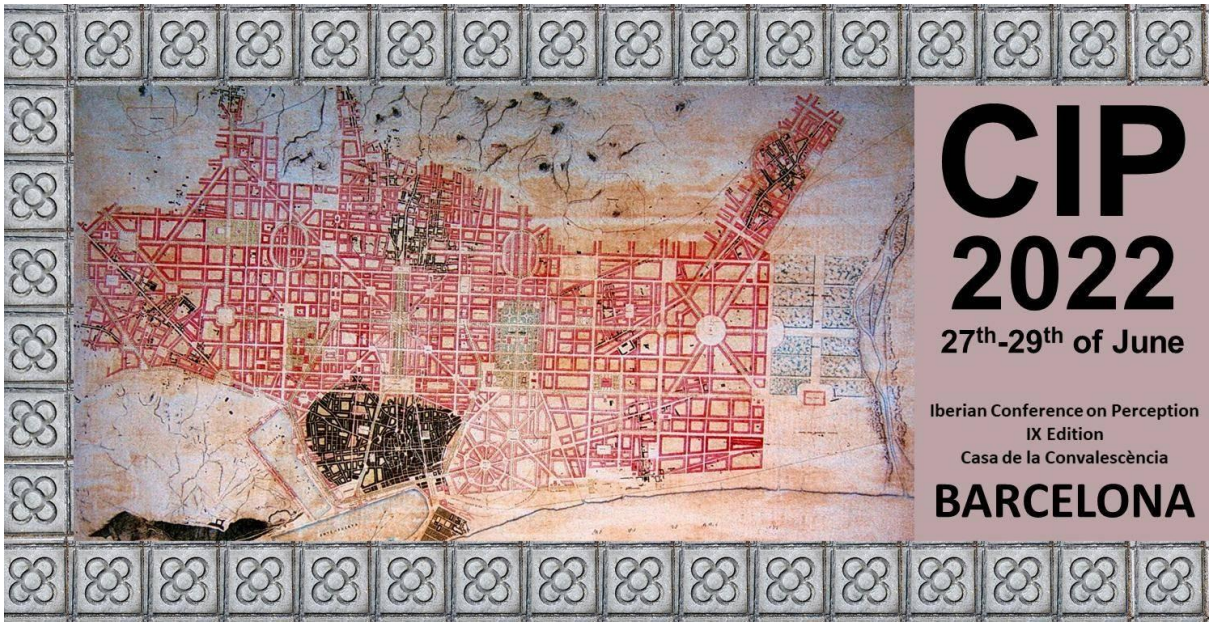

The Venue

Casa Convalescència,
Carrer St Antoni Maria Claret 171,
08041 Barcelona

The Casa Convalescència is one of the last modernist buildings in Barcelona, It was built by Domènech i Roura in the 1920's. It is in the historical complex of Hospital de la Santa Creu i Sant Pau, which was declared a UNESCO World Heritage Site in 1997.

Instructions for participants

Conference Talks
Each talk lasts exactly 15 minutes; 12 minutes presentation, 3 minutes Q&A. The chairs will be asked to strictly adhere to the time. Bring a USB stick or your own laptop. All presenters are asked to be in the lecture hall 20 minutes before the session.

Symposium talks
The duration of symposium talks should be agreed beforehand with each symposium organizer.

Posters
All posters should be in 'Portrait' orientation, maximum size 94cmx200cm (DIN-A0 size fits well). On the day of their presentation, all poster presenters may set up their posters from 9:00am onwards.

WiFi:
Network ID: Casa Convalescencia
Login: cip22
Password: wifi2022

Committee

Organizers
Xavier Otazu
Xim Cerda-Company
C. Alejandro Parraga
Olivier Penacchio

Scientific Committee
Ana Clemente
Cristina de la Malla
Claudia Feitosa-Santana
Nara Ikumi
Matthias Keil
Julio Lillo
Joan Lopez-Moliner
Marta Matamala-Gomez
Enric Munar
Sérgio Nascimento
Ignacio Serrano-Pedraza
Mireia Torralba
David Travieso
Adrià Vilà-Balló

Schematic Programme:

	Monday 27	Tuesday 28	Wednesday 29
08:30	Reception & Registration	Registration	Registration
08:45		Talks	Talks
09:45		Room ventilation	Room ventilation
10:00	Symposium “Artificial Visual Intelligence”.	Symposium “Perception and Medical Research”	Symposium “Multisensory integration in Neurorehabilitation”
11:30	Coffee break	Coffee break	Coffee break
12:00	neurOBIT sepex Lecture	sepex Lecture	Talks
13:00	Lunch	Lunch	Business meeting
14:30	Talks	Talks	
15:30	Posters & Break	Posters & Break	
16:30	Symposium “Individual Differences”	Symposium “Pleasure in perception”	
18:00	End of Presentations	End of Presentations	
18:30		Social Activity	

Detailed Programme:

Monday 27th

08:30-10:00	**Reception and registration**
10:00-11:30	**Symposium "Artificial Visual Intelligence".** Organizer: Arash Akbarinia
	S1.1 - "A visual psychophysics decalogue to check the human nature of artificial networks" **Jesús Malo**
	S1.2 - "Learning to see Stuff: Unsupervised models of material perception" **Kate Storrs**
	S1.3 - "Leveraging a massive fMRI data set and deep learning to synthesize images preferred by functional brain areas" **Katja Seeliger**
	S1.4 - "Measuring sensitivity of deep networks in low-level vision" **Arash Akbarinia**
11:30-12:00	Coffee Break
12:00-13:00	**I01 - NeuroBiT/SEPEX Lecture**
	Iris Groen "Understanding real-world vision in the human brain using computational models"
13:00-14:30	**Lunch**
14:30-15:30	**Talks** Moderator: Cristina de la Malla
14:30	**T01 -** "The strength of the interaction between fine and coarse scales is unaffected under monocular viewing" **Sandra Arranz-Paraíso**
14:45	**T02 -** "Measuring the interaction between coarse and fine moving scales at long durations, different sizes, and viewing conditions" **Omar Bachtoula**
15:00	**T03 -** "Basic psychophysics of deep networks trained for image segmentation" **P. Hernández-Cámara**
15:15	**T04 -** "Differences in the use of position and motion information for saccadic and goal directed actions" **Cristina de la Malla**
15:30-16:30	**Posters and Break**
	P01 - "Moving things with your eye's mind. Dynamic mental imagery of visual stimuli in motion and its link to time perception" **Jose Á. Muñoz**
	P02 - "Basic psychophysics of deep networks trained via maximum differentiation" **Qiang Li**
	P03 - "Basic psychophysics of deep networks trained for subjective image distortion" **J. Vila-Tomás**
	P04 - "The detection of perceptual statistical irregularities interacts across sensory modalities" **Marc Sabio**
16:30-18:00	**Symposium "Individual Differences"** Organizer: Raul Luna del Valle
16:30	**S2.1 -** "Compensating the effects of individual differences in colour vision: potential uses and limitations of Daltonization methods" **Julio Lillo**
17:00	**S2.2 -** "Factor analysis of individual differences reveals two temporal- frequency mechanisms in frontoparallel cyclopean motion" **Ichasus Llamas-Cornejo**
17:30	**S2.3 -** "Metacognition about the use of Basic Colour Terms in Red-Green Dichromats" **Humberto Moreira**

Tuesday 28th

08:30-08:45	**Meeting and registration**
08:45-09:45	**Talks** Moderator: Mireia Torralba
08:45	**T05 -** "Conflict monitoring and attentional adjustment during binocular rivalry" **Alice Drew**
09:00	**T06 -** "Studying error perception in complex scenarios stresses the importance of midfrontal theta during social cognition" **Teresa Sousa**
09:15	**T07 -** "Using occipital alpha-bursts to modulate behaviour in real-time" **Irene Vigué-Guix**
09:30	**T08 -** "Alpha fluctuations regulate the accrual of visual information to awareness" **Mireia Torralba**
09:45-10:00	**Room ventilation**
10:00-11:30	**Symposium "Perception and Medical Research"** Organizer: Daniel Linares
	S3.1 - "Reduced serial dependence suggests deficits in synaptic potentiation in anti-NMDAR encephalitis and schizophrenia" **Heike Stein**
	S3.2 - "Disentangling altered sensory perception in migraine" **Nara Ikumi**
	S3.3 - "Motion sensitivity and spatial suppression in psychosis and anti-NMDAR encephalitis" **Daniel Linares**
11:30-12:30	**Coffe Break**
12:00-13:00	**I02 - SEPEX Lecture** **Manuel Spitschan** "What does the eye tell the clock?"
13:00-14:30	**Lunch**
14:30-15:30	**Talks** Moderator: Raquel Gil Rodríguez
14:30	**T09 -** "Local surround for colour constancy using virtual reality" **Raquel Gil Rodríguez**
14:45	**T10 -** "The influence of different screens and lighting conditions when selecting the achromatic point in digital images" **Andreia E. Gomes**
15:00	**T11 -** "How universal is preference for curvature? A systematic review and meta-analysis" **Erick G. Chuquichambi**
15:15-16:30	**Posters and Break**
	P05 - "Colour differences between consecutive hyperspectral acquisitions of paintings" **Alexandre Monteiro**
	P06 - "Don´t let me down: emotional context influences pitch perception" **Marta Szabina Papai**
	P07- "Experimental aesthetics without semantics" **C. Alejandro Parraga**
	P08- "Saccadic characteristics differ between different types of strabismus" **Elena Sanz**
	P09- "Perception Of Computer-Manipulated Scenes: A Pilot Study With People With Functional Diversity" **Luis L. Lobato-Rincón**
16:30-18:00	**Symposium "Pleasure in perception"** Organizer: Ana Clemente
	S4.1 - "Sensory liking" **Martin Skov**
	S4.2 - "The embodied neuroaesthetics of dance" **Emily S. Cross**
	S4.3 - "Sensorimotor impact on pleasure, emotion and aesthetics in the perception of dance" **Beatriz Calvo-Merino**
	S4.4 - "Musical Pleasure and the Paradox of Negative Emotions" **David Huron**
	S4.5 - "Exploring the interplay between perceptual and reward networks in the ability to experience pleasure from music" **Josep Marco-Pallarés**
18:30-later	**Social Activity**
	Trekking on foot: Carretera de les aigües

Wednesday 29th

08:30-08:45	**Meeting and registration**
08:45-09:45	**Talks** Moderator: Joan López-Moliner
08:45	**T12 -** "A neurophysiological explanation of S-R spatial compatibility effects" **José M. Gavilan**
09:00	**T13 -** "Position and speed visual precision in a timing task under different temporal constraints" **Joan López-Moliner**
09:15	**T14 -** "The two phases of grasping with a Sensory Substitution Glove" **Carlos de Paz**
09:30	**T15 -** "Memories of Collisions" **Matthias S. Keil**
09:45-10:00	**Room ventilation**
10:00-11:30	**Symposium "Multisensory integration in Neurorehabilitation"** Organizer: Marta Matamala-Gomez
	S5.1 - "Home-based enriched Music-supported Therapy in the rehabilitation of upper limb motor functions for patients with chronic stroke" **Emma Segura** **S5.2 -** "Using interactive movement sonification to alter body perception and support physical activity in physically inactive adults" **Judith Ley-Flores** **S5.3 -** "Impact of virtual embodiment on motor resonance after a Mirror-PAS protocol" **Francesca Frisco** **S5.4 -** "Effects of multisensory audio-visual stimulation for the rehabilitation of unilateral spatial neglect" **Luca Zigiotto**
11:30-12:00	**Coffee Break**
12:00-13:00	**Talks** Moderator: Nara Ikumi
12:00	**T16 -** "Hard to ignore? Irrelevant distractors receive partial attention in a contextual cueing task" **M Pilar Aivar**
12:15	**T17 -** "Investigating Auditory Role-Reversal Effects Using Spatialized Pitch Distributions" **Thomas McGee**
12:30	**T18 -** "Virtual Reality maze generator tool for the study of spatial navigation in humans" **Sergi Àvila Sangüesa**
13:00-14:00	**Business Meeting**

Abstracts:

Invited talks

I01 **NeuroBiT/SEPEX Lecture:**
Title: "Understanding real-world vision in the human brain using computational models" **Author:** Iris Groen.
Affiliations: Video & Image Sense Lab, Informatics Institute, University of Amsterdam
Abstract: Visual perception in humans is mediated by a large and complex network of brain regions. Neuroscientists traditionally study this system by examining neural activity elicited by highly controlled, simplified visual inputs, such as gratings, line drawings or cut-out objects. Real-life visual perception however requires rapid processing of a continuous stream of complex natural scenes, which typically contain a multitude of objects, high-level semantics, and complex temporal structure.
In this talk, I will describe a number of studies in which we attempted to quantify such complex, more realistic visual inputs and link them to brain activity and human behaviour using computational models. In particular, I will discuss three separate research lines dedicated at better understanding the neural

computations underlying real-world vision in the human brain: 1) rapid perception of natural scenes, studied with EEG and models of low-level image statistics; 2) the role of high-level semantics and action affordances in natural scene categorization, studied using multi-voxel pattern fMRI and deep neural network models; and 3) temporal dynamics of visual responses, studied with ECoG and temporal encoding models.

