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Opening Note

The Spanish Society of Experimental Psychology (SEPEX) was born from an agreement of 16 pioneering researchers from different Spanish universities, gathered in the University of Almería on July 1st, 1997, for its foundation. In that first meeting, the first statutes of SEPEX were drafted and the first Board of Directors was elected, whose composition partially changes every 2 years. The objectives of the Society are to promote the development of scientific knowledge in all fields of Psychology; promote research and the dissemination of its results among researchers and promote the relationship with national and international homologous societies and organizations; organize and promote scientific meetings; periodically inform members of the Society about activities related to Experimental Psychology. From its foundations in 1997, SEPEX has grown to more than 400 members and has become the referent in the field for the exchange of scientific research in Spain. From the first SEPEX Conference held in Granada in 1998 to the last one held in Almería in 2022, the Society has promoted the holding (on a biannual basis) of fourteen consecutive editions. All of them included plenary conferences given by Spanish and foreign researchers of recognized international prestige. The XIV SEPEX Conference at the University of Almería has featured 125 Oral Communications, including 9 Thematic Sessions, 113 written communications (Posters), one Emerging Researcher Award Lecture given by Dr. Garikoitz Lerma-Usabiaga (Basque Center on Cognition, Brain and Language), and three plenary talks. The Pio Tudela lecture given by Professor Nuria Sebastián (Universitat Pompeu Fabra, Barcelona), and the keynote lectures given by Professor Kimberly Noble (Columbia University, New York, USA) and Professor Michael Anderson (University of Cambridge, UK). This XIV meeting has also included a special symposium to commemorate the 25th anniversary of the foundation of SEPEX. In this symposium, 7 of the founding researchers have illustrated their beginnings in the field of psychological research, a good reflection of the conditions in which research was carried out in our country at that time. Through the presentation of their experimental work, they tried to explain the questions of interest in their respective fields of study, the resources and equipment they had at their disposal, and the various vicissitudes that usually accompanied research work at that time. You can find further information about SEPEX in <https://websepex.com/>

Plenary Lectures

Pío Tudela Lecture. Language learning throughout life

Nuria Sebastián

Pompeu Fabra University, Barcelona

Adults are amazed at how young children learn language in the first years of life. By six months of age they can recognize a few words, at 18 months they may say more than a hundred. This ease in language learning is in stark contrast with the difficulties that humans experience in learning a second language later in life. The concept of the existence of a "critical period" has been at the center of heated debates, with the hypothesis that language learning takes place in a continuous way throughout life contrasted with the hypothesis that different mechanisms are in place before and after the critical period. In the present talk I will review different types of evidence supporting and challenging the different points of view.

Plenary Lecture 1. Socioeconomic Inequity and Child Brain Development

Kimberly Noble

Teachers College, Columbia University, New Your, USA

Socioeconomic disparities in childhood are associated with notable differences in cognitive and socio-emotional development during a time when dramatic changes are occurring in the brain. Recent work has focused on understanding the neurobiological pathways through which socioeconomic factors may shape development. It is likely that socioeconomic factors operate via multiple mechanisms to explain the development of different neural circuits. A theoretical model will be presented whereby differences in the home language environment and family stress likely impact particular brain systems, which in turn support distinct neurocognitive skills. Evidence for the model, as well as ongoing and future work testing aspects of the model, will be discussed. Finally, the question of interventions will be addressed, along with an overview of early findings from the first US clinical trial of unconditional income support in early childhood.

Plenary Lecture 2. Brain Mechanisms Underling the Inhibitory Control of Thought

Michael Anderson

Cambridge University

Controlling action and thought requires the capacity to stop mental processes. Over the last two decades, evidence has grown that a domain-general inhibitory control mechanism supported by the right lateral prefrontal cortex achieves these functions. However, current views of the neural mechanisms of inhibitory control derive largely from research into the stopping of action. Whereas action stopping is a convenient empirical model, it does not invoke thought inhibition and cannot identify its unique features. Here I review research using a different model of inhibitory control that addresses how organisms stop a key process driving thoughts: memory retrieval. Retrieval stopping shares right anterior dorsolateral and ventrolateral prefrontal mechanisms with action stopping, consistent with a domain general inhibitory control mechanism; however, retrieval stopping also recruits a distinct fronto-temporal pathway that determines mental control's success. For example, GABAergic inhibitory networks within the hippocampus, driven polysynaptically by prefrontal input uniquely contribute to thought suppression. These unique elements of mental control raise the hypothesis that hippocampal disinhibition is a trans-diagnostic factor underlying intrusive thinking, linking the proposed fronto-temporal inhibitory control pathway to preclinical models of psychiatric disorders and to fear extinction. I suggest that transdiagnostic retrieval-stopping deficits underpin broad vulnerability to psychiatric disorders and are reflected in robust aberrations in large-scale brain network dynamics.

SEPEX Emerging Talent Award. Quantifying reliable MRI metrics in reading and vision

Garikoitz Lerma-Usabiaga

Basque Center on Cognition, Brain and Language (BCBL)

My research focuses on 1) utilizing behavioral, functional, and structural Magnetic Resonance Imaging (MRI) techniques to investigate the neural basis of reading and vision, and 2) developing advanced functional and structural MRI methods to further explore cognitive functions and enhance the reproducibility, validity, and generalizability of neuroimaging studies. In this talk, I will recount my professional journey, spanning the years before and after my formal scientific training, and present my primary research findings and ongoing research lines.

Thematic sessions

Thematic session 1. Experimental Advances in Numerical Cognition

Coord.: Ismael Gutiérrez-Cordero (UMA)

Do Numbers and Letters help each other? Evidence from Masked Priming

Ana Calviño

University of the Basque Country (UPV/EHU)

In this research report, we want to determine whether letters and numbers share the same identification process or if they are fundamentally separate. There are two positions on this issue: one that supports shared processing and another that argues letters and numbers only share visual identification processes. To explore this, we examine the temporal progression of facilitation between letters and numbers to determine whether both stimuli undergo a common identification process (resulting in facilitation) or if, conversely, the identification processes are distinct, suggesting that letters and numbers should not enhance each other. Continuing with this idea, we conducted two masked priming studies with university students. Participants had to decide whether the presented stimulus was a letter, number, or a different symbol. The primes were either similar to the target stimulus (e.g., 2-2, Z-Z, 2-Z, Z-2) or not (e.g., 0-2, Q-Z, 0-Z, Q-2), and belonged to the same category as the target or not. We found that the effects of perceptual similarity disappeared in pairs with different categories (letter-number or number-letter), suggesting an early categorical distinction between letters and numbers.

Representation of the magnitude of symbolic and non-symbolic fractions

Josefku Orrantia

University of Salamanca (USAL)

Although fractions are important both in the academic context and for being competent in everyday life, understanding them poses a particular challenge for many elementary students. In contrast to whole numbers, for which children have an implicit conceptual understanding from birth, it has been assumed that understanding fractions requires extensive formal instruction because quantities reflected in fractions are a relatively recent cultural artifact for which students lack any implicit knowledge. However, a growing number of studies suggest that we have a primitive system for processing nonsymbolic fractions that would serve as a basis for learning symbolic fractions. In fact, some studies suggest that the ability to process non-symbolic fraction magnitudes is related to the knowledge of symbolic fractions, although the findings on this relationship are not consistent. In this study, which is part of a larger project that analyzes rational number processing, we examined the association between non-symbolic and symbolic fraction processing in a sample of 320 students from 4th to 6th grade of elementary school. After controlling for intelligence, general mathematical competence, and integer processing, we found a significant, albeit moderate ($\beta = .22$), relationship between nonsymbolic and symbolic fraction processing. These results suggest that non-symbolic fraction magnitude processing may constitute a tool for building the foundations of fraction knowledge and are interpreted within the framework of the "Integrative Theory of Numerical Development", which postulates that the common core of numerical development lies in the understanding of numerical magnitudes.

