distribución espacial de los mismos. La presente línea de investigación propone el estudio de la estructura social de distintas especies de primates (por ejemplo, mangabeys, drils o monos araña) en cautividad y semi-cautividad, bajo la perspectiva de la conducta adaptativa. También es posible realizar dichos estudios sobre cualquier otra especie que presente conductas gregarias que deriven en estructura social (por ejemplo, los cánidos y otras especies de mamíferos).

Movimiento colectivo coordinado de cardúmenes de peces. Análisis empírico y simulaciones con modelos basados en agentes.

El movimiento colectivo coordinado es un tipo de movimiento común en la naturaleza que puede observarse no sólo en los bancos de peces, sino también en las bandadas de pájaros, en las colonias de bacterias, en los enjambres de insectos, en los rebaños de mamíferos e incluso en las multitudes humanas. Un rasgo común entre estos sistemas biológicos es su capacidad para desplazarse de forma sincronizada, como un macro-organismo, sin que exista necesariamente la figura de un líder que dirija las maniobras grupales. En general, se considera que los peces pueden adoptar dos patrones de movimiento: el school, donde los individuos se desplazan con una velocidad y orientación sincronizada; y el shoal, donde existe cohesión entre los individuos pero no hay sincronización entre ellos. A pesar de que se conocen los mecanismos sensoriales implicados en la sincronización del movimiento de los peces, como la visión o la línea lateral, todavía no está claro cómo los individuos integran la información de los inputs sensoriales y modifican su conducta en función de ésta. Durante las últimas décadas se han propuesto diferentes modelos computacionales afines a la perspectiva de la conducta adaptativa, denominados modelos basados en agentes, que son capaces de simular el patrón de movimiento colectivo coordinado de los bancos de peces a partir de un conjunto de reglas de interacción simples. Actualmente uno de los retos consiste en caracterizar el movimiento colectivo de diferentes especies de peces y comparar el grado de ajuste entre el patrón observado y el producido por los modelos. Esta línea de investigación aborda el estudio del patrón de movimiento colectivo coordinado de peces cebra (Danio rerio) y neones negros (Hyphessobrycon herbertaxelrodi) en condiciones controladas de laboratorio. También es posible estudiar otras especies que exhiban un movimiento grupal coordinado (por ejemplo, pájaros, mamíferos).

Keywords: Adaptive behavior, coordinated collective motion, fish, shoal, school, social structure, social organization, hierarchy, spatial distribution, grooming networks, conservation.

Referencias:

Lett, C., & Mirabet, V. (2008). Modelling the dynamics of animal groups in motion. South African Journal of Science, 104, 192-198.

Miller, N., & Gerlai, R. (2012). Automated tracking of zebrafish shoals and the analysis of shoaling behavior. In Zebrafish Protocols for Neurobehavioral Research (pp. 217-230). New York: Humana Press. Dolado, R., & Salvador Beltran, F. (2011). Dominance hierarchy and spatial distribution in captive red- capped mangabeys (Cercocebus torquatus torquatus): Testing Hemelrijk's agent-based model. Interaction Studies, 12(13), 476-488.

Electrophysiology of predictive processes in action-perception interactions and the sense of agency

Iria SanMiguel

Summary

Active perception and predictive processing. Everyone is familiar with bistable stimuli like the Rubin vase, which can be perceived either as two faces or a vase. How is it possible that the same sensory stimulation can give rise to different percepts in different occasions? Such phenomena highlight the active nature of perception. The world we perceive is an interpretation of the information that arrives at our senses. A key factor in this interpretative process is prediction. The brain constantly and automatically formulates predictions regarding the sensory input. Sensory responses, and hence perception, are influenced by such predictions. We are interested in understanding the neural mechanisms that support predictive processing, and their effects on perception.

Motor-driven sensory prediction. An important source of sensory predictions is our own motor behaviour. How is it possible that the visual image remains still, despite we are constantly moving our body and our eyes? The solution lies in predictive processing: the sensory consequences of the organisms' motor actions are predicted by the nervous system, and this prediction is used to compensate the effects of self-action during sensory processing. In our research, we make use motor-driven prediction to study predictive processing in audition. In a typical experiment, participants deliver auditory stimuli to themselves by pressing buttons. Comparing responses to self- and externally-generated sounds we can study the effects of motor-driven prediction in auditory processing.

Agency. How do we recognize ourselves as the agents of certain stimuli in the environment, when there is nothing that can differentiate such stimuli from other stimuli that we did not cause ourselves? The sensation of agency may arise from the effects of motor-driven sensory predictions on sensory processing. That is, whenever a sensation is cancelled out by a motor prediction, we may feel that we were the agent causing the stimulation. We are interested in understanding the precise relationship between motor-driven sensory predictions and the sensation of agency.

Keywords: Predictive coding, sense of agency, EEG, ERPs, motor control, sensorimotor processes, perception

Selected publications:

Schröger, Marzecová & SanMiguel (2015) Attention and prediction in human audition: a lesson from cognitive psychophysiology. *European Journal of Neuroscience*, 41(5):641-64.

SanMiguel, Widmann, Bendixen, Trujillo-Barreto & Schröger (2013) Hearing Silences: Human Auditory Processing Relies on Preactivation of Sound-Specific Brain Activity Patterns. *The Journal of Neuroscience*, 33(20):8633-9.

Bendixen, SanMiguel & Schröger (2012) Early electrophysiological indicators for predictive processing in audition: A review. *International Journal of Psychophysiology*, 83(2):120-31.

Timm, Schönwiesner, Schröger & SanMiguel (2016) Sensory suppression of brain responses to self-generated sounds is observed with and without the perception of agency. *Cortex,* 80:5-20.

Timm J, SanMiguel I, Keil J, Schröger E, Schönwiesner M. (2014). Motor intention determines sensory attenuation of brain responses to self-initiated sounds. *J Cogn Neurosci.,* 26(7):1481-9.