I02 **SEPEX Lecture:**
Title: "What does the eye tell the clock?"
Author: Manuel Spitschan
Affiliations: Technical University of Munich & Max Planck Institute for Biological Cybernetics
Abstract: Illumination of the world around us enables vision and visual perception. Additionally, light exposure profoundly affects our physiology and behaviour by entraining the circadian system to the light-dark cycle and modifying melatonin production. These "non-visual" effects are mediated by a subset of retinal ganglion cells, the melanopsin-containing intrinsically photosensitive retinal ganglion cells (ipRGCs). Demonstrating how the different photoreceptors in the eye – including the cones and rods – contribute to non-visual light-mediated functions requires specific methods for stimulating photoreceptors in isolation. Here, I will describe recent work on uncovering the mechanisms underlying the non-visual effects of light and recent forays into translating these findings into the real world.

Symposium talks:

S1.1 **Title:** "A visual psychophysics decalogue to check the human nature of artificial networks"
Author: Jesús Malo
Affiliations: Facultat de Física. Image Processing Laboratory. Universitat de València
Abstract: Current artificial neural networks were originally inspired by classical vision models. Therefore, following their success in computer vision, it is not surprising that a growing body of literature considers deep learning as the ultimate framework also in visual neuroscience. The main difference between current deep networks and classical vision models is the procedure to obtain their free parameters: while vision models are intended to fit physiological or psychophysical measures, deep networks are optimized to fulfill a certain (visual) task over a training dataset. However, both strategies to get the parameters (fit the biology or fit the statistics) have fundamental problems to describe vision. On the one hand, traditional physiological/psychophysical experiments are not easy. As a result, simpler psychophysics such as Maximum Differentiation [Wang&Simoncelli J.Vis 08, Malo&Simoncelli SPIE 15] or fitting massive image quality databases [Watson&Malo IEEE ICIP 02, Laparra&Malo JOSA 10] have emerged as alternatives the traditional methods in visual neuroscience. On the other hand, statistical learning leads to systems that display distinctly non-human errors as illustrated by adversarial examples [Szegedy et al. ICLR 13], show substantial bias from human behavior [Gheiros et al. ICLR 19], and its eventual human-like response strongly depends on the architecture for the same goal [Gomez-Villa et al. Vis. Res. 20, Li et al. J.Vis. 22]. As a result, one may wonder if the models obtained from these alternative methods (non-classical psychophysics vs statistical learning) actually reproduce basic visual psychophysics. In this talk I present a decalogue based on classical psychophysics to check the human nature of artificial networks. This decalogue is inspired by the factors that determine successful subjective distortion metrics. The considered visual effects are so strong that accurate observation control and calibration are not required. Specifically, the decalogue consists of several series of visual stimuli and the associated qualitative responses. Given the

compelling nature of the effects, the trends of the responses can be confirmed by plain inspection of the stimuli (even by non-expert viewers). Therefore, this decalogue can be considered as a basic set of facts that should be reproduced by models that claim to describe human vision.
More info (and links) at https://isp.uv.es/docs/Malo_talk_CIP2022.pdf

S1.2 **Title:** "Learning to see Stuff: Unsupervised models of material perception"
Author: Katherine R. Storrs[1,2] & Roland W. Fleming[1,2]
Affiliations: (1) Justus Liebig University Giessen, Germany; (2) Center for Mind, Brain and Behavior (CMBB), University of Marburg and Justus Liebig University Giessen, Germany
Abstract: How does the brain learn to see properties of the world—like the glossiness of a surface—that cannot be measured by any other senses? Recent advances in unsupervised deep learning provide us with unprecedentedly powerful statistical learning systems, which may help shed light on how brains learn from their visual experience. I will discuss two projects in which we probe the visual representations learned by unsupervised deep neural networks trained on artificial environments. In one project, we train a convolutional PixelVAE network to model the pixel statistics in 10,000 static images of bumpy surfaces that have different shapes, materials and lighting. In another, we train a recurrent convolutional PredRNN network to predict the next frame in 10,000 video clips of moving objects with different shapes, materials, lighting and trajectories. In both cases, the models spontaneously come to encode those factors in their internal representations, providing a proof-of-principle for how knowledge about the outside world can be learned from visual experience alone. Most strikingly, the models make patterns of errors in their perception of material that follow, on an image-by-image basis, the patterns of errors made by human observers. The network trained on static images shows human-like failures of perceptual gloss constancy, and the network trained on moving videos learns a representation of material that combines both static and motion cues in human-like ways. Unsupervised deep learning may provide a coherent framework for how many perceptual dimensions form, in material perception and beyond.

S1.3 **Title:** "Leveraging a massive fMRI data set and deep learning to synthesize images preferred by functional brain areas"
Author: K. Seeliger[1], J. Roth, T. Schmid[1], M. Hebart[2]
Affiliations: (1) Max Planck Institute for Human Cognitive and Brain Sciences; (2) J. Roth, T. Schmid: Leipzig University
Abstract: One major goal in vision neuroscience is characterizing the responses of higher order functional regions in the visual system. As visual computations are complex and grounded, it is likely that underlying their semantic selectivity (e.g. places, faces, objects, body parts) there exists a composite of image-computable features, and that these could be activated selectively. Exhaustively characterizing this composite experimentally would require showing massive amounts of stimuli; which - due to the variety of the visual world - is impossible in-vivo. An alternative approach would be deriving computational models from neuroimaging data and probing them as in-silico models with neural network sensitivity methods. This avenue now exists through convolutional neural network models of the visual system and is currently being explored. The direct route to brain-like in-silico models would be training them end-to-end on massive amounts of neuroimaging data. Using a large-scale functional MRI dataset where naturalistic videos were shown, we derived such a model of the visual system. To identify the preferred stimuli of voxels and regions, we used a neural network interpretability technique, based on a generative adversarial neural network (GAN) for synthesizing preferred images. The higher order areas in our model showed expected (e.g. faces and low spatial frequencies in FFA, places and high spatial frequencies in PPA) but also unexpected behavior. Preferred images for each investigated region were localized in highly distinct regions of

the GAN latent space. This approach may reveal previously unknown functional selectivity in visual cortex.

S1.4 **Title:** "Measuring sensitivity of deep networks in low-level vision"
Author: Arash Akbarinia
Affiliations: Justus-Liebig Universität Giessen
Abstract: Signal detection, the ability to differentiate between two stimuli or a stimulus and background, is extensively studied in experimental psychology to precisely measure the limits of our sensations and perception. Here, I will discuss the same concept in modern deep neural networks. Thanks to their human-level performance, these models are ubiquitously explored as a tool to understand perception. I will focus on the visual domain covering several types of networks, such as Convolutional Neural Networks (CNN), Vision Transformers (ViT) and Variational Autoencoders (VAE). I will present the results of two projects where we compared the sensitivity of the human visual system to deep networks with the same paradigms. In one project, we measured the contrast sensitivity function (CSF) in deep networks. CSF is a fundamental signature of the visual system by defining the visibility threshold across all spatial frequencies. The results show that human-like CSF emerges in deep networks trained to perform high-level visual tasks. Our analysis indicates the inverted U-shape of CSF is directly utilised in the network's performance. In the other project, we measured the chromatic discrimination threshold in deep networks and compared it to our colour vision. Similar to our visual system, deep networks trained on natural images become more sensitive to hue than saturation. Furthermore, the reported asymmetry in human colour discrimination also emerges in these networks. Altogether, these results suggest insights into low-level visual processing can be acquired by studying deep neural networks.

S2.1 **Title:** "Compensating the effects of individual differences in colour vision: potential uses and limitations of Daltonization methods"
Authors: Julio Lillo[1], Leticia Álvaro[2], Humberto Moreira[1,3], Leyla Quispe[1] & Laura Abad[1]
Affiliations: (1) Departamento de Psicología Social, del Trabajo y Diferencial, Facultad de Psicología, Universidad Complutense de Madrid, Madrid, Spain; (2) Departamento de Psicología Experimental, Procesos Cognitivos y Logopedia, Facultad de Psicología, Universidad Complutense de Madrid, Madrid, Spain; (3) División de Psicología, C. E. S. Cardenal Cisneros, Madrid, Spain
Abstract: Main perceptual-cognitive limitations of CDOs (Colour Deficient Observers) are analysed, along with the uses and limitations of the tools that transform images so that CDOs can use them as CNOs (Colour Normal Observers): the so called daltonization tools. Our analysis is focused on daltonic people, including the most common CDO types (protanopia, deuteranopia, protanomaly and deuteranomaly). We begin pointing to the main cause of colour vision individual differences and of the CDOs problems to perform tasks based on colour: the existence of pseudoisochromatic stimuli and the corresponding colour space volume reduction. It is showed how this fact affects every one of the four colour uses included in the Chaparro and Chaparro tasks taxonomy. It is emphasised that three of these uses (denotative, connotative and aesthetic) are related to colour categories and not to specific colours. The last CIE (Commission Internationale de L'Eclairage) technical report on the "enhancement of images for colour-deficient observers" is used with two different goals. First, to divide daltonization methods into three different types (recoloring, edge enhancement and pattern superposition) considering how they transform original images to facilitate CDO use. Second, to show different ways to test daltonization accuracy. It is concluded that the choice of a daltonization tool requires considering, for every specific situation, both the kind of image, the color use required, and the individual characteristics of the CDOs. Simple images, such as "document images", and simple uses, like denotative use, make daltonised images provided by simple daltonization tools adequate for very

different types of CDO, so these images can be used to promote universal design (transformed images valid for different users). At the other extreme, images with many stimuli differences and/or sophisticated uses of colour make daltonizations valid only for some kinds of CDO (due to individual differences) and are more difficult to use

S2.2 **Title:** "Factor analysis of individual differences reveals two temporal- frequency mechanisms in frontoparallel cyclopean motion"

Authors: Ichasus Llamas-Cornejo[1], María Olivares-Fernández[1], David Peterzell[3] & Ignacio Serrano-Pedraza[1,3]

Affiliations: (1) Department of Experimental Psychology. Complutense University of Madrid, Madrid, Spain; (2) Center for Behaviour and Evolution, Newcastle University, Newcastle upon Tyne, UK; (3) Fielding Graduate University, Santa Barbara, California, and National University (JFK), Pleasant Hill, California, USA

Abstract: The study of the underlying mechanisms in stereovision is mainly limited to static stereopsis (Howard & Rogers, 2012). Masking experiments and factor analytic techniques, using sinusoidal depth corrugations, have suggested the existence of more than two spatial-frequency disparity mechanisms (Serrano-Pedraza et al., 2013,JoV; Peterzell, et al., 2017,VR). Here, using individual differences, we want to investigate the possible existence of independent temporal-frequency disparity mechanisms in frontoparallel cyclopean motion. Cyclopean motion was constructed using sinusoidal disparity corrugations obtained with random gaussian-dots stereograms that changed every frame at 120Hz (no luminance motion was present monocularly, only the sinusoidal corrugation was moved). In total we tested 34 participants. We measured disparity thresholds for detecting the correct direction of motion of horizontal (left-right) and vertical (up-down) sinusoidal corrugations of 0.4 c/deg drifting at 0.25,0.5,1,2,4,6, and 8Hz. Results show a mild orientation anisotropy with higher thresholds for vertical corrugations. Disparity thresholds as a function of temporal frequency are almost constant from 0.25 up to 1c/deg and then they increase monotonically. Principal component analysis uncovered two factors that accounted for 72% of the variability. Varimax rotation showed that one component loaded from 0.25 to 2Hz and a second component from 4 to 8Hz. Direct Oblimin rotation indicates a moderate intercorrelation of both components. Our results suggest the existence of two moderately interdependent temporal-frequency mechanisms in cyclopean motion (slow and fast) like those found in the luminance domain suggesting a similar low-level motion mechanism for both types of motion.