The production of multi-digit numbers is not special: An error-based study in Aphasia

Ismael Gutiérrez-Cordero

University of Malaga (UMA)

The phenomenon Stimulus Type Effect on Phonological and Semantic errors (STEPS), by which people with aphasia (PWA) produce more phonological errors (e.g., pencil → fensil) with words and more semantic errors with numbers (e.g., twenty-seven → thirteen), can be hardly explained by classical models of language processing, as both types of errors would stem from different sources (impairments at phonemic level or the semantic system, respectively). The current work offers an alternative account to the Building Blocks hypothesis (proposed to explain the STEPS) based on interactive models of language processing, in which the different levels of the language system interact with each other. From an interactive perspective, semantic errors in numbers are expected regarding their high-lexical-frequency and the high memory load (usually multi-digits) and homogeneous context in which they are assessed (García-Orza et al., 2020). Two PWA with conduction aphasia, suffering from phonological deficits (one located at the phonological input buffer and the other at the phonological output buffer), who predominantly produced phonological errors during speech production, are assessed in three production tasks (naming, repetition, reading) with multi-digit numbers (e.g., 365), and color sequences varying in lexical frequency and sequence length. We found that high-frequency color-sequences (e.g., green-red-blue), like multi-digits, were produced with more semantic errors, while the phonological errors emerge again with low-frequency color-sequences (e.g., beige-mauve-ocher). In addition, we observed that length increased errors in number and color sequences rather than changing their nature. These findings lead to rejecting the Building Blocks hypothesis while adopting an interactive account, claiming that the STEPS is rather the result of the combination of both the intrinsic material properties (lexical frequency and memory load) and the evaluation context (semantic context) during clinical assessment. This study holds significant importance in the current discussion of language and number production models and the understanding of speech error mechanisms in aphasia.

Math performance and state- and trait-math anxiety: the mediating role of executive functions

Rocío Linares

University of Jaén

Emotions may influence performance on numerical tasks. We aimed to investigate the possible contribution of executive functions to explaining the well-documented negative relation between math performance and math anxiety (MA). We used a structural equation modeling (SEM) approach to comprehensively examine the potential mediating role of updating, inhibition, and switching in the relationship between state- and trait-MA with math performance. 205 undergraduate students completed three computerized tasks for each executive function along with MA questionnaires. Confirmatory factor analysis (CFA) confirmed the negative relationships between both state- and trait-MA and math performance, with trait-MA emerging as a stronger predictor of individual differences in math performance. Notably, among the different executive functions, only working memory updating mediated the relationship between MA and math performance. These findings are discussed in terms of their implications for views that have put forth an explanation for the detrimental effect of MA on math performance, particularly the deficit and interference proposals.

Thematic session 2. Insights from the interplay between semantic and episodic memories

Coord.: M^a Jesús Maraver (UGR)

Disentangling the contributions of semantic and inhibitory control processes in creative problem-solving

Raquel Lezama

University of Granada (UGR)

When confronted with everyday challenges, we often use past effective solutions and prior experiences to address them, even though some problems require novel and creative solutions. The generation of original, useful, and innovative ideas or solutions to problems requires the access and combination of distantly associated pieces of episodic and semantic-based information in memory as well as the downregulation of interfering traces that might hamper the creative process. Across three experiments, we investigated a) individual differences in associative processes in semantic memory and memory inhibitory control) and b) the brain activity associated with these processes contributing to creative behavior. In Experiment 1 (N = 124), we aimed to test whether larger semantic priming and inhibitory control were associated with more creative responses. With this aim, participants performed a lexical decision task, and a Remote Associates Test (RAT) after engaging in repeated selective retrieval (SR) of previously presented items. Critically, some RAT problems could be solved with words from earlier phases of the experiment, including those that might be less accessible due to inhibition while other problems required novel, non-presented words. Our results indicated that larger semantic priming with strong associates and inhibitory control indexes were associated with better RAT performance. In Experiments 2 and 3, transcranial direct current stimulation (tDCS) was used to investigate the distinct involvement of two relevant cortical hubs in semantic processing (the left anterior temporal lobe, IATL) and inhibitory control (right dorsolateral prefrontal cortex, rDLPFC) in solving creative problems. Experiment 2 (N = 64) showed that anodal tDCS over the IATL had a negative effect on the production of correct responses to baseline RAT problems but left unaffected those problems that required inhibited solutions. Experiment 3 (N = 40) yielded the reverse pattern with cathodal tDCS over the rDLPFC. Finally, before and after administering tDCS, resting-state EEG recordings were obtained, revealing site-specific changes in frequency bands induced by tDCS. Overall, this joint evidence underscores the involvement of semantic and control processes in creative problem-solving, which are linked to different brain networks.

The effect of episodic and semantic retrieval on creativity in children and adults

Guillermo Tomás

University of Granada (UGR)

Creativity has been related to the recombination of associations between distant concepts in semantic memory. However, recent studies have also highlighted that generating creative solutions also requires access to episodic information and the recombination of this information into new ideas (Gerver et al., 2022). Episodic Specificity Induction (ESI) (Madore et al., 2014) is a well-known procedure that has been shown to enhance episodic retrieval by biasing retrieval orientation into specific details of a video. ESI also improves performance in creative tasks (i.e. Alternative Uses Task, AUT), suggesting that these tasks engage not only the recombination of semantic associates but also the recombination of episodic information. ESI effects have been observed in older and younger adults, but they have not yet been studied in children. Developmental studies indicate that episodic memory is not fully developed in children and that the capacity to recall episodic information develops with the maturation of the prefrontal cortex (Shing et al., 2010). In two experiments, we study if ESI enhances children's episodic retrieval and if it transfers to creative tasks to the same extent in children and adults. We also evaluated ESI effects when the episodic induction was elicited by difficult materials (Experiment 1) or easy (Experiment 2) to integrate into a pre-existing schema. In Experiment 1 children (10-11 years old) and young adults watched a difficult-to-integrate video followed by an ESI or a control condition. Finally, they carried out a creativity task (AUT) in which participants generated as many unusual uses as possible for everyday objects. The same procedure was employed in Experiment 2 but using an easy-to-integrate material. Although no improvement was found in AUT following ESI, results showed that both young adults and children recalled more episodic details (vs. general/more semantic details) in the ESI condition when compared to the control condition. Interestingly, there were developmental differences in the proportion of episodic details depending on the integrability of the materials. Thus, in the more difficult-to-integrate condition, children reported fewer episodic details compared to younger adults (Experiment 1) but this pattern was reversed in the easy-to-integrate condition (Experiment 2). Results are discussed in terms of the interplay between episodic and semantic memory and their connection with idea generation.

Contextual incongruity triggers memory reinstatement and the disruption of neural stability

Lluís Fuentemilla

University of Barcelona (UB)

Schematic knowledge or schemas are internal models representing our environment and are considered fundamental in organizing our daily behavior by providing stability and predictability to our understanding of the world's structure. However, when an element within an unfolding event does not align with our schema-based expectations, it disrupts the coherent narrative, necessitating an update to our current event model. In this study, we investigated the neural mechanisms that support the perceived incongruence of an element within an unfolding event and its impact on memory. We conducted three experiments involving human participants who encoded images of objects following trial-unique sequences of events depicting daily routines. We found that neural stability patterns gradually increased during exposure to schema-consistent episodes and that the encoding of an object incongruent with the ongoing schema disrupted this stability pattern. The decrease in neural stability for low-congruence items occurred approximately 1000 ms after object encoding onset and was preceded by enhanced N400 ERP activity and increased neural reactivation of the just-encoded episode. Current results offer new insights into the neural mechanisms and their temporal orchestration that are engaged during the online encoding of schema-consistent episodic narratives and the detection of incongruity.