Acknowledgements: Supported by grant PGC2018-093406-B-I00 from Ministerio de Ciencia, Innovación y Universidades (Spain) to ISP.

S2.3 **Title:** "Metacognition about the use of Basic Colour Terms in Red-Green Dichromats" **Authors:** Humberto Moreira[1,2], Julio Lillo[1], Leticia Álvaro[3], María Sánchez[1] & Ricardo Arancón[1]

Affiliations: (1) Departamento de Psicología Social, del Trabajo y Diferencial, Facultad de Psicología, Universidad Complutense de Madrid, Madrid, Spain; (2) División de Psicología, C. E. S. Cardenal Cisneros, Madrid, Spain; (3) Departamento de Psicología Experimental, Procesos Cognitivos y Logopedia, Facultad de Psicología, Universidad Complutense de Madrid, Madrid, Spain

Abstract: Normal trichromats have three types of cones in their retinas: L, M and S cones. Red-Green (R-G) dichromats lack L cones (protanopes) or M cones (deuteranopes). The results obtained in two different experiments were used to compare R-G dichromats' empirical and metacognized abilities to discriminate basic color categories (BCCs) and to use the corresponding basic color terms (BCTs). A first experiment used a 102-related-colors set in a colour-categorization task to identify all the stimuli that could be named with each BCT by each R-G dichromat type (8 protanopes and 9 deuteranopes). In a second

experiment, a group of R-G dichromats (15 protanopes and 16 deuteranopes) estimated their difficulty discriminating BCCs-BCTs pairs in a verbal task. Strong coincidences were found between the results derived from both tasks, indicating that R-G dichromats have very accurate metacognition about their capacities and limitations in the use of BCTs. Multidimensional scaling (MDS) solutions derived from the confusion matrices obtained in both tasks were very similar: BCTs in R-G dichromats were properly represented in 2D MDS solutions that clearly reveal one chromatic dimension and one achromatic dimension. Important concordances were found between protanopes and deuteranopes. None of these dichromats showed substantial difficulty discriminating the Red-Green pair. The metacognition about the use of BCTs in R-G dichromats can be considered a "caricature" of their empirical difficulties. This caricature omits some difficulties including their problems differentiating "white" and "black" from other BCTs, while they overestimate their limitations in differentiating the most difficult pairs. Individual differences scaling (INDSCAL) analyses indicated that the metacognition regarding the use of BCTs in R-G dichromats, especially deuteranopes, is driven slightly more by the chromatic dimension and driven slightly less by the achromatic dimension, than their empirical use of BCTs.

S3.1 **Title:** "Reduced serial dependence suggests deficits in synaptic potentiation in anti-NMDAR encephalitis and schizophrenia"

Authors: Heike Stein, Joao Barbosa, Mireia Rosa-Justicia, Laia Prades, Alba Morató, Adrià Galan-Gadea, Helena Ariño, Eugenia Martinez-Hernandez, Josefina Castro-Fornieles, Josep Dalmau, Albert Compte

Affiliations: (1) Group for Neural Theory, Départament d' Etudes Cognitives, (2) Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), (3) Department of Child and Adolescent Psychiatry and Psychology, 2017SGR881, CIBERSAM, Institute Clinic of Neurosciences, Hospital Clínic, (4) Department of Medicine, University of Barcelona (5) Department of Neurology, University of Pennsylvania

Abstract: The NMDA receptor (NMDAR) subserves memory mechanisms at several timescales, including sustained delay activity and different temporal components of synaptic potentiation. We investigated behavioral and electrophysiological working memory alterations in a delayed response task in two diseases linked to hypofunctional NMDARs: schizophrenia and autoimmune anti-NMDAR encephalitis. We report a markedly reduced influence of previous stimuli on to-be-remembered working memory contents, while memory accuracy was preserved. Moreover, decoding analyses showed a limited influence of memory codes from previous on subsequent trials in patients' EEG. In spiking network simulations of our memory task, we conclude that changes in cortical excitation strongly affect memory performance and cannot account for disrupted between-trial interference. In contrast, our modeling supports alterations in NMDAR-dependent memory mechanisms operating on longer timescales, such as short-term potentiation.

S3.2 **Title:** "Disentangling altered sensory perception in migraine"

Authors: Nara Ikumi, Xim Cerdà Company, Angela Martí Marca, Adrià Vilà Batlló, Victor J Gallardo, Anna De la Torre Suñe, Edoardo Caronna, Alicia Alpuente, Patricia Pozo Rosich

Affiliations: (1) Vall d'Hebron Institut de Recerca, Medicine department. (2) Headache and Neurological Pain Research Group (2) Vall d'Hebron University Hospital, Neurology Department. Headache Unit

Abstract: Migraine is characterized by the presence of recurrent and unpredictable attacks of headache and accompanying sensory symptoms such as decreased tolerance to light (photophobia), sound (phonophobia), and odors (osmophobia). Phonophobia is present in 70-80% of patients. However, past studies have only employed one method (method of limits) to determine sound aversion thresholds. Here, we will present two studies that aim to disentangle potential effects of protective behavior, sensory/decision processes, and intensity of pain in the estimation of these thresholds. Our results will give insight

to the potential integrative mechanism which drives this altered sensory perception, and findings could also be translated to other disorders where sensory thresholds need to be studied.

S3.3 **Title:** “Motion sensitivity and spatial suppression in psychosis and anti-NMDAR encephalitis”

Authors: Daniel Linares, Francina Badia, Mireia Rosa-Justicia, Laia Prades, Josefina Castro-Fornieles, Josep Dalmau, Gisela Sugranyes, Albert Compte
Affiliations: (1) University of Barcelona (2) Institut d’Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), (2) Department of Child and Adolescent Psychiatry and Psychology, 2017SGR881, CIBERSAM, Institute Clinic of Neurosciences, Hospital Clínic, (3) Department of Neurology, University of Pennsylvania

Abstract: Motion perception is altered in schizophrenia: sensitivity and spatial suppression are reduced. It is unclear, however, which is the contribution of non-perceptual factors to the alterations. Also, as previous studies are conducted on chronic patients, it is unclear whether the alterations are caused by the etiology of the disease or by factors associated with its chronicity. Finally, it is unclear whether a hypofunction of the NMDA receptors—which plays a fundamental role in the pathogenesis of the disease— mediates the alterations. To assess these questions, we measured motion perception sensitivity as a function of the size and the contrast of the stimuli in patients with schizophrenia, patients that have suffered a first episode of psychosis, patients with anti-NMDAR encephalitis, and healthy controls. We found a reduced sensitivity and spatial suppression in the three groups of patients controlling for lapses, which suggests that the perceptual alterations are due to the etiology of psychosis and are mediated by a hypofunction of the NMDAR receptors.

S4.1 **Title:** “Sensory liking”

Author: Martin Skov
Affiliations: (1) Danish Research Center for Magnetic Resonance, Centre for Functional and Diagnostic Imaging and Research, Copenhagen University Hospital - Amager and Hvidovre, and (2) Center for Decision Neuroscience, Copenhagen Business School, Denmark

Abstract: Historically, sensory liking has been investigated as a fixed reaction to the perceptual properties of physical objects. In order to determine what humans and other species like, experimenters have manipulated properties of a stimulus and measured liking responses to them, either in the form of choice behavior or self-reported ratings. The hope of this research has been to discover stimulus-preference laws that explain why organisms like certain sensory objects and dislike others. Unfortunately, this body of work has revealed that individuals often respond differently to the same stimulus in different evaluative contexts: sensory liking is not fixed but rather variable. This ubiquitous finding has led to a search for possible reasons why individuals might "deviate" from a stimulus-preference law, including personality differences, experience, or knowledge. Here, I want to defend a view of sensory liking that accounts for the inherent variability of sensoy liking by giving up on the assumption that hedonic liking arises as a fixed reaction to a given stimulus. Instead, I will argue, liking outcomes emerge as a function of the organism's contextual physiological and behavioral needs rather than the stimulus alone. How pleasant a stimulus is depends on, amongst other factors, how rewarding it is expected to be, the organism's homeostatic state, and the behavioral tasks the organism is engaged in. In this sense, sensory liking is not a reaction to the inherent value of a stimulus, but rather an answer to the biological question of what value a given stimulus represents in the context of the organism's current survival needs.

S4.2 **Title:** “The embodied neuroaesthetics of dance”

Author: Emily S. Cross

Affiliations: Centre for Social, Cognitive & Affective Neuroscience, School of Psychology and Neuroscience, University of Glasgow, UK
Abstract: Perceiving others in action, whether in everyday contexts, such as seeing a commuter run to catch a train, or in highly refined artistic settings, such as watching a skilled dancer perform on stage, evokes automatic affective responses in an observer. The extent to which an observer's prior experience with an observed action shapes his or her affective evaluation remains poorly understood. Better understanding of this relationship is essential for advancing knowledge about the role of pleasure in perception in general, and in artistic and aesthetic contexts spanning the performance arts in particular. In my remarks, I will discuss research that attempts to construct a more complete understanding of the impact of experience on emotional responses and aesthetic judgements when watching others dance. My team studies the execution and observation of complex, whole-body dance movements, using complementary behavioural and brain-based approaches, such as training interventions, functional neuroimaging and physiological measures of implicit affective responses. Findings from our work offer some suggestions for why we have evolved to derive such intense pleasure from watching others dance.

S4.3 **Title:** "Sensorimotor impact on pleasure, emotion and aesthetics in the perception of dance"
Author: Beatriz Calvo-Merino
Affiliations: Department of Psychology, City University of London, UK
Abstract: This talk explores how different cognitive and neural mechanisms that contribute to emotion perception and aesthetic experience, engage in a similar manner with sensorimotor representations during dance observation. We revise evidence from work focused on the sensorimotor expertise of expert dancers. We explore how dance expertise modulates visual, sensorimotor and psychophysiological responses to affective body movements. And we further explore how this enhanced expert emotion sensitivity is domain-specific or general to other forms of emotional expression. We propose dance experts show an enhanced general emotion sensitivity beyond the observation of their motor acquired skill but onto general and everyday emotional expressions. We also revise work on dance observation by naïve observers (non-dancers) and suggest that similar sensorimotor recruitment participates in aesthetic and emotion perception of dance. We discuss venues for emotional sensitivity training based on engaging motor and artistic knowledge.