Have I told you this story before? The challenging dialogue between episodic and semantic processes on destination memory

Pedro B. Albuquerque

University Do Minho

Have I told you this story before?" In various contexts, such as classes, conversations with friends, or family gatherings, we often experience the embarrassment of being told, "You've already shared that story with me before!" Remembering to whom we've conveyed certain information relies on destination memory, which involves associating what is said with the intended recipient. Past research has consistently found that recalling the recipient of information (destination memory) is more challenging than remembering the source of the information (source memory). This imbalance has been attributed to differences in attentional focus and resource allocation. When sharing information, attention tends to be directed towards the transmitter and the content itself, leaving fewer resources available for encoding the association between the information and the recipient. This explanation is supported by studies demonstrating that an internal focus on personal details during transmission impairs destination memory. Research shows that when reporting personal information, the internal attentional focus decreases the resources available to associate that information with recipients, resulting in worse destination memory (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). We will deepen this discussion throughout the presentation of three experiments. Considering the poorer destination memory when participants transmitted personal facts was always compared with the transmission of interesting facts, in Experiment 1 (between-participants) and Experiment 2 (within-participants), we compared the generation and transmission of personal facts with the transmission of familiar proverbs. Again, the generation and transmission of personal facts hampered destination memory. Besides the type of information (personal vs. familiar proverbs), the conditions differed regarding the kind of process (generation and transmission vs. only transmission of information). In Experiment 3, we intended to clarify the influence of generation on destination memory since participants (1) transmitted and (2) generated and transmitted familiar proverbs and no significant differences in destination memory between the conditions were observed. In general, our experiments seem to support the assumption that transmitting personal information leads to worse destination memory, not because of participants but because personal facts drive the attentional focus to the self

Thematic session 3. The fallible but malleable nature of memory

Coord.: M^a Teresa Bajo (UGR)

Social network structure shapes the formation of true and false memories at collective level

Lluís Fuentemilla

University of Barcelona (UB)

Societal structures and theoretical models of memory organization share network-like features, suggesting potential mutual insights into how information spreads and shapes collective memories. Here, we used experimental manipulations of the topological structure in lab-created community networks during a computer-mediated conversational recall task of lists of words from a DRM paradigm to test a central premise from the spreading of activation account in cognitive psychology: the emergence of true and false memories. We hypothesized that social network structure, whether clustered or not, would influence the formation of true and false memories. We found that information exchange promoted true memories in clustered networks by reinforcing the mnemonic convergence of the community members' memories. Conversely, nonclustered networks lead to a greater number of false memories by increasing widespread cross-activation of nonoverlapping memories, blurring the boundaries between true and false memories. Current findings provide empirical evidence that mnemonic spreading within the social network influenced the emergence of true and false memories and highlight the dynamic interplay between network topology, memory dynamics, and collective knowledge evolution, shedding light on memory processes in both individual and social contexts.

Semantic activation and semantic control modulate episodic memory distortions: Evidence from non-invasive brain stimulation

Angel Fernández

University of Salamanca (USAL)

Research on memory distortions has consistently shown that presenting a list of words associated with a critical word not presented for study produces high levels of false recall and false recognition of that critical word (the DRM paradigm). There is strong behavioral evidence of a relationship between the memory illusion typically obtained with the DRM paradigm and aspects of semantic representation and semantic processing. These memory illusions have been shown to always depend on the existence of semantic relatedness between studied items and critical items, pointing to the central role played by the structure and dynamics of the representational systems supporting specific inter-item relations. There is also empirical evidence that the production of these kinds of memory distortions is reliably modulated by control mechanisms aimed at controlling error production at encoding and monitoring operations at retrieval. The presentation will summarize the results of three studies in which transcranial direct current stimulation (tDCS) was used to interfere with the either error generation or error control, by applying the stimulation over specific cortical regions while participants studied DRM lists. The results of recognition tests that followed the study of the lists demonstrated an effect of anodal stimulation that was dependent on the particular locus of stimulation. Applying anodal tDCS over the left anterior temporal lobe (ATL) led to a decrement in the rate false recognition, while the same type of stimulation applied over the right ATL did not significantly affect false recognition. The application of anodal stimulation over the left posterior middle temporal gyrus (pMTG) had the opposite effect, provoking an increment in the rate of false recognition of unstudied items. The effect of tDCS on the left ATL (false memory decrement), but not in the right ATL, is interpreted as evidence that this lateralized cortical region plays a critical role in the generation of semantically-related errors at encoding. And the effect of tDCS on the left pMTG (false memory decrement) is interpreted as evidence for the role of this cortical brain region as a key component within an anterior-posterior control network that regulates the intrusion of available but contextually-inappropriate semantic information.

Memory, is it easy to fool?

Malen Migueles

University of the Basque Country (UPV/EHU)

On the 25th anniversary of SEPEX, a review of research and presentations at previous meetings is made where the fragile power of memory has been highlighted. Working with ecologically valid materials, but emphasizing experimental rigor, I will present 3 lines of research showing various situations where the malleability of memory has been observed. First, using the post-event information paradigm popularized by Elisabeth Loftus, evidence will be presented on the impact of introducing false information into memory. In this case we will analyze which contents are easier to be introduced into memory as a Trojan horse. Specifically, we will analyze variables such as the type of suggested content (actions vs. details and central and peripheral information), emphasizing that there are some false contents that are remembered and recognized with great confidence in the response –as if they were really perceived facts– opposite to other contents that are more resistant to suggestion. However, it is not always necessary to include false information to see the malleability of memory and observe false memories. Thus, we have observed that, on many occasions, the activation of our prior knowledge is sufficient to distort memory. In a series of experiments, we obtained normative data for scripts, or scripts for different types of crimes such as a bank robbery, and observed that participants accept actions and details that, although absent in the presented material, are consistent with the participants' prior knowledge. These errors derived from the activation of our knowledge baggage are more accentuated in older people who, to compensate for their limitations, introduce erroneous data, confuse the origin of the information and give to their false memories a high confidence in their answer. A final line that we will analyze are the future thoughts of participants of different ages collected during confinement by COVID-19. Through experiments where participants had to evaluate sentences about the future after the pandemic or had to produce their own ideas and plans and recall them afterwards, we have observed a bias towards positivity. When recalling, participants transform the information to make it more positive and pleasant. This bias, also more accentuated in older people, shows that memory transformations and distortions would sometimes contribute to personal well-being and to compensate and resist in the face of a hard and complex situation

Learning from memory errors, did that really happen?

M^a Jesús Maraver

University of Granada (UGR)

Schacter's notion of the "fragile power" of memory is evident in its inherent susceptibility to various forms of distortion. Of the many experimental paradigms that exist for the study of memory distortions, sentences containing pragmatic implications are particularly useful for the study of memory errors that arise from the erroneous recall of events that did not occur - at the episodic level - but were rather inferred from semantic activation (Brewer, 1977; McDermott & Chan, 2006), when using examples from everyday situations. Because the malleable nature of memory not only acknowledges its limitations but highlights its strengths, research on errorful learning and memory updating has shown how memory failures can be corrected. This presentation will summarize the evidence from a series of experiments demonstrating that failed retrieval attempts can be amended when corrective information (feedback) is provided to allow memory updating and learning from errors. All experimental procedures involve the comparison of memory performance across retrieval tests before and after the presentation of corrective feedback, in healthy young adults and combining different methodological approaches. First, results from behavioral experiments have demonstrated that retrieval seems to enhance memory malleability, improving the incorporation of feedback, compared to restudy. Moreover, we have also observed that the mere presentation of feedback is already enough to correct memory errors, and it doesn't matter whether the feedback is simply corrective or incorporates additional metacognitive aids. Second, neurophysiological evidence from EEG recordings allows us to identify the neural mechanisms and the temporal course of error detection (e.g., N400 or Error-Related Negativity) and memory updating (e.g., theta brain oscillations). And third, using neuromodulation methods such as transcranial Direct Current Stimulation (tDCS) we can study the causal role of neural hubs in the generation of memory errors and their correction due to their role in semantic integration (e.g., the Anterior Temporal Lobe, ATL or memory encoding (e.g., Dorsolateral Prefrontal Cortex, DLPFC). Through the exploration of the cognitive and neural mechanisms of learning from errors, this research aims to contribute to a deeper understanding of memory retrieval and updating processes as adaptive properties of memory, which compensate for its failures.