S4.4 **Title:** "Musical Pleasure and the Paradox of Negative Emotions"
Author: David Huron
Affiliations: (1) School of Music & Center for Cognitive and Brain Sciences, Ohio State University, USA
Abstract: How is it that (some) listeners can enjoy nominally sad music? And how is it that (some) listeners can enjoy nominally aggressive musics--like Heavy Metal? In this brief presentation I review two theories that endeavor to account for the pleasure of musics that are ostensibly associated with negatively-valenced emotions.

S4.5 **Title:** "Exploring the interplay between perceptual and reward networks in the ability to experience pleasure from music"
Author: Josep Marco-Pallarés
Affiliations: (1) Department of Cognition, Development and Educational Psychology, Institute of Neurosciences, University of Barcelona, (2) Cognition and Brain Plasticity Unit, Bellvitge Biomedical Research Institute (IDIBELL), Spain
Abstract: Most of the reinforcing stimuli for animals are related to aspects relevant to survival or means to achieve them. Humans, however, are moved by a wider range of rewarding stimuli that may not be directly associated with Darwinian survival imperatives. Among these, music is particularly relevant, as

it is present in all known cultures and is one of the most pleasant stimuli for most people. Therefore, an intriguing question is how an abstract sound might become pleasant and what are the underlying brain mechanisms explaining such processing. In the present talk we will present the brain networks involved in musical pleasure. In addition, we will also address the key role of the dynamics between perceptual and reward areas that allow giving value to music. Finally, we will explore how these mechanisms are impaired in healthy people who do not enjoy music, a condition known as specific musical anhedonia.

S5.1 **Title:** "Home-based enriched Music-supported Therapy in the rehabilitation of upper limb motor functions for patients with chronic stroke"

Authors: Emma Segura[1,2], Jennifer Grau-Sánchez[1,2,3], David Sanchez-Pinsach[4], Myriam De la Cruz-Puebla[2,5,6,7], Esther Duarte[8,9], Josep Lluis Arcos[4], and Antoni Rodríguez-Fornells[1,2,9]

Affiliations: (1) Department of Cognition, Development and Educational Psychology, University of Barcelona, Barcelona, Spain; (2) Cognition and Brain Plasticity Unit, Bellvitge Biomedical Research Institute, Barcelona, Spain; (3) Escola Universitària d'Infermeria i Teràpia Ocupacional, Autonomous University of Barcelona, Terrassa, Barcelona, Spain; (4) Artificial Intelligence Research Institute, Spanish National Research Council, Bellaterra, Barcelona, Spain; (5) Department of Equity in Brain Health, Global Brain Health Institute (GBHI), University of California, San Francisco (UCSF), California, USA; (6) Department of Cellular Biology, Physiology and Inmunology, Neuroscience Institute, Autonomous University of Barcelona, Barcelona, Spain; (7) Department of Internal Medicine, Health Sciences Faculty, Technical University of Ambato, Tungurahua, Ecuador; (8) Department of Physical and Rehabilitation Medicine, Hospital de l'Esperança, Barcelona, Spain; (9) Institut Hospital del Mar d'Investigacions Mèdiques (IMIM), Barcelona, Spain; jInstitució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

Abstract: Musical activities provide a multimodal experience that requires the simultaneous activation of different brain areas involved in sensory-motor function, auditory processing, emotional processing, and cognitive functions such as memory and attention. Music-supported Therapy (MST) is a neurorehabilitation technique based on this framework which consists of playing music instruments with the paretic upper limb to improve fine and gross motor functions post stroke. MST can improve motor and cognitive functions as well as quality of life (QoL) in subacute and chronic stroke patients. Most stroke patients do not achieve full upper limb motor function recovery after completing formal rehabilitation programs. We designed a home-based enriched MST program (eMST) to provide them with the opportunity of continuing rehabilitation by themselves in the chronic phase of the disease. The eMST aims to improve upper limb motor function through musical training. The intervention combines self-training and group sessions in order to promote autonomy, motivation and social interaction, crucial elements for motor recovery. We developed an app to conduct the sessions at home with a MIDI-piano and percussion instruments. A randomized controlled trial is being conducted to test the efficacy of the eMST in improving motor and cognitive functions as well as QoL of chronic stroke patients. Participants are evaluated pre- and post- intervention, as well as 3 months later. We expect to observe a significant recovery in upper limb motor and cognitive functions, as well as an improvement in the QoL of patients undergoing the eMST intervention in comparison to those undergoing a conventional home-based motor intervention

S5.2 **Title:** "Using interactive movement sonification to alter body perception and support physical activity in physically inactive adults"

Authors: Judith Ley-Flores

Affiliations: DEI Interactive Systems Group, Computer Science and Engineering Department, Universidad Carlos III de Madrid, Spain.

Abstract: Physical inactivity is a serious health problem. It is linked to negative body perceptions, including negative perceptions of physical capabilities, which act as psychological barriers to perform physical activity (PA). Here, I will show the use of a technique, called interactive movement sonification, which employs real-time sound feedback produced by body movement to tackle bottom-up sensorimotor mechanisms related to body perception, to ultimately address psychological barriers to PA. I will present different studies that are part of my PhD thesis in which we used two different interactive prototype systems (SoniShoes and Soniband), designed to modulate body perception, emotional state, and movement behavior through movement sonification. Results from our quantitative studies with users showed effects of particular movement-sound mappings on body feelings (e.g., feeling lighter), feelings about the movement (e.g., control over the movement), and emotional feelings (e.g., having more motivation to complete the exercise, or feeling happier) during PA. Results also showed sound effects on actual movement behavior (e.g., acceleration) and on proprioceptive awareness. Two qualitative studies were also run with participants using SoniBand during several days in laboratory and home contexts. The results revealed specific connections between properties of the movement sonifications (e.g., gradual changes of frequencies); particular body feelings (e.g., feeling strong), and aspects of PA (e.g., movement repetitions). The effects of movement sonification seem to be related to the PA-level of the populations. The presented studies have implications for potential interventions and applications supporting PA and open opportunities for future research investigating the use of interactive movement sonification for neurorehabilitation.

S5.3 **Title:** "Impact of virtual embodiment on motor resonance after a Mirror-PAS protocol"

Authors: Francesca Frisco[1,2], Marta Matamala-Gomez[2,3], Giacomo Guidali[4], Carlotta Lega[1,2], Nadia Bolognini[1], Angelo Maravita[1,2].

Affiliations: (1) Psychology Department, University of Milano-Bicocca, piazza dell'Ateneo Nuovo, 1, 20126 Milan, Italy. (2) Mind and Behavior Technological Center (MIBTEC), University of Milano-Bicocca, Milan, Italy (3) Brainvitge Cognition and Brain Plasticity. Dept. of Cognition, Development and Education Psychology. University of Barcelona, Barcelona, Spain. (4) Neurophysiology Lab, IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy

Abstract: The Mirror Neuron System (MNS) is endowed with an action-observation network whereby the movement observation leads to greater excitability of the primary motor area (M1) (motor resonance) [1]. The activity in MNS seems to be modulated by learning new visuo-motor associations, i.e., Hebbian associative plasticity. A method to induce such plasticity and reshape motor resonance is the so-called mirror Paired Associative Stimulation (PAS) protocol, in which a transcranial magnetic stimulation (TMS) pulse over the M1 is paired to a visual stimulus showing ipsilateral hand movements [2]. Further, observing virtual movements while being embodied in a virtual body impacts motor learning [3]. Here, we carried out a mirror-PAS protocol in immersive virtual reality (VR) (i.e., Head Mounted Display) to investigate the impact of body representation on motor resonance when observing a grasping movement from a first-person perspective (1PP) while being embodied in a virtual body. A control group observed the same movement from a 1PP in a non-immersive setting (i.e., computer monitor). During the virtual mirror-PAS, a single-pulse TMS was applied over the right M1 paired to the observation of an ipsilateral grasping movement. Moreover, we recorded Motor Evoked Potentials induced by single-pulse TMS over the right M1 during the observation of grasping movements made with both hands. Following the virtual mirror-PAS protocol, we found differences between groups in motor resonance, sense of ownership, and agency toward the virtual arm performing the grasping movement. These results show the pivotal role of virtual embodiment in modulating the mirror-PAS's effects on corticomotor excitability.

[1] Rizzolatti G, Sinigaglia C. The mirror mechanism: a basic principle of brain function. Nat Rev Neurosci 2016;17:757e65. https://doi.org/10.1038/nrn.2016.135
[2] Guidali, G., Carneiro, M. I. S., & Bolognini, N. (2020). Paired Associative Stimulation drives the emergence of motor resonance. Brain Stimulation, 13(3), 627–636.
[3] Matamala-Gomez, M., Slater, M., & Sanchez-Vives, M. V. (2022). Impact of virtual embodiment and exercises on functional ability and range of motion in orthopedic rehabilitation. Scientific Reports, 12(1), 1-10.

S5.4 **Title:** "Effects of multisensory audio-visual stimulation for the rehabilitation of unilateral spatial neglect"

Authors: Luca Zigiotto[1, 2], Alessio Damora[3], Federica Albini[4, 5], Carlotta Casati[4, 6], Gessica Scrocco[3, 4], Mauro Mancuso[3, 7], Luigi Tesio[8, 9], Giuseppe Vallar[4, 6], Nadia Bolognini[4, 6]
Affiliations: (1) Division of Neurosurgery, Santa Chiara Hospital, Azienda Provinciale per I Servizi Sanitari (APSS), Trento, Italy; (2) Division of Psychology, Santa Chiara Hospital, Azienda Provinciale per I Servizi Sanitari (APSS), Trento, Italy; (3) Tuscany Rehabilitation Clinic, Arezzo, Italy; (4) Department of Psychology, University of Milano-Bicocca, Milan, Italy; (5) Clinical Neuropsychology Unit, Rehabilitation Department, S. Antonio Abate Hospital, Gallarate, Varese, Italy; (6) Laboratory of Neuropsychology, Istituto Auxologico Italiano, IRCCS, Milan, Italy; (7) Physical and Rehabilitative Medicine Unit, NHS South-Est Tuscany, Italy; (8) Department of Neurorehabilitation Sciences, Istituto Auxologico Italiano, IRCCS, Milan, Italy; (9) Department of Biomedical Sciences for Health, University of Milan, Italy

Abstract: Unilateral spatial neglect (USN) is a neuropsychological syndrome, usually caused by right-hemisphere lesions. Brain-damaged patients with USN fail to orient towards and respond to events occurring in the left (contralesional) side of space. Multisensory integration mechanisms may be largely spared in USN patients; hence they may help in the modulation of spatial orienting. This study aims to develop a new rehabilitation procedure for USN based on Multisensory audio-visual Stimulation (MS): the effects of this stimulation was compared to that of a highly effective treatment for USN, Prismatic Adaptation (PA). Twenty USN stroke patients were divided in two groups (10 per group) and received a 2-week treatment (20 sessions, twice per day) of MS or PA. The effects of MS and PA were assessed by a set of neuropsychological tests widely used in the clinical practice for the diagnosis of USN: target cancellation, line bisection, sentence reading, personal neglect and complex drawing; moreover, the functional disability in the activities of daily living was assessed using the Catherine Bergego Scale. Results showed that MS brought to improvements in USN, which were comparable than those induced by PA; in addiction, personal neglect was improved only by MS, not by PA. Improvements remained stable at least for one month after the end of both treatments and were unrelated to duration of disease and extent of cerebral lesion. In conclusion, MS represents a novel and promising rehabilitation procedure for USN.