Thematic session 4. Experimental studies of psychedelics in mental health

Coord.: Elena Martín-González (UAL)

Psychedelics and mental health: unlocking the therapeutic promise from animal models

Elena Martín-González

University of Almería (UAL)

It is expected that Mental Illness will be the main cause of disability in the world for 2030. Compulsivity, a key factor in the loss of control over behavior, is being considered as a transdiagnostic trait present in different disorders, such as obsessive-compulsive disorder, pathological gambling, addiction, and eating disorders. However, few therapeutic advances has been made in recent years in psychopharmacological treatments. Psychedelics are a new hope for the treatment of mental disorders, due to their plasmatic properties that promote structural and functional neuronal plasticity in circuits important for the proper functioning of the brain. Moreover, psychedelic specific action on the 5HT_{2A} receptor has been proposed as a possible explanatory mechanism of therapeutic effects. Our group has experience testing the effect of different drugs on a preclinical model of compulsivity, as well as mapping other behaviors associated with transdiagnostic symptoms. This presentation aims to show our most important results on the topic, having two differentiated parts.

First, we studied the effect of different substances on the compulsive phenotype of rats and explored the possible action mechanism. Second, we tested the potential therapeutic role of two agonists of the 5HT_{2A} receptor, ibogaine and tabernanthalog on transdiagnostic clinical symptoms such as compulsivity, anhedonia, anxiety, and reactivity to novelty. We will discuss the importance of the hallucinogenic component in the therapeutic effect and will evaluate these promising candidates of this substance as treatment for different neuropsychiatric disorders. The results might constitute new experimental evidences in preclinical models for the development of new psychopharmacological treatments.

Ibogaine as a promising tool for the treatment of substance use disorders

Genis Ona

Rovira i Virgili University (URV)

Ibogaine, a psychoactive compound derived from the *Tabernanthe iboga* shrub, primarily found in Central West Africa, is positioning as a promising candidate for the treatment of substance use disorders. Our group has performed pharmacological and clinical research with ibogaine. This presentation is an overview of these studies. We will delve into the multifaceted pharmacodynamics/pharmacokinetics of ibogaine, illustrating its unique mechanism of action on the central nervous system, with a particular focus on its interaction with multiple neurotransmitter systems, including serotonergic, dopaminergic, and glutamatergic pathways. Furthermore, the presentation will highlight significant clinical research outcomes, emphasizing ibogaine's potential in treating substance use disorders, notably opioid dependence, by mitigating withdrawal symptoms and reducing both drug tolerance and cravings. Ethical considerations, including the cultural significance of ibogaine in traditional practices and the need for integrating indigenous knowledge with contemporary medical research, will be also examined.

Evaluation of the antidepressant effect of psilocybin in an animal model of disease

Jorge Emilio Ortega

University of the Basque Country (UPV/EHU)

Depression and anxiety are invalidating and high incidence mental disorders characterized by phenotypic heterogeneity. Currently available treatments show severe limitations. Thus, there is an urgent need for effective treatments in this population. In the search for novel rapid-acting antidepressants, the psychedelic psilocybin has emerged as a promising therapy in several clinical trials. Nevertheless, the role of psychedelic-induced subjective effects in therapeutic outcomes is still debated. In order to address these issues, preclinical evaluation of psilocybin treatment in translational animal models of disease is imperative. First, we aimed to study in vitro pharmacological profile and in vivo acute mechanism of psilocin/psilocybin. Competition binding studies with psilocin were performed in brain and cell cultures. The role of 5HT_{2A}, 5-HT_{2C} and 5-HT_{1A} receptors on the psychosis-like head-twitch response (HTR) and on body temperature in mice after psilocybin administration were evaluated. In addition, a dose-response study for acute psilocybin-induced head-twitch response was performed in order to support dose finding for psilocybin long-lasting effects evaluation. Secondly, chronic unpredictable mild stress (CUMS) mouse model of depression was treated with psilocybin (1 mg/kg, i.p.) and a wide behavioural evaluation was conducted. Psilocybin reversed impairments in anhedonia and behavioural despair dimensions of depressive phenotype but not in apathy-related behaviour. Anxiety-like phenotype was also improved by the drug. Physiological alterations caused by stress, indicative of a hyperactive hypothalamic-pituitary-adrenal axis (HPA), were not reversed by psilocybin. When neuroplasticity-related proteins were assessed in cerebral cortex, brain-derived neurotrophic factor (BDNF) was found to be decreased in stressed animals, and treatment did not reverse such impairment. Psilocybin administration increased expression and function of serotonin-2A- receptor (5HT_{2A}R) in brain cortex of control and CUMS groups. However, psilocybin treatment caused a selective increase in the expression of glucocorticoid-receptor (GR) in brain cortex of CUMS mice.

Altogether, this work provides new knowledge on the behavioural actions of psilocybin and contributes to the understanding of the therapeutic mechanism of action of psychedelics.

Thematic session 5. On the neuro-affective response to violation of expectations

Coord: Manuela Ruzzoli (BCBL)

The “sweet spot” of cognitive conflict

Marta LaPietra

Basque Center on Cognition, Brain and Language (BCBL)

Cognitive conflict is an effective trigger for control, flexible behaviour, and adaptation. It is considered effortful, detrimental to performance and affectively aversive. However, converging evidence also indicates that, when successfully resolved, cognitive conflict has positive consequences. In this talk, we propose a radical change in perspective advocating that some degree of cognitive conflict can be beneficial for subsequent performance or pursued, instead of, as commonly assumed, be a cost or aversive. First, we will examine if instances of cognitive conflict can positively impact subsequent cognitive processes and, therefore, human behaviour. In a second experiment, asked participants to decide how much cognitive conflict they wanted to perform at each block of a Stroop task and to rate enjoyment, mental effort, and emotional state on an Arousal- Pleasantness grid. Altogether, our findings challenge the inherently aversive nature of cognitive conflict, highlighting its potential for positive engagement and enhanced performance, paving the way for a more nuanced understanding of the cognitive processes involved.

Conflict regulation in flavour perception: A unitary framework for perceptual and hedonic responses

Salvador Soto-Faraco

Universitat Pompeu Fabra

For many, flavour is the quintessential multisensory experience. The perception of flavour arises from the concurrent processing of inputs across a wide variety of sensory modalities, including but not limited to taste, smell, sound, several somatosensory channels as well as a range of other cues that help generate expectations about the flavour object (visual cues, smell through the nose, contextual cues, etc). For these bundles of inputs to be experienced as a unitary flavour percept, and to lead to a positive hedonic response, a certain degree of agreement between them is necessary.

Remarkably, despite the mounting amounts of empirical evidence currently available, a framework to understand the processes triggered by sensory (in)congruence in flavour perception is lacking. Here, we consider the psychophysical, cognitive, and neural mechanisms related to flavour congruency within the framework of conflict monitoring. More specifically, we argue that brain mechanisms monitoring for, signalling, and eventually orchestrating the resolution of sensory discrepancies are decisive for the emergence of a unified subjective flavour percept, and its associated hedonic appraisal. This framework could help to elucidate certain well documented facets of the experience of flavour such as attentional processes, hedonic responses and perhaps even expectancy effects as well as suggest new avenues for future research.