Regular Talks

T01 **Title:** "The strength of the interaction between fine and coarse scales is unaffected under monocular viewing"

Authors: Sandra Arranz-Paraíso[1], Francisco Prados-Rodríguez[1] & Ignacio Serrano-Pedraza[1,2]
Affiliations: (1) Department of Experimental Psychology. Complutense University of Madrid, Madrid, Spain; (2) Center for Behaviour and Evolution, Newcastle University, Newcastle upon Tyne, UK

Abstract: As psychophysical research has shown, certain motion discrimination impairments can be explained by two inhibitory mechanisms: surround suppression and the interaction between motion sensors tuned to fine and coarse scales (Serrano-Pedraza et al., 2013). When a static low spatial-frequency component is added to a moving high-spatial-frequency component, motion discrimination is impaired (Derrington & Henning, 1987). Surround suppression emerges when stimulus size and contrast increase (Tadin et al., 2003) and is reduced under monocular viewing (Arranz-Paraiso et al., 2021). However, little is known about what occurs in the interaction between fine and coarse scales under the monocular viewing condition. We measured the duration thresholds of fifteen participants in a motion discrimination task under binocular and monocular (right/left eye) viewing conditions. The stimuli were vertical Gabor patches of frequencies 1 and 3c/deg, 46% contrast, 3deg diameter, drifting at 2deg/sec. Four conditions were tested: 1c/deg moving added to a 3c/deg static (1m+3s), 1c/deg static added to a 3c/deg moving (1s+3m), 1c/deg moving and 3c/deg moving. The strength of the interaction was measured with an interaction index, subtracting the duration thresholds, in logarithmic units, of the complex minus the simple stimulus. As in previous research, duration thresholds were higher in the 1s+3m condition, showing impairment in motion direction discrimination. Our results show that the strength of the interaction between fine and coarse scales is unaffected under monocular viewing suggesting different underlying mechanisms for surround suppression and for the interaction between scales.
Acknowledgements: Supported by Grant No. PGC2018-093406-B-I00 to ISP from Ministerio de Ciencia, Innovación y Universidades, Spain

T02 **Title:** "Measuring the interaction between coarse and fine moving scales at long durations, different sizes, and viewing conditions"
Authors: Omar Bachtoula[1], Juan Molinero-Solla[1] & Ignacio Serrano-Pedraza[1,2]
Affiliations: (1) Department of Experimental Psychology, Complutense University of Madrid, Madrid, 28223, Spain; (2) Centre for Behaviour and Evolution, Newcastle University, Newcastle upon Tyne, NE2 4HH, UK
Abstract: The combination of a static low frequency patch with a moving high frequency component, at short durations, originates an illusion where the physical motion is perceived in the opposite direction, and is unaffected by binocular, monocular, or dichoptic presentations (Derrington et al., 1993). This impairment in motion perception was also obtained at long durations using a flickering low frequency patch (Serrano-Pedraza et al., 2007). Serrano-Pedraza & Derrington (2010) showed that, at short durations, this interaction becomes more intense depending on stimulus size. Here, we wanted to explore this interaction for long durations using three viewing conditions (dichoptic, monocular, and binocular), and two stimulus sizes (3 and 7 deg). The stimuli consisted of vertical Gabor patches composed of a flickering low frequency component and a drifting high frequency component. We determined the strength of the interaction by means of the contrast level of the flickering component that cancelled motion direction discrimination. Results were similar for both sizes, suggesting that the strength of the interaction is not affected by the sizes of the stimulus tested. Interestingly, binocular and monocular presentations generated a strong interaction, while the interaction under dichoptic viewing produced a weak effect. This finding suggests that there is a critical duration to trigger the interaction between low and high spatial frequencies under dichoptic presentations.
Acknowledgements: Supported by grant PGC2018-093406-B-I00 from Ministerio de Ciencia, Innovación y Universidades (Spain) to ISP.

T03 **Title:** "Basic psychophysics of deep networks trained for image segmentation"
Authors: P. Hernández-Cámara, J. Vila-Tomás, Q. Li, V. Laparra and J. Malo
Affiliations: Image Processing Lab (IPL). Universitat de València

Abstract: Current deep architectures are easy to train according to different functional goals. As a result, deep learning using biologically plausible objectives is becoming a standard tool in theoretical visual neuroscience. For example, direct learning of the input-output physiological responses [Burg et al. PLOS 21] is complemented with explanations of physiological responses of classification networks (high-level goal) [Cadena et al. PLOS 19], or with explanations of psychophysical trends of autoencoder networks (low-level goal) [Hepburn et al. ICLR 22, Gomez-Villa et al. Vis. Res. 20, Li et al. J.Vis. 22]. Classification and optimal reconstruction are biologically sensible tasks but the analysis of these networks as biological vision models is problematic. On one hand, classification implies generating a global image label so abstract visual information is spread in unclear ways. This implies complicated read-out schemes to relate classification networks and biological vision. On the other hand, autoencoders with different constraints are so low-level and dependent on the architecture that they may be appropriate only to model very early vision stages. Segmentation lies between the high and low-level problems represented by classification nets and autoencoders. It identifies classes but also generates coherent masks in the spatial domain. Here we study the psychophysical behaviour of a successful semantic segmentation network. Our model extends conventional U-net architectures by using biologically inspired divisive normalization stages, which certainly contribute to substantial improvements [Hernandez-Camara et al. IEEE ICIP 22]. However, the use of perceptually inspired nonlinearities and a task that may be biologically sensible do not guarantee a human-like behaviour of the net. In order to explore the eventual similarity of U-nets with divisive normalization and human vision, here we check if these nets reproduce a representative program of classical visual psychophysics [Malo CIP 22].
More info and links at http://isp.uv.es/docs/Hernandez_et_al_CIP_22.pdf
Acknowledgements: This work was partially funded by the EU / Spanish Government grants MICINN PID2020-118071GBI00 and MICINN PDC2021-121522-C21, and by the Generalitat Valenciana grant Grisolía-P/2019/035

T04 **Title:** “Differences in the use of position and motion information for saccadic and goal directed actions”
Authors: Cristina de la Malla[1] & Alexander Goettker[2]
Affiliations: (1) Vision and Control of Action (VISCA) Group, Department of Cognition, Development and Psychology of Education, Institut de Neurociències, Universitat de Barcelona, Barcelona, Catalonia, Spain (2) Justus-Liebig University Giessen, Giessen, Germany
Abstract: Inherent sensorimotor delays require predicting where moving targets will be in the future to successfully interact with them. These predictions are based on the combination of position and motion signals. Research using isoluminant targets has shown that when the computation of motion information is impaired, saccades are less precise and land at positions where targets were ~100 ms before saccade initiation. Here we use targets with first- and second-order motion to compare the effects that impairing the computation of motion has on saccades and on hand movements. To do so, participants completed three conditions where a step-ramp paradigm was used. Target’s steps were of 14 cm upwards from a fixation point, and ramps were of 5, 10 and 15 cm/s. In one condition, participants had to make a saccade towards the target and pursue it accurately. In that case, saccades were more accurate when aiming at first- than at second-order motion targets. In another condition, participants had to look at the targets and try to intercept them by tapping on them. Accuracy in saccades depended on whether the target was defined by first- or second-order motion, but accuracy in interception was similar in both cases. In another condition, participants had to try to intercept the target while keeping their gaze at the initial fixation location. Accuracy in interception was not worse than when looking at the targets. Our results speak in favour of a difference in the way position and motion signals are used for gaze and hand movements.

Acknowledgements: This work was supported by grant PID2020-116400GA-I00 funded by MCIN/AEI/10.13039/501100011033 to CM.

T05 **Title:** "Conflict monitoring and attentional adjustment during binocular rivalry"
Authors: *Alice Drew[1], *Mireia Torralba[1], Manuela Ruzzoli[1,2,3], Luis Morís Fernández[1,4], Alba Sabaté[1], Márta Szabina Pápai[1], Salvador Soto-Faraco[1,5]
Affiliations: (1) Multisensory Research Group, Centre for Brain and Cognition, Universitat Pompeu Fabra, Barcelona, Spain; (2) BCBL, Basque Center on Cognition, Brain and Language, Donostia-San Sebastian, Spain; (3) Ikerbasque, Basque Foundation for Science, Bilbao, Spain; (4) Departamento de Psicología Básica, Universidad Autónoma de Madrid, Madrid, Spain; (5) Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain
Abstract: To make sense of ambiguous and, at times, fragmentary sensory input, the brain must rely on a process of active interpretation. At any given moment, only one of several possible perceptual representations prevails in our conscious experience. Our hypothesis is that the competition between alternative representations induces a pattern of neural activation resembling cognitive conflict, eventually leading to fluctuations between different perceptual outcomes in the case of steep competition. To test this hypothesis, we probed changes in perceptual awareness between competing images using binocular rivalry. We drew our predictions from the conflict monitoring theory, which holds that cognitive control is invoked by the detection of conflict during information processing. Our results show that fronto-medial theta oscillations (5–7Hz), an established electroencephalography (EEG) marker of conflict, increases right before perceptual alternations and decreases thereafter, suggesting that conflict monitoring occurs during perceptual competition. Furthermore, to investigate conflict resolution via attentional engagement, we looked for a neural marker of perceptual switches as by parieto-occipital alpha oscillations (8–12Hz). The power of parieto- occipital alpha displayed an inverse pattern to that of fronto-medial theta, reflecting periods of high interocular inhibition during stable perception, and low inhibition around moments of perceptual change. Our findings aim to elucidate the relationship between conflict monitoring mechanisms and perceptual awareness.

T06 **Title:** "Studying error perception in complex scenarios stresses the importance of midfrontal theta during social cognition"
Authors: Teresa Sousa[1,3], Camila Dias[1,2], João Estiveira[1,2], Diana Costa[1,2], João Castelhano[1,2], Gabriel Pires[4,5], Miguel Castelo-Branco[1,3]
Affiliations: (1) Coimbra Institute for Biomedical Imaging and Translational Research, University of Coimbra; (2) Institute for Nuclear Sciences Applied to Health, University of Coimbra; (3) Faculty of Medicine, University of Coimbra; (4) Institute of Systems and Robotics, University of Coimbra; (5) Engineering Department, Polytechnic Institute of Tomar
Abstract: The capacity to voluntarily optimize our responses in changing or challenging environments is highly dependent on error/performance monitoring. This is particularly critical during social cognition processing and, when compromised, contributes to atypical thinking and behavior in several mental disorders. Oscillations in the theta band over the medial frontal cortex have been increasingly suggested as a neural index of higher-order control over behavior and in particular action selection. Nevertheless, the role of theta in the coordination of goal-directed processes across different brain regions remains unclear. Here, we investigated how the ongoing midfrontal theta reflects different aspects of executive function. We started by identifying the neural markers of error monitoring when performing different responses and using the perception of facial cues as instruction. Our data confirm the robustness of midfrontal theta to study error monitoring in complex scenarios, as it carries information from locked and non-phase-locked signals. Importantly, we found action-independent diminished versus augmented midfrontal theta during pre-error and error commission. This opposite temporal pattern suggests that high midfrontal theta

levels are related to general cognitive control mechanisms required during performance monitoring starting before a response. Source analysis suggests an origin in distinct regions of the salience network. Therefore, we then investigated the effect of task difficulty on the modulation of these core error monitoring brain regions and communication with others, such as the dorsolateral prefrontal cortex, which is involved in error awareness. Our findings reinforce the hypothesized role of the salience network as a hub between distinct neural networks, such as the one involved in cognitive control and the frontoparietal executive network.

Acknowledgements: This work was supported by the BIAL Foundation (Grant No. PT/FB/BL-2018-306) and the Portuguese Foundation for Science and Technology (Grants No: PTDC/PSI-GER/30852/2017, PTDC/EEI-AUT/30935/2017, FCT-UID/4950/2020, and UI/BD/150832/2021).

T07 **Title:** "Using occipital alpha-bursts to modulate behaviour in real-time"

Authors: Irene Vigué-Guix, Salvador Soto-Faraco

Affiliations: Pompeu Fabra University

Abstract: Spontaneous oscillatory neural activity can influence the processing of sensory inputs and subsequent behavioural reactions. Although spontaneous activity often appears in stochastic bursts, typical approaches in human neuroimaging are based on trial averages, making it thus nearly impossible to connect oscillatory bursts to behaviour directly. In order to garner support for the intrinsic role of the oscillatory bursts in the alpha band (8-13 Hz) in visual perception, we developed an EEG-based brain-computer interface (BCI) that allowed for burst-triggered stimulus presentation in real-time while participants performed a visual speeded detection task. Because of the well-known inhibitory function of α-activity over sensory cortices, we hypothesised that the occurrence of alpha bursts at the target onset would impact reaction times (RTs). As expected, targets presented during alpha-burst episodes led to slower RTs than those presented outside. Furthermore, targets presented during bursts were more likely to be missed, whereas those presented in the absence of bursts led to false alarms more often. The concluding remarks of our study are threefold: (i) Our findings corroborate both the theories and the empirical evidence on the role of alpha-oscillations in visual perception on a trial-by-trial basis; (ii) it is possible to modulate behaviour (RTs and errors) using occipital alpha-bursts, and (iii) real-time BCI systems can be used as a test bench for brain-behavioural theories, making them a promising research tool for cognitive neuroscience.

Acknowledgements: This research was supported by the Ministerio de Economia y Competitividad (PSI2016-75558-P and PID2019-108531GB-I00, both to S.S.F.).

T08 **Title:** "Alpha fluctuations regulate the accrual of visual information to awareness"

Authors: Mireia Torralba Cuello[1], Alice Drew[1], Alba Sabaté San José[2], Luis Morís Fernández[1], Salvador Soto-Faraco[1,3]

Affiliations: (1) Multisensory Research Group, Center for Brain and Cognition, University of Pompeu Fabra, Barcelona, Spain; (2) Universitat de Barcelona, Barcelona, Spain; (3) Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain.

Abstract: Endogenous brain processes play an important role in shaping perceptual phenomenology caused by sensory input. This is illustrated dramatically by the alternations experienced when watching ambiguous images, However the relationship between endogenous states and perceptual experience is still not well understood. Here, we hypothesised that endogenous alpha fluctuations in the excitability of visual cortex neural populations play a role in pacing the accumulation of sensory information, leading to the emergence of specific perceptual outcomes. We addressed this hypothesis using binocular rivalry combined with visual entrainment and electroencephalography in humans (N=117, 64 female). Consistent with the hypothesis, the individual frequency of alpha oscillations in the occipital cortex correlated with perceptual alternation

rates experienced during binocular rivalry. In subsequent experiments we up- or down-regulated endogenous brain activity via rhythmic visual entrainment, and produced corresponding changes in perceptual alternation rate. These changes were observed only in the alpha range but not at lower entrainment frequencies, and were much reduced when using arrhythmic stimulation. Additionally, entraining at frequencies above the alpha range did not result in speeding up perceptual alternation rates. Overall, these findings support the notion that visual information is accumulated via alpha cycles to promote the emergence of conscious perceptual representations. We suggest that models of binocular rivalry incorporating posterior alpha as a pacemaker can provide an important advance in the comprehension of the dynamics of visual awareness.

Acknowledgements: This research was supported by the Ministerio de Ciencia e Innovación (PID2019-108531GB-I00 AEI/FEDER), AGAUR Generalitat de Catalunya (2017 SGR 1545). This project has been co-funded with 50% by the European Regional Development Fund under the framework of the FEDER Operative Programme for Catalunya 2014–2020, with a grant of 1,527,637.88€. We want to thank Dr. Márta Szabina Pápai and Indre Pileckyte for helping in the piloting of the Experiments and in EEG data collection.

T09 **Title:** “Local surround for colour constancy using virtual reality”

Authors: Raquel Gil Rodríguez, Laysa Hedjar, Matteo Toscani, Dar'ya Guarnera, Giuseppe Claudio Guarnera, Karl R. Gegenfurtner

Affiliations: Justus-Liebig Universität Giessen; Bournemouth University; Norwegian University of Science and Technology; University of York

Abstract: Virtual reality (VR) allows us to create realistic and immersive experiments on colour perception. Previous studies showed the possibility of colour calibrating the headset mounted display (HMD). Based on that, we utilise VR to investigate the influence of local surround in a colour constancy experiment. In our approach, we use a specific rendering software, Unreal Engine, and HTC Vive Pro Eye for visualisation. We model a photo-realistic complex outdoor scenario and choose five different illuminations, one neutral and four chromatic for testing. The object of interest is a small grey lizard placed in a particular location, on the side of a cliff. We have two scenes: 1) the control and 2) the local surround. In a control condition, all cues to constancy were available. In the latter scenario, we modify the reflectance of the background object (cliff) to match the reflected colour under the neutral illumination, so it remains constant under the chromatic illuminants. Under each illuminant, two lizards pop up with five distinct reflectances (colours under the chromatic illuminants are chosen to reflect reflectance matches, tristimulus matches, or in between levels of colour constancy). Participants selected the coloured lizard closer to achromatic. Results show the colour constancy metrics are lower under the local surround scenario. This outcome follows previous studies on colour constancy and emphasises the importance of local information also using virtual reality.

Acknowledgements: The study was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – project number 222641018 - SFB/TRR135, TPA8 and C2; and the European Research Council Advanced Grant `Color3.0' – project number 884116. D. Guarnera and G. C. Guarnera were supported by the project Spectraskin N-288670, funded by the Research Council of Norway.

T10 **Title:** “The influence of different screens and lighting conditions when selecting the achromatic point in digital images”

Authors: Andreia E. Gomes[1], Andreia Ribeiro, Sérgio M.C. Nacimento and João M.M. Linhares

Affiliations: Physics Centre of Minho and Porto Universities (CF-UM-UP), Gualtar Campus, University of Minho, 4710-057 Braga (Portugal)

Abstract: Color calibration and appropriate ambient lighting conditions are paramount for accurate colored images displayed on screens. Changes to these

conditions will impact the observer's color perception. Nevertheless, the impact of changing the screen and ambient lighting conditions when selecting images' achromatic point is undetermined. The purpose of this work was to assess the influence of different screens and lighting conditions on the perceived achromatic point.

32 observers with normal color vision assessed 8 images across 3 experimental conditions: laboratory monitor display with lights on (LL) and lights off (LD) and home screen either with lights on or off (H). The observers' task was to select the achromatic point of each image using a mousepad. Each mousepad position was correlated to a particular hue and saturation that recolored the image presented with that specific color. The color of the selected achromatic point was recorded in CIELAB color space. Results showed that the selected achromatic point was not purely achromatic, shifting towards green and blue hues. Averages estimated across observers found CIE(a*,b*) of (-1.18,0.09), (-1.00,-2.04) and (-1.05,0.19) for LL, LD and H conditions, respectively. Statistically significant differences were only found for b* between no light and lighting conditions. These results seem to indicate that observers select slightly bluish greenish points instead of achromatic point. Differences were only found in the bluish hue but not between LL and H conditions suggesting that the screen does not affect the selection of the achromatic point on those images.

Acknowledgements: This study was supported by the Portuguese Foundation for Science and Technology (FCT) under the scope of the strategic funding of UIDB/04469/2020 and UIDB/04650/2020 and also in the framework of the PhD scholarship grants SFR/BD/147336/2019 and 2020.05785 BD.

T11 **Title:** "How universal is preference for curvature? A systematic review and meta-analysis"

Authors: Erick G. Chuquichambi[1], Oshin Vartanian[2], Martin Skov[3,4], Enric Munar[1]

Affiliations: (1) Human Evolution and Cognition Group (EvoCog), University of the Balearic Islands Palma de Mallorca, Spain; (2) Department of Psychology, University of Toronto, Toronto, Canada; (3) Danish Research Centre for Magnetic Resonance, Copenhagen University Hospital, Kettegaards Alle 30, DK-2650 Hvidovre, Denmark; (4) Decision Neuroscience Research Cluster, Copenhagen Business School, Solbjerg Plads 3, DK-2000 Frederiksberg, Denmark.

Abstract: Visual preference for curvature is widely supported by the Empirical Aesthetics literature. This effect has been reported using multiple measures, kinds of stimuli, and experimental designs. A few historical and theoretical reviews on preference for curvature can be found in the scientific literature. However, less is known about the overall quantitative magnitude of the effect, and its possible moderator variables. In light of the accumulation of empirical evidence, we present a pre-registered systematic review and meta-analysis of visual preference for curvature that quantifies its magnitude, and synthesizes the factors moderating this effect. Specifically, we compared studies including curved and angular contour types in behavioural preference tasks. 301 effect sizes obtained from 101 samples of participants of 60 studies were collected and analysed by means of a three-level meta-analysis model. Results demonstrate a moderate magnitude of preference for curvature. However, the effect is moderated by variables such as dimension (i.e., the concept employed to measure preference), stimuli type (meaningless, object, space design, symbol design), presentation time of the stimulus (limited vs. unlimited), and participants' expertise (non-experts, quasi-experts, experts). This study provides a more complete framework to understand visual preference for curvature. We also discuss our findings with the aim to enrich the design of subsequent studies exploring the effect of curvature.

T12 **Title:** "A neurophysiological explanation of S-R spatial compatibility effects"

Authors: José M. Gavilán[1] & José A. Aznar-Casanova[2]

Affiliations: (1) Department of Psychology, Research Center for Behavior Assessment (CRAMC), Universitat Rovira i Virgili, Tarragona, Spain; (2) Departmental Section of Cognition. Faculty of Psychology. Universitat de Barcelona, Barcelona, Spain
Abstract: Studies with S-R spatial compatibility tasks show that subjects are faster and more accurate when they have to press a button that is on the same side as the stimulus (ipsilateral) than when it is on the opposite side (contralateral). The present study uses tasks of this type to explore the activity of the ventral (VP) and dorsal (DP) pathways of vision, aiming to support neurophysiological explanations that propose that the function of the VP (What-system) is object recognition, while that of the DP (Where-system) is object localization. A total of three experiments were performed by using two Stroop-type spatial compatibility tasks (A and B). Experiment-1 analyzes the interaction between the relevant and irrelevant properties of the stimulus by manipulating the participants' attention, orienting it to its shape (VP) or its spatial position (DP). In Experiment-2, we manipulated the subject's reference frame (North-South-East-West) by virtually varying the orientation of the PC in which the stimuli and responses appeared. In Experiment-3, we manipulated the rotation of the screen or keyboard only. The results of Experiment-1 showed a different pattern of response depending on the property to which attention is directed (shape versus spatial position), which seems to indicate a different involvement of the ventral and dorsal visual pathways. Experiments 2-3 showed that virtual rotations modulated the results of Experiment-1, with a predominance of DP (localization) over VP (identification). We conclude that a plausible interpretation of S-R spatial compatibility effects is consistent with the anatomical-physiological framework of perceptual and action processing pathways.