The investigation of music curiosity in laboratory and ecological settings

Laura Ferreri

University of Pavia; Italy

Curiosity is an intrinsically motivated information-seeking state characterized by a momentary desire for knowledge which can be influenced by novelty, complexity and expectation violation and is associated with reward, learning, and control processes in the brain. Here, we aimed to study curiosity through a unique, rewarding stimulus: music. Music is able to induce surprise and uncertainty in listeners as it unfolds, thus modulating curiosity states. However, how music curiosity is ignited, and influence behaviour remains an unexplored question. In the first experiment, we developed a music curiosity trade-off paradigm, and we computed the amount of money (cost) that participants (n=58) would be willing to pay to obtain the possibility to keep listening to a new song (exploration option), to which they were shortly pre-exposed (10 s). Instead, they could decide on listening to their preferred rewarding, well-known songs (exploitation option). Results showed that curiosity experienced in the first 10 s of exposure increased the willingness to sacrifice money for discovering new music, being as well associated with individual sensitivity to music reward.

Furthermore, we observed that music associated with higher curiosity states was also associated with better long-term memory performance. In the second experiment, we translated this paradigm into an ecological setting, measuring curiosity in an electronic music festival (SONAR-I+D). A DJ presented previously unreleased new songs and participants (n=150) rated their curiosity, pleasure, and absorption at the end of each song. Using a similar trade-off task as in the first experiment, we were able to replicate the findings by computing the cost of curiosity in each participant and its influence on decision-making and memory performance. The present research provides new information regarding how curiosity in music is ignited and its important relation with intrinsic reward motivational components and memory modulations.

Cognitive model types in cross-domain clashes

Ines Lozano

Polytechnic university of Valencia (UPTV)

Within Cognitive Linguistics, Lozano and Ruiz de Mendoza (2022) have explained irony as a clash between two scenarios: an epistemic scenario and an attested scenario. The epistemic scenario captures any expectations that the participants in the production or detection of irony judge likely or certain to occur. On the other hand, the attested scenario is built on what is observable to the interpreter. The interpreter's detection of this clash results in the derivation of an attitudinal element of standard dissociation that is then parametrized contextually. Both verbal and situational irony rely on the identification of a contradiction and a reversal of their expectations with regards to a certain state of affairs. In verbal irony, the epistemic scenario is built on an echo. The echoic component of irony was introduced by Relevance Theory, which claims that irony involves echoing a thought or a belief and expressing an attitude towards it (Wilson & Sperber, 2012). The approach proposed by Ruiz de Mendoza and Lozano (2019ab, 2020) takes this premise and builds it into a broader account of irony where ironic meaning arises from an inferential process.

Take a situation where two friends discuss the likelihood of Barça FC winning the next Champions League. David believes the team will win, but Charles disagrees. When Barça wins, David remarks: Yeah, right, Barça; they're absolute losers! David's expression of agreement, marked off by two adverbs and an echo, sets up an epistemic scenario about Charles's belief that it was unlikely that Barça would win. Its reliability then has to be evaluated against the facts arising from the observable scenario (the fact that Barça did not win). In situational irony, the epistemic scenario takes the form of a generally reliable assumption about a state of affairs. An event that may be perceived as ironic is finding a pilot who is afraid of heights. The epistemic scenario contains the assumption that it is highly unlikely that someone whose job is to drive a vehicle that circulates high up in the air will have fear of heights. Postulating epistemic scenarios introduces a degree of systematicity in the study of irony, since it makes it possible to bring together verbal and situational irony into a single unified framework. The present study further analyses instances of various kinds of irony by relating their meaning effects to the different types of epistemic scenario involved in their creation.

Thematic session 6. Brain and cognitive signatures of physiological strain states

Coord.: Luis Ciria (UGR)

Neurophenomenological dynamics of mental content during breathwork

Tristán Bekinschtein

Cambridge University

The relationship between the physiological states and its dynamics with the brain and behavioural processes has been governed by the Dodson-Yerkes Law (inverted U-shaped curve) between arousal and performance. These states of low and high arousal can be defined in terms of physical and emotional arousal, but the dimensions of altered states of consciousness (ASC) such as drug-induced or breathing-induced psychedelics are not captured by the law nor they are commonly included in a common framework. I will take this opportunity to set some theoretical guidelines and experimental evidence to include psychedelic breathing within the arousal-brain-behavioural framework in a way that the interpretation is compatible with the work in exercise and transitions to sleep experiments. Breathwork is a term for an understudied school of practices that involve the intentional modulation of respiration to induce an altered ASC. We map here the neural dynamics of mental content during breathwork, using a neurophenomenological approach by combining Temporal Experience Tracing, a quantitative phenomenological methodology that preserves the temporal dynamics of subjective experience, with low-density portable EEG devices for every session.

Participants completed a series of up to 28 breathwork sessions - of 20, 40 or 60 minutes - in 28 days, yielding a neurophenomenological dataset of 301 breathwork sessions. Using hypothesis-driven and data-driven approaches, we found that 'psychedelic-like' experiences that occurred within the breathwork sessions were associated with increased neural Lempel-Ziv complexity and aperiodic exponent of the power spectral density (PSD) - but not alpha power. These neural measures map both a data-driven complex composite of positive experiences, and hypothesis-driven aspects of positive psychedelic-like experience states such as high bliss that can be frames both in terms of physical and emotional arousal.

Multisensory redundancy effect during the wake-sleep transition

Clara Alameda

University of Granada (UGR)

A basic principle of multisensory research posits that our ability to make adaptive responses arises from the combined action of our senses in producing a coherent multimodal representation of the external world by exploiting redundancies. This beneficial multisensory phenomenon, called the “redundancy effect”, manifests behaviourally as faster responses when two redundant stimuli (from different senses) appear together, as compared to when a single stimulus appears. Despite extensive research has repeatedly shown this effect, it is not clear whether it is modulated by the individual’s level of alertness, and if so, to what extent it affects early sensory integration. In the present study, we presented a multisensory detection task to easy-sleepers while naturally fluctuating between attentive wakefulness and drowsiness in a comfortable reclining armchair. They were instructed to respond as quickly as possible to (a) somatosensory, (b) auditory, and (c) simultaneous spatially aligned auditory- somatosensory stimuli, while their brain activity was recorded with electroencephalography (EEG).

After classifying trials as “awake” or “drowsy” based on EEG time-frequency, we have combined behavioural, computational, ERPs and MVPA analyses to determine whether audio-tactile interactions occur via similar spatiotemporal neural mechanisms under reduced alertness. Together with a systematically worse overall performance in drowsiness compared to wakefulness, our results suggest that some dimensions of multisensory processing may be modulated by reduced alertness.

Beyond the limit: characterizing the neural dynamics of physical exhaustion

Chiara Avanzini

University of Granada (UGR)

Reaching maximal physical exertion is a complex transition associated not only with a reduction of our capacity to exercise, but also with brain function, perception and phenomenological experience fluctuations. During aerobic exercise, heart and respiratory rates increase, facilitating oxygen transfer to muscles. As exercise intensity rises, a transition to anaerobic metabolism occurs, leading to the anaerobic threshold (AT) where anaerobic mechanisms supplement aerobic energy production. Eventually, individuals reach the volitional exhaustion threshold (VET), unable to sustain required power output. Traditional paradigms focus on metabolic and cardiorespiratory indices, but fail to accurately identify individual exhaustion points. In this study, we aimed to characterize the neural dynamics and adaptations during physical exhaustion, determining the maximum effort threshold and identifying markers of voluntary exercise cessation.

We employed EEG and cardiorespiratory monitoring during cycling tests to exhaustion. Thirty participants cycled on a stationary bike starting at low resistance (120 watts). Every 5 minutes, the resistance of the bike was increased to produce an increment in power output of 30 watts. Participants were instructed to maintain a regular pedaling cadence despite the resistance increment until they felt they could no longer continue due to exhaustion. Hence, participants were consistently pushed beyond their AT to VET. During the test, participants were presented with a passive task in which they heard tones of different pitches. To capture nonlinear neural changes associated with exhaustion and voluntary exercise cessation, we measured the complexity of the EEG signal with compressibility algorithms and changes in connectivity with nonlinear information sharing measures. Furthermore, we assessed changes in perceptual auditory representations with multivariate analysis. Overall, this study offers insights into the neural underpinnings of strained states characterized by extreme physiological activation.

The Temporal Dynamics of Metacognitive Experiences Track Rational Adaptations in Task Performance

Luc Vermeylen

Katholieke Universiteit Leuven

Human task performance elicits diverse subjective metacognitive experiences, such as boredom, effort, fatigue and frustration, which are thought to play important roles in the monitoring and regulation of cognitive processes. Yet, their specific contributions to task performance remain poorly understood. Therefore, we investigated the temporal dynamics underlying these metacognitive experiences and the cognitive processes supporting task performance. We used a time-on-task design using a conflict Flanker task, and analyzed the data using a multi-methodological approach involving behavioral, model-based, subjective, and neural measures. Our results show that the temporal dynamics supporting task performance can be understood as a rational attempt to optimize behavior and that distinct metacognitive experiences track different aspects of this rational endeavor. These findings suggest that metacognitive experiences act as tools for humans to gain insights into the optimality of their cognitive performance.

Thematic session 7. Meta-science in Psychology: Evidence from the past, reflections in the present, solutions for the future

Coord.: Rafael Román Caballero (UGR)

Perverse incentives in research on unconscious cognition

Miguel A. Vadillo

Autonomous University of Madrid (UAM)

In an ideal world, researchers would be rewarded for producing high-quality research but, sadly, that's not the world we live in. Research assessment is often focused on proxies for research quality, like the number of publications or their impact factors. Researchers who neglect those metrics might not make ends meet, even if their research is brilliant. It has been suggested that this structure of incentives leads to the natural selection of bad science, characterized by questionable research practices and high publication bias. But the impact of perverse incentives on research quality might be quite different across scientific disciplines and research problems. In this talk, I will argue that research on unconscious mental processes suffers from particular problems and biases. Quite unlike research in other areas, studies on unconscious cognition gain popularity or influence because some crucial contrasts fail to reach statistical significance. For instance, claiming that an experimental manipulation influences behavior through unconscious and automatic processes often requires evidence that the manipulation does not affect consciousness, is not affected by age or neurological conditions, or operates independently from working memory resources. In all these cases, finding non-significant results is crucial, which sets strong incentives for relying on underpowered tests and insensitive measures with poor psychometric properties. The solutions typically offered to fix the so-called "replication crisis" tend to focus on reducing false positives and, consequently, they might not necessarily work in this context, where it is false negatives we should be concerned about.

Prevalence of preregistration in Psychology: an empirical assessment (2013-2023)

Alejandro Sandoval

University of Murcia (UM)

Among the various proposals aimed at achieving transparent and high-quality research, preregistration has rapidly gained popularity among psychology researchers. Preregistering a study involves publicly sharing a timestamped document containing research questions, hypotheses, methods, and analysis plans before data collection or analysis. Benefits of preregistration include distinguishing confirmatory from exploratory research and preventing questionable research practices. Nevertheless, it has also faced criticism for requiring more effort and time, and potentially limiting creativity and exploration. Current estimates of its prevalence in psychology remain scarce and are limited to certain types of research. Additionally, other important aspects related to preregistration remain understudied. In our study, we will estimate the prevalence of preregistration over the last decade (2013-2023), considering all psychology subdisciplines and types of research for which preregistration has been suggested to be beneficial. Furthermore, we will present information regarding the stage at which studies are preregistered and the number of preregistered studies that disclose any deviation from the preregistration, examining whether the rates found have changed over the years.

Beyond outright fraud: how cognitive biases can affect scientific inferences

Fernando Blanco

University of Granada (UGR)

In the context of the credibility/replication crisis in Psychology, p-hacking has been described as one of the questionable research practices that help understand some worrying phenomena such as the abundance of false positives in the literature, or the difficulty in replicating certain phenomena. Although p-hacking and other questionable research practices have been generally portrayed as fraudulent, this characterization is likely incomplete. It is also useful to understand them as a manifestation of certain cognitive biases that are inherent to all human beings, such as confirmation bias, hindsight bias, or causal illusion. Although the scientific method provides us with tools to avoid errors that stem from human limitations (e.g., calculating p-values to make decisions), very often these tools are not enough, or they are not used in the appropriate manner to ensure that scientists arrive at safe conclusions. In this presentation, we will reflect on how these biases can affect scientific inference and discuss some ways to mitigate them.

Statistical power of random-effects meta-analyses

Rubén López-Nicolás

Autonomous University of Madrid (UAM)

Underpowered studies are ubiquitous in psychology and related disciplines. Meta-analysis can help alleviate this problem, increasing the statistical power by combining the results of a set of primary studies. However, this is not necessarily true when we use a random-effects model, which is currently the predominant approach when carrying out meta-analyses. In this study, we examined the statistical power of a sample of 141 meta-analyses. Additionally, we compared the estimated statistical power of these meta-analyses with the power of the individual studies that comprised them. To do so, we used different analytical approaches and a Monte Carlo approach. The statistical power of random-effects meta-analyses was computed under different values of the true effect size and levels of heterogeneity. Our results show that under certain scenarios, the hypothesis test of the null hypothesis of no average effect is underpowered, even showing a lower statistical power than the average or maximum statistical power of included primary studies. Overall, these scenarios were characterized by high heterogeneity and a low number of included studies. While this pattern is expected, our findings show the steepness of this drop in statistical power. These results are discussed in light of the statistical and conceptual basis of random-effects meta-analysis.

Thematic session 8. The interplay between language, memory and attention in bilinguals

Coord.: Alejandra Marful (UGR)

Language effects in prospective memory

Cristina López Rojas

University of Granada (UGR)

Over 65% of the global population regularly use two or more languages in their daily life tasks and in many situations (e.g. academic, professional, etc.) that require the recall of past information or the retrieval of future intention (prospective memory, PM). The present studies aim to investigate the interplay between memory and language in bilingual individuals. The aim is to understand whether language experience and the language in which memory retrieval is performed modify the processes required for successful remembering in the context of prospective memory tasks (PM, the recall of future intentions). In our studies, we use a linguistic task (e.g. lexical decision, sentence comprehension, picture naming) as the ongoing (ON) activity and we instruct the participants to create an intention and provide a different response (PM intention) when a prospective cue is presented during the ON-task. In the experiments we manipulate the language in which the task is performed (Spanish/English) and the type of cue (focal vs non-focal) in bilinguals with different language experiences. Behavioral results revealed a notable impairment in the recall of future intentions when the task is conducted in L2. This impairment is particularly pronounced in more demanding conditions, indicating that heightened attentional demands resulting from L2 processing hinder the processes necessary for prospective remembering. In contrast, behavioral and event-related potential (ERP) results indicated that bilinguals differed in their performance on the prospective task in L1 when compared to monolinguals. Specifically, bilinguals showed larger differences between the ongoing activity and the prospective task in the N300 and P3b components when performing the more difficult non-focal PM task, indicating that they engaged in monitoring/updating to adjust to the task's demands. However, these differences were not observed in late bilinguals, suggesting that prospective processing is dependent on the bilingual experience.