T13 **Title:** “Position and speed visual precision in a timing task under different temporal constraints”
Authors: Joan López-Moliner
Affiliations: Universitat de Barcelona
Abstract: Changes of target position and speed are known to be relevant to determine the precision of motor movements in interceptive timing but, little is known about visual sensitivity to position and speed of targets under different temporal constraints. We use reverse correlation to interceptive timing in a novel way within Virtual Reality (VR) to study precision to position and speed by inferring their kernels at the time of interception. Participants pressed a button (keypress condition) or synchronized the end of hand movements (movement condition) when a cloud of approaching dots was aligned with a grid in front of the participants. We added Gaussian noise to the average speed of the cloud so that each dot had a slightly different speed. We recorded the time of the keypress and hand movement onset and offset. After categorizing the responses into early and late categories, we computed the difference of the position and speed noisy distributions between these categories. This difference resembled an edge detection filter and a tuning function for position and speed respectively and were well explained by a kernel based on the difference of two Gaussians with similar means in the case of speed and the SD of the Gaussians reflecting their sensitivity to position or speed. We found a superior selectivity for position and speed in the movement condition probably because these variables could be measured at different times during the action. These results show the benefits of VR in combination with psychophysical techniques in interceptive timing.
Acknowledgements: Grant PID2020-114713GB-I00 funded by MCIN/AEI/10.13039/501100011033

T14 **Title:** “The two phases of grasping with a Sensory Substitution Glove”
Authors: Carlos de Paz, David Travieso, Jorge Ibáñez-Gijón, & David M. Jacobs
Affiliations: Facultad de Psicología, Universidad Autónoma de Madrid, 28049, Madrid, Spain

Abstract: Grasping objects with the hand is a fundamental skill of humans. Current theories on the motor control of grasping differ in their description of this action. The visuomotor channels model holds that prehension is divided into two sequential, although dependent, reach and grasp components (Jeannerod, 1984, 1999). Alternatively, the double-pointing theory (Smeets & Brenner, 1999) claims that grasping consists of moving and placing the fingers on the object surface, controlling them independently as a pointing movement. In order to address the two phases in the prehension movement, a pointing and a grasping task were performed with a sensory substitution glove, without vision. The glove includes two vibration motors, on the index finger and on the thumb. The motors vibrate when the corresponding finger points toward the object. The vibration intensity increases when the hand approaches the target. Hand movements were recorded through a motion capture system. Results of Experiment 1 show that participants pointed to objects with a mean absolute angular error (1.38º) lower than the angular size of the object (3.82º). In Experiment 2, participants grasped cylinders of different sizes and distances. They were successful in 83% of the trials, and their grasping behavior was adapted to the different distances and sizes. Most important, the analysis of the hand trajectory showed distinguishable reaching and grasping phases. Therefore, our results support the idea that prehension is divided into sequential phases rather than independent movements of the fingers.

T15 **Title:** "Memories of Collisions"
Authors: Matthias S. Keil
Affiliations: Facultat de Psicologia, Departament de Cognició, Desenvolupament i Psicologia de l'Educació (Processos Cognitius), Pg. de la Vall d'Hebron, 171 (Campus Mundet), ES-08035 Barcelona
Abstract: Getting hit by a ball is usually not a pleasant experience. While a ball may not terminate one's life, other objects may well do so. For this reason, many organisms (from humans to insects) have neuronal mechanisms for detecting and avoiding collision threats. The study of the underlying neuronal circuitry is still ongoing. Many computational proposals rely on some form of temporal contrast integration, because the temporal contrast of an approaching object correlates with its visual angle. Mechanisms based on contrast integration, however, are quickly driven to their limits when the observer moves as well. With observer movement, it is often difficult to distinguish the background-induced temporal contrast from that of an approaching object.
Acknowledgements: This work was funded by the grant PGC2018-099506-B-I00 of the Spanish government.

T16 **Title:** "Hard to ignore? Irrelevant distractors receive partial attention in a contextual cueing task"
Authors: M Pilar Aivar, Patricia Aniento, David Hernández-Gutiérrez, Luca Saini, Miguel A. Vadillo
Affiliations: Facultad de Psicología, Universidad Autónoma de Madrid
Abstract: In simple visual search tasks, repetition of spatial context reduces RTs when the context is predictive of target location (Chun & Jiang, 1998). But, what happens when the context is composed of relevant (same color as target) and irrelevant (different color) items? In these cases participants are instructed to ignore irrelevant elements, but some influence of the ignored context seems to still remain (Vadillo et al., 2020). To clarify this issue, in this study we directly analyzed to which degree participants were able to ignore irrelevant items. In a first experiment, we kept the number of relevant items constant, but varied the number of irrelevant items. In each trial, participants had to find a rotated T among rotated Ls. Eight distractors had the same color as the target (relevant distractors), while either 4 or 16 distractors had a different color (irrelevant distractors). Half of the configurations were repeated along the experiment, intermixed with newly generated configurations. RTs replicated contextual cueing effects, but also showed that it took longer to find the target when more

irrelevant distractors were presented, which suggests that these items could not be completely ignored. In a second experiment, we recorded eye movements during the task to obtain a direct measure of focal attention to irrelevant items. Analysis of eye fixations over the whole experiment showed that about 12% of all fixations were on relevant distractors and 6% on irrelevant distractors. This suggests that selective attention cannot completely suppress the effect of irrelevant items.

Acknowledgements: Research supported by grant PID2020-118583GB-I00.

T17 **Title:** "Investigating Auditory Role-Reversal Effects Using Spatialized Pitch Distributions"

Authors: Thomas McGee, Ömer Dağlar Tanrıkulu

Affiliations: Cognitive Science Program, Williams College, MA, USA

Abstract: The nuances of visual priming have been thoroughly investigated using various paradigms with different types of visual features. One such method is role reversal, a priming methodology in which the visual feature values of distractors and targets in a search task switch following multiple trials. Research in audition, however, has largely addressed the priming of words or vocalizations rather than lower-level auditory features. To our knowledge, there have been no studies investigating auditory role-reversal effects; therefore, the degree to which auditory priming parallels the repetition and role-reversal effects observed in low-level visual search tasks is unknown. By adapting an auditory search task designed by Cusack and Carlyon (2003) to a role-reversal paradigm, we designed the first instance of such a task. In our study, participants were tasked with identifying the spatial location of a target tone that was differentiated from distractors by its frequency range. The results of Experiment 1 demonstrate auditory role-reversal effects using spatialized pitch distributions. In contrast to visual role-reversal effects, in which increased response times may persist throughout multiple trials, the observed role-reversal effects in the current study were contained to the first trial following reversal. Preliminary data from Experiment 2 suggests that the auditory system may encode the statistics of distractor pitch distributions when presented with multiple stimulus arrays. These experiments demonstrate further parallels between auditory and visual priming in low-level stimulus features and may provide important insights into the probabilistic nature of perceptual representations in auditory processing.

T18 **Title:** "Virtual Reality maze generator tool for the study of spatial navigation in humans"

Authors: Sergi Àvila Sangüesa[1], Marcos Sánchez[2], Salvador Soto-Faraco[3,4], Josep Blat[2], Lluis Fuentemilla[5,6,7], Mireia Torralba Cuello[2]

Affiliations: (1) Research Center for Visualization, Virtual Reality and Graphics Interaction, Universitat Politècnica de Catalunya, Spain; (2) Departament de les Tecnologies i la Informació, Universitat Pompeu Fabra, Barcelona, Spain; (3) Multisensory Research Group, Center for Brain and Cognition, University of Pompeu Fabra, Barcelona, Spain; (4) Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain; (5) Cognition and Brain Plasticity Group, Bellvitge Biomedical Research Institute (IDIBELL), Hospitalet de Llobregat, Spain; (6) Department of Cognition, Development and Educational Psychology, University of Barcelona, Barcelona, Spain; (7) Institute of Neurosciences, University of Barcelona, Barcelona, Spain

Abstract: Everyday life often requires us to navigate and orient in the environment to reach our goals. Inter-personal skills in Spatial Navigation (SN), the set of abilities that allows us to accomplish this, varies largely through humans. It is well established, for example, that SN declines in elder adults. Recent studies have highlighted the potential of using Virtual Reality (VR) for the study of SN in humans. The main potential of VR in research is that it allows for control of the environment without being limited to a 2d screen, thus increasing the ecological validity of the experiments. However, the time and technical skills required for developing VR environments may limit the use of this new powerful

tool in cognitive studies. We developed a tool in Virtual Reality in order to perform experiments that study spatial navigation in humans with simultaneous EEG recording. The tool allows the design of customized T-junction mazes with different characteristics and also includes the option to perform auditory and visual stimulation. Importantly, users do not need previous VR knowledge in order to use the tool. We expect this maze design tool will make available the use of VR to study SN to many researchers in the cognitive neurosciences area.
Acknowledgements: This project is supported by Bial Foundation (Sensory Entrainment for Improving Spatial Navigation, ref: 229-2020). We acknowledged Hanna Preus for developing questionnaires for the evaluation of the VR tool and for her contribution in the design.

Posters

P01 **Title:** "Moving things with your eye's mind. Dynamic mental imagery of visual stimuli in motion and its link to time perception"

Authors: Jose Á. Muñoz[1,2], Antonio Prieto[3], Pedro R. Montoro[3]
Affiliations: (1) Escuela Internacional de Doctorado UNED. Programa de Doctorado en Psicología. Universidad Nacional de Educación a Distancia (UNED), Madrid, España; (2) Universidad Internacional de la Rioja (UNIR), Logroño, España; (3) Departamento de Psicología Básica I, UNED, Madrid, España.

Abstract: Given the lack of sensory receptors for a direct time perception in the nervous system, as opposed to those for other sensory features, this study intends to determine whether the psychophysical curves that can be obtained for time perception in motion-related tasks resemble those of other sensory systems or rather show any significant differences. However, since the cognitive system is known to take advantage of motor activity, as a motor-sensory feedback for on-the-go corrections on time perception, we hypothesize mental motion imagery (without body movement) to prevent this feedback from affecting time perception -as revealed through dynamic mental imagery-. In this regard, 100 participants (50 each) performed two consecutive tasks: (1) a partially imagined task, where the subjects mentally indicated the moment when a visible object in straight motion, that turns invisible at some point, reached the end of its trajectory; and (2) a fully imagined task, in which the participants had to mentally visualize the object and its whole motion between two visible boundaries at the same constant speed already seen in the former task. In the partially imagined condition, subjects consistently overestimated the elapsed time, whereas, in the fully imagined condition, short durations (2000 - 6000 ms) were overestimated, whereas long ones (6000 – 12000 ms) were underestimated, with an absolute error increasing as the real durations became shorter or longer than 6000 ms. These findings may show relevant implications for existing theories about the structure and dynamics of mental visual imagery along with time perception.

P02 **Title:** "Basic psychophysics of deep networks trained via maximum differentiation"

Authors: Q. Li, P. Hernandez-Camara, J. Vila-Tomas, V. Laparra & J. Malo
Affiliations: Image Processing Lab (IPL). Universitat de Valencia

Abstract: Traditional experiments to get the parameters of vision models are based on direct physiological recordings of neural responses or on the psychophysics of incremental thresholds of calibrated patterns. These experiments would guarantee the accuracy of the models but they are costly, and data is scarce to fit complex general-purpose models. That is why newer psychophysical alternatives have been proposed for faster model estimation.