Overall, our findings suggest that PM is influenced both positively and negatively by prior bilingual experience. Whereas event-related potentials (ERP) data suggests that bilinguals engaged in monitoring processes to a greater extent than monolinguals during PM tasks, when bilingual participants are asked to complete the task in their second language, their performance is generally impaired compared to their first language.

Language proficiency and false memories

Soledad Beato

University of Salamanca (USAL)

Our research focused on unravelling the impact of language on false memory, seeking to understand the cognitive processes involved in bilingual contexts. Specifically, across different studies, we aimed to contribute valuable insights into the intricate interplay of language proficiency and associative strength on false recognition in the Deese-Roediger-McDermott (DRM) paradigm. To achieve this, we constructed new DRM lists using both Spanish and English free association norms, enabling us to control the associations between studied items and critical lures. Participants included both native Spanish and native English speakers, and depending on the studies, DRM lists were constructed based on forward associative strength (FAS lists) or backward associative strength (BAS lists). Regarding the role of language proficiency on false memory, our studies consistently revealed that false memory rates were higher when critical lures were studied and tested in participants' dominant language (L1) compared to their non-dominant language (L2). This held true for both native English speakers acquiring Spanish as L2 and native Spanish speakers acquiring English as L2, and irrespective of whether the lists were FAS or BAS. Additionally, concerning false recognition in L2, we demonstrated that highly proficient speakers in L2 exhibited higher false memory rates than those with lower proficiency, emphasizing the role of automatic concept access in false memory formation. To further delve into the influence of language proficiency on false memory, we examined whether language proficiency's effect on false memories was observed when DRM lists varied in associative strength. We constructed DRM lists that varied in associative strength (high-BAS lists vs. low-BAS lists) and included native Spanish speakers with high, intermediate, or low English proficiency. For the first time in literature, our results showed that false recognition was higher in high-BAS lists than in low-BAS lists in both L1 and L2, although BAS had larger effects in L1 than in L2.

The bilingual effects on cognition in Balkan bilingual populations and the socio-affective-linguistic context: Lessons learnt and new directions

Ana Vivas

City College, York University, Grecia

I will present research that spans over a decade on four relatively homogeneous non- migrant and migrant bilingual populations in South East Europe, which investigates bilingual effects on cognition and potential modulations by socio-cultural, affective and language factors. We have assessed over 800 bilingual and monolinguals participants across the life span (children, adolescents, young and older adults), using a wide range of cognitive tasks, as well as measuring socio-educational (e.g., acculturation, school environment), affective (e.g, parental encouragement, affective attitudes toward the language) and linguistic (e.g, linguistic similarity between languages) factors. Overall, we have not found systematic evidence for a positive effect of bilingualism on a wide range of cognitive processes, measuring mostly executive functions but other processes as well. However, important lessons can be learned from the research conducted in this field.

Metacognitive processes in second language learners

Marta Reyes

University of Granada (UGR)

The use of a second language (L2) is now common for a significant portion of the world's population. L2 use is evident across different contexts, where individuals with different L2 proficiency levels read, learn, and make decisions using their L2 (particularly English). Hence, students with lower L2 proficiency levels may struggle learning and memorizing information in an L2 since L2 processing may be cognitively demanding and influence the processes involved in learning. Previous research suggests that L2 processing may overload cognitive systems due to language control needs, potentially compromising metamemory processes and cognitive resources required for learning.

This research aimed to examine the effects of L2 studying on the interplay between memory monitoring and control and whether L2 proficiency influences these two metacognitive processes. Across five experiments, we manipulated different features that could be used for learning monitoring: a perceptual cue such as font type, a lexical-semantic cue such as concreteness, a semantic-relational cue such as relatedness, and an organizational cue such as cohesion. University students provided judgments of learning (JOLs) as a measure for learning monitoring for materials studied in both L1 and L2. Despite expectations, studying in L2 did not compromise the monitoring process of learning. Participants, regardless of their proficiency level, accurately judged the materials in L1 and L2, by using language and other features as cues to assess the difficulty of the materials.

More interestingly, data from the memory tests broadly validated the pattern observed in the study phases with the JOLs, showing accurate monitoring in L1 and L2. Moreover, participants tended to predict worse performance (i.e., gave lower JOLs) in L2 yet this pattern was mediated by contextual factors such as the order in which each language was studied, especially with simple studying materials (e.g., words). Overall, the findings suggest that monitoring strategies are preserved in both L1 and L2 contexts, demonstrating that individuals, regardless of their proficiency level, can effectively monitor study materials irrespective of the language in which they are presented. We discuss these effects in terms of current metamemory theories and theories regarding L2 memory representations.

Thematic session 9. Measuring individual differences with experimental tasks: current pitfalls and future directions

Coord.: Francisco Garre Frutos (UGR)

Can the reliability of the contextual cueing task be improved?

Miguel A. Vadillo

Autonomous University of Madrid (UAM)

Many studies have explored individual differences in visual statistical learning, often failing to find any associations. For instance, contextual cueing, a popular attentional learning effect, has been found to be stable across age groups and neurological conditions. It also seems to be independent from participants' conscious awareness and from working memory resources. Crucially, all these claims rely on the assumption that the contextual cueing task can capture individual differences in visual statistical learning. But the evidence available so far suggests that this assumption is poorly supported by empirical data. Our previous research suggests that the reliability of the measures collected in contextual cueing experiments is typically between .40 and .50, clearly insufficient for its use in studies exploring individual differences. In the present work we report the results of two new experiments where we tried to improve the reliability of the task by introducing a series of manipulations aimed at increasing between-participant variability. We also submitted the data to a multiverse analysis to explore whether specific data preprocessing pipelines result in more reliable estimates. We found that it is possible to achieve modest gains in the reliability of learning and awareness measures collected with this task, although the psychometric properties still leave much to be desired.

Evaluation of the Permutation-Based Split-Half Reliability in Experimental Paradigms for Habit Induction in Humans

Pablo Martínez

University of Málaga (UMA)

Animal models' literature has postulated that repeating an action with enough frequency transforms it from goal-directed to habitual. In contrast to goal-directed, habitual behaviour is commonly accepted as unsensible to outcome value changes, inflexible, and guided by the specific context where it was formed. However, recent experimental studies in humans could not reproduce key results with animals. This fact has meant a crucial translational problem, requiring a valid procedure for inducing habits in humans. Since a measure cannot be valid if it is not reliable, the current study proposes an evaluation of the reliability of these experimental tasks in humans. To this aim, we re-analyse public data from eight different studies and seven experimental paradigms and calculate the internal consistency of their measures through split-half correlation via permutations, which has been proposed as an approximation to Cronbach's alpha. Subsequently, we meta-analyze the internal consistency of the measures in the experimental paradigms for habit induction and offer some recommendations about which experimental conditions would favour better reliability in new tasks. Specifically, some of these suggestions are relative to the length of the test phases (more or fewer trials), the test approximation or the amount of overtraining. The conclusions from this work will promote the development of more reliable tasks and well-powered replications of the previous studies.