However, one may wonder if the models fitted using these non-classical psychophysics actually reproduce the trends of classical visual psychophysics. In fact, limitations in reproducing classical psychophysics have been used as a noble way to propose improvements to architectures which are not easy to propose otherwise [Martinez et al. Front. Neurosci. 19]. In this work we focus on a specific cascade of linear+nonlinear layers which was tuned via non-classical psychophysics, e.g. Maximum Differentiation and fitting large image quality databases [Martinez et al. PLOS 18, Malo et al. J. Vis. 21]. The architecture of this network is classical as it was intended to account for the different physiological layers in the neural pathway (retina, LGN, V1) and for the different psychophysical features of perception (opponent color nonlinearities, contrast computation, frequency selectivity, masking in the spatial domain, and masking in local-oriented representations). However, in this network, the reproduction of a wide set of classic psychophysical facts has not been tested. In this work we fill this gap by checking a representative visual psychophysics program [Malo CIP 22]. More information and links at http://isp.uv.es/docs/Li_et_al_CIP_22.pdf
Acknowledgements: This work was partially funded by the EU / Spanish Government grants MICINN PID2020-118071GBI00 and MICINN PDC2021-121522-C21, and by the Generalitat Valenciana grant Grisolía-P/2019/035

P03 **Title:** "Basic psychophysics of deep networks trained for subjective image distortion"
Authors: J. Vila-Tomás, P. Hernández-Cámara, Q. Li, A. Hepburn, V. Laparra and J. Malo
Affiliations: Image Processing Lab (IPL). Universitat de València
Abstract: Perceptnet is a convolutional neural network that established the state-ofthe-art in image quality metrics in 2020 with a fraction of the parameters of conventional models (such as Alexnet or VGG) [Hepburn et al. IEEE ICIP 2020]. The architecture of Perceptnet is inspired in classical vision models where the physiologically inspired divisive normalization was used for the nonlinear stages [Carandini and Heeger Nat. Neurosci. 2012]. Its cascade of linear+nonlinear transforms has the following biological rationale: input images undergo a divisive normalization so that digital units may be transformed into tristimulus values, the following pointwise convolutional layer may generate achromatic and opponent chromatic channels while another divisive normalization is used so that Weber-like and Von-Kries-like nonlinearities may emerge. A spatial convolution with 6 filters follows so that centersurround neurons may emerge, whereas the next divisive normalization may account for energy masking in the spatial domain. The last convolutional layer includes multiple spatial filters to allow V1-like local oriented sensors to appear, and the final divisive normalization may account for cross frequency/orientation masking. It is important to note that despite Perceptnet was tuned with human opinions and its architecture was chosen so that biological-like behavior could emerge, there is no actual guarantee that its final elements are similar to biological neurons or that the network reproduces other visual psychophysics beyond image distortion [Martinez et al. Front. Neurosci. 2019]. In order to clarify if Perceptnet can be seen as an actual vision model, here we check if Perceptnet reproduces a representative program of classical visual psychophysics [Malo CIP 2022]. More info and links at http://isp.uv.es/docs/Vila_et_al_CIP_22.pdf
Acknowledgements: This work was partially funded by the EU / Spanish Government grants MICINN PID2020-118071GBI00 and MICINN PDC2021-121522-C21, and by the Generalitat Valenciana grant Grisol´ıa-P/2019/035

P04 **Title:** "The detection of perceptual statistical irregularities interacts across sensory modalities"
Authors: Marc Sabio, Lluís Fuentemilla, Alexis Pérez-Bellido
Affiliations: (1) Department of Cognition, Development and Educational Psychology, University of Barcelona; (2) Cognition and Brain Plasticity Group,

Bellvitge Institute for Biomedical Research; (3) Institute of Neurosciences, University of Barcelona

Abstract: In daily life, we draw on environmental regularities to anticipate perceptual changes. Research on statistical learning showed that this can occur incidentally and independently for each sensory modality. Here, we examined whether statistical learning in one sensory modality had any impact on another sensory modality, even without conscious awareness.

Participants were exposed to concurrent but uncorrelated pairs of visual (oriented gratings) and auditory stimuli (frequency tones). In different blocks, participants performed a perceptual discrimination task on the visual (orientation discrimination) or in the auditory modalities (frequency discrimination), that was orthogonal to the learned stimuli associations. We tested whether expectation violations in the unattended modality affected the discrimination performance in the attended one. Using Signal Detection Theory analyses, we found that concurrent expectation violations in the unattended modality had a negative impact on the performance in the attended modality. Specifically, a violation in the unattended modality reduced the sensitivity to discriminate stimulus differences in the attended modality, by increasing the proportion of false alarms (that is, biased participants to categorize the standard stimuli as deviant ones). Our results suggest that predictive systems are not completely modality-specific, as predictive violations in an unattended sensory modality affect the perceptual performance in the attended modality.

P05 **Title:** "Colour differences between consecutive hyperspectral acquisitions of paintings"

Authors: Alexandre Monteiro[1], Sérgio Nascimento[1], João Linhares[1]

Affiliations: (1) Physics Center of Minho and Porto Universities (CF-UM-UP), Gualtar Campus, University of Minho, 4715-057 Braga (Portugal)

Abstract: The aim of this work was to compare consecutive hyperspectral acquisitions of the same art painting, comparing the data obtained and the influence of image registration methodologies. Spectral reflectance of four paintings were retrieved from data acquired by imaging the paintings using a hyperspectral imaging system. Two consecutives' images were obtained, without changing the acquisition setup. Reflectance was then converted into the CIELAB color space assuming the CIED65 illuminant and the CIE 1931 Standard Observer. Comparisons were done in CIELAB by computing the variations in the volume of the colour gamut and the number of discernible colours across paintings and acquisitions, under three different conditions. First condition of analysis assumed no image registration (NoIR) between consecutive acquisitions. Second condition assumed manual image registration (MIR) and the third condition assumed automatic image registration (AIR). Variations were estimated as the ratio computed across acquisitions, assuming a variation of 0 as no variations across acquisitions.

It was found that the average across the four paintings for the variations in the number of discernible colours, was of 0.55±0.13 for NoIR and AIR and of 9.55±0.62 for MIR, and for the variations in the colour volume an average of 0.66±0.19 for NoIR and AIR and of 30.19±3.82 for MIR. These results seem to indicate that consecutive hyperspectral image acquisitions provide small variations on the colour volume and on the number of discernible colours. If image registration procedures are required between acquisitions, it seems that manual image registration procedures increase the colour errors between acquisitions.

Acknowledgements: Fundação para a Ciência e a Tecnologia, I.P. (FCT)

P06 **Title:** "Don´t let me down: emotional context influences pitch perception"

Authors: Marta Szabina Papai, Vasileia Christou & Jordi Navarra

Affiliations: University of Barcelona

Abstract: Context priming allowed us to investigate whether generating a perceptual context in a particular domain (e.g., the visual perception of

positive/negative emotions) influences the perception in another domain (the auditory perception of pitch).
Happy versus sad visual contexts were created to test possible congruent/ incongruent effects in the identification of ascending/descending sounds. We considered congruent the combination of happy emotion and ascending pitch, or sad emotion and descending pitch, respectively. Our results suggest a statistically significant congruency effect in happy as well as in sad conditions, with different directionality though. When happy images were followed by sounds with ascending pitch, we observed slower reaction times in comparison to the presentation of happy images accompanied by sounds with descending pitch. An opposite pattern was observed for sad contexts, where reaction times were faster in congruent than in incongruent condition. One might raise the question then, to what extent could be these differences explained by emotional contexts triggered by different attentional mechanisms. Besides, the results are also discussed in terms of the representation of magnitude.

P07 **Title:** "Experimental aesthetics without semantics"
Authors: C.Alejandro Parraga[1], Marcos Muñoz González[2], Xavier Otazu[1], Olivier Penacchio[3]
Affiliations: (1) Computer Vision Centre /Computer Science Dept., Univ. Autònoma de Barcelona, Spain; (2) Computer Science Dept., Univ. Autònoma de Barcelona, Spain; (3) School of Psychology and Neuroscience, University of St Andrews, UK
Abstract: Observers can easily assess how beautiful/ugly they consider an image to be. However, this aesthetics decision is influenced by both perceptual factors (which determine bottom-up neural processing) and cognitive factors such as contextual variables (which determine personal aesthetic preferences). This dualism makes the problem of predicting aesthetic responses particularly difficult from a computational point of view. In this work we simplify the problem by creating a database of images devoid of contextual information (i.e. "semantics") which contains only images of natural objects. To address the strong bias of such databases towards highly valued (beautiful) scenes, we incorporate images that were intentionally modified to make them "uglier". We then ask observers to evaluate the aesthetic value of every image using a crowdsourcing paradigm (10426 images, 100 valuations each). This unbiased, low-semantics database allows us to study the low-level visual properties that are more likely to explain observers' aesthetic response. Our results show that the strongest candidate is the "Chromatic contrast" (r= 0.513), followed by "Global Contrast" (r= 0.220), "Fourier Alpha Slope" (r= -0.209) and "Gamut Expansion" (r= -0.118). For comparison, we run the same analysis using a more traditional aesthetics image database (AVA, CVPR2012) with inconclusive or negative results.
Acknowledgements: CAP, MMG and XO are funded by the Ministry of Science and Innovation, Spain. (Ref. PID2020-118254RB-I00)

P08 **Title:** "Saccadic characteristics differ between different types of strabismus"
Authors: Elena Sanz[1], Mª Pilar Aivar[1], Jaime Tejedor[2]
Affiliations: (1) Facultad de Psicología, Universidad Autónoma de Madrid; (2) Facultad de Medicina, Universidad Autónoma de Madrid
Abstract: Previous studies have reported abnormal characteristics of eye movements in patients with strabismus. Unfortunately, the existing results are not entirely clear. An important shortcoming is that patients are not differentiated according to their type of strabismus. In this study, we analyzed saccadic eye movements of young strabismic patients suffering from intermittent exotropia or accommodative esotropia, comparing performance with that of controls. Participants were 28 children, of ages between 5 and 12 years old (11 cases of accommodative esotropia, 7 cases of intermittent exotropia and 10 controls). Eye movements were recorded while performing different tasks. To produce saccades a single image was presented at the center of the screen, which

jumped randomly to a new position. Displacements varied in direction and amplitude (10º and 15º left and right, 10º up and down). Saccadic latency and gain, and differences in eye position between both eyes were analyzed. We found significant differences in latency between the three groups, although variability was very high. Gain was most affected in cases of exotropia, showing significant differences between patients and controls for all saccadic directions except upwards. Gain was also significantly different between exotropia and esotropia, but only for saccades in the right direction. Esotropia patients also showed the biggest differences in eye position between left and right eye, which suggests possible problems in adjusting vergence.

These results show that eye movement parameters differ for each type of strabismus. An exhaustive analysis of each clinical subtype is needed to understand how these differences affect visuo-motor performance.

P09 **Title:** "Perception of Computer-Manipulated Scenes: A Pilot Study With People With Functional Diversity"

Authors: Lobato Rincón L.L.[1], Miguel Vicente C.[2], Martínez Madrid C.B.[3] & Medina Sánchez, M.A.[4]

Affiliations: (1) Department of Experimental Psychology, Cognitive Processes and Speech Therapy. University Complutense of Madrid. (2) Department of Social Work and Social Services. University Complutense of Madrid; (3) Department of Animal Medicine and Surgery. University Complutense of Madrid; (4) Department of Statistics and Data Science. University Complutense of Madrid.

Abstract: The perception of landscape in people with functional diversity has been an understudied area. For this reason, an experimental pilot study was designed with the dual aim of analysing the environmental perception of people with and without functional diversity and investigating the effect of altering digital images on their realism or declared preferences. Using an online questionnaire, the order and appearance of two environmental scenes of the Somosaguas Campus area (Madrid) were manipulated. In this way, the altered image was presented to half of the sample in first place (n=12) and in the second place to the other half (n=12). In total, 10 people with functional diversity of varied profile (physical, sensory, etc...) were evaluated. Among the findings obtained, we found that people with functional diversity use more general descriptions for the computer-altered images than people without diversity, who use assessments that include a greater number of environmental details. On the other hand, the familiarity, realism or affective evaluation of the images were analysed as a whole. As a result, it emerges that, for the whole sample, the first image presented always achieved better evaluation, while there is a tendency in the group with functional diversity to value the digitally altered photograph more highly. Although this is an exploratory study, the results indicate that there could be a greater vulnerability to altered images on the part of people with functional diversity and would allow us to know in the future under what conditions this phenomenon could exist.

Acknowledgements: The team would like to thank the workers of the AFADIS-UCM Special Employment Center for their involvement, as well as all the study participants.