Attention-Deficit/Hyperactivity Disorder Symptoms as Function of Arousal and Executive Vigilance: Testing the Halperin and Schulz's Neurodevelopmental Model in an Adult Community Sample

Tao Coll-Martín

University of Granada (UGR)

In this presentation, I intend to illustrate how the implementation of recent methodological recommendations can improve the transparency and severity with which theoretical predictions are tested in the field of individual differences, specifically in the neurodevelopment of attention-deficit/hyperactivity disorder (ADHD) symptoms. Halperin and Schulz's neurodevelopmental model postulates that the onset of ADHD in childhood is due to subcortical alterations, whereas the disorder trajectory into adulthood depends on the development of executive functions. Based on a dimensional framework of ADHD, Coll-Martín et al. (2021) found support for the model in an adult community sample assessed in arousal and executive vigilance. The present study is a preregistered (<https://osf.io/tkdq7>) close replication of Coll-Martín et al. with stricter control of statistical error rates to test the two hypotheses of the model. A sample of university students (N = 292 valid; 49% women) completed self-reports of ADHD symptoms in childhood (retrospectively) and adulthood and performed the online version of an attentional task (the ANTI-Vea). Our preregistered hypotheses achieved an acceptable statistical power for the effects of interest, even after accounting for random measurement error. Despite this, only the unexpected negative correlation between executive vigilance and symptoms in childhood was significant, therefore refuting the theoretical predictions. Similarly, neither multiverse nor exploratory analyses supported the dissociation pattern proposed by the neurodevelopmental model. ADHD symptoms across the lifespan may be pathophysiologically identical, at least in terms of vigilance. Future studies could include complementary assessment methods and clinical groups.

An online replication and multiverse reliability analysis of value-Modulated Attentional Capture

Francisco Garre-Frutos

University of Granada (UGR)

Stimuli predicting rewards are more likely to capture attention, even when they are not relevant to our current goals. Individual differences in value-modulated attentional capture (VMAC) have been associated with various psychopathological conditions in the scientific literature.

However, the claim that this attentional bias can predict individual differences requires further exploration of the psychometric properties of the most common experimental paradigms. The current study replicated the VMAC effect in a large online sample ($N = 182$) and investigated the internal consistency, with a design that allowed us to measure the effect during learning (rewarded phase) and after acquisition, once feedback was omitted (unrewarded phase). Through the rewarded phase there was gradual increase of the VMAC effect, which did not decline significantly throughout the unrewarded phase. Furthermore, we conducted a reliability multiverse analysis for 288 different data preprocessing specifications across both phases. Specifications including more blocks in the analysis led to better reliability estimates in both phases, while specifications that removed more outliers also improved reliability, suggesting that specifications with more, but less noisy, trials led to better reliability estimates. Nevertheless, in most instances, especially those considering fewer blocks of trials, reliability estimates fell below the minimum recommended thresholds for research on individual differences. Given the present results, we encourage researchers working on VMAC to take into account reliability when designing studies aimed at capturing individual differences and provide recommendations to improve methodological practice.

Oral sessions

Oral Session 1. Language

Age-related decline in agreement resolution: an eye-tracking study in Spanish

Victoria Cano-Sánchez, Itziar Laka, Mikel Santesteban

University of the Basque Country (UPV/EHU)

Introduction: Language processing in aging, particularly regarding grammar, is understudied. This study focuses on agreement, a delicate and cognitively fragile syntactic dependency (Garaffa, 2009). Older adults (OAs) are more vulnerable to agreement errors and illusions compared to younger adults (YAs). A few previous studies have shown that OAs take longer to process ungrammatical sentences and make more agreement attraction errors (e.g., *The key to the cabinets were rusty) than YAs (Cano-Sánchez et al., 2021; Reifegerste et al., 2020; Reifegerste et al., 2017). Experiment: To evaluate these aging effects on agreement attraction in Spanish, we recorded the eye-movement patterns of 44 younger (18-34 years; $M=28.5$, $SD=7.7$) and 48 older (60-80 years; $M=64.0$, $SD=5.6$) healthy native Spanish speakers during a sentence-reading task. We created 60 experimental sentences in four conditions by manipulating the agreement of the head noun phrase with the plural verb (grammatical/ungrammatical) and the agreement of attractor nouns with the verb (singular/plural). It was predicted (prediction 1) that OAs would show larger grammaticality effects and commit more grammatical (e.g., erroneously accepting “with the designs MASC.PL. never won [...]” as correct) attraction errors (prediction 2). Discussion: (G)LME analyses at the verb region revealed main effects of group, grammaticality and attractor, with larger fixations and more regressions for OAs vs YAs, in ungramm. than gramm. sentences, and in singular vs. plural attractors. An age group by grammaticality interaction was found in Regression Path Duration, with larger grammaticality effects for OAs than YAs. Additionally, in Total Time Duration attraction effects were significant only in ungrammatical sentences, showing a grammatical asymmetry of attraction effects (Wagers et al., 2009). This grammaticality illusion created by plural attractors in ungrammatical sentences was also observed in Regressions-In at the subject region. Importantly, this asymmetry was found only for OAs, as revealed by a three-way interaction at the verb region at Total Time Duration. YAs did not show any attraction effects. Conclusion: The findings suggest that in ungrammatical sentences, OAs fixate more on the verb and show more regressions between the head of the subject NP and the verb region than YAs, indicating greater difficulty in resolving ungrammaticality (confirming prediction 1). Additionally, in ungrammatical sentences with singular subjects and plural attractors, OAs are more likely to be misled into a grammatical illusion (attraction effects for OA but not for YA: confirming prediction 2). In conclusion, these results suggest that agreement processing declines with age. The potential roles of age-related declines in inhibitory control and working memory will be discussed.

Do bilinguals modulate the activation of their languages based on the linguistic identity of their interlocutors? Evidence from intra-sentential code switching

Mikel Santesteban, Anna Hatzidaki, Eduardo Navarrete

University of the Basque Country (UPV/EHU)

According to the Adaptive Control hypothesis (Green & Abutalebi, 2013), bilinguals can modulate the use of inhibitory-control mechanisms to regulate language activation depending on the communicative context. Recent studies at the lexical level have shown that the linguistic-identity of an interlocutor, may also modulate the activation and selection of languages (Blanco-Elorrieta & Pylkkänen, 2016, 2017; Hartsuiker, 2015; Martin et al., 2016; Molnar et al., 2015). Yet, less is known about sentence processing. In the present self-paced-reading experiment, 46 Italian-English bilinguals were familiarized through videos with 3 types of interlocutors (Italian vs. English vs. Italian-English bilinguals) and then read 2 types of sentences (Italian-only vs. Italian-English code-switched ones) presented beneath each speaker's face, supposedly “produced” by them. The interaction that was yielded in the code-switched word position reflected an interlocutor identity effect, with slower reading times in Italian-English code-switched sentences than in Italian-only sentences when they were “produced” by Italian speakers ($p=.057$) than by English or Italian-English bilinguals ($p<.001$). In the next region, there were equal sentence-type effects for all speakers. Thus, when reading sentences in L1-Italian, unexpected code-switches to L2-English produced by Italian speakers delayed the detection of the code-switch, whereas code-switching costs were immediately demonstrated when code-switched sentences were produced by English and Italian-English speakers. These findings suggest that during sentence comprehension (i) bilinguals modulate the activation of their languages by taking into account the interlocutor's identity, and (ii) such information is a critical cue in bilingual communication and code-switching cannot be dissociated from the producer of a message.

Integration of audiovisual cues in multilingual contexts: a gaze behavior study

Inka Romero-Ortells, Jon Andoni Duñabeitia, Eva Gutierrez-Sigut, Manuel Perea

University of Nebrija

Watching videos is integral to daily life. Videos combine auditory signals (e.g., dialogue, music) and visual signals (e.g., image, subtitles) to convey meaning. This multimodal encoding is particularly significant in multilingual settings, where integrating these components may improve speech comprehension. The present study examines gaze behavior when watching didactic expository videos in L2 with two on-screen speakers without subtitles (Experiment 1) and with subtitles (Experiment 2). Experiment 1 examined the differences in gaze behavior in original versus dubbed videos among L2 learners. Results showed that participants watching dubbed videos spent more time fixating on the speaker's eyes—this difference was not observed in the original videos. Experiment 2 examined how simultaneous audio and written speech (subtitles either in the participants' L1 or L2) influence gaze behavior in L2 videos. Participants spent more time looking at the subtitles than at the speaker's eyes or mouth, regardless of the language of the subtitles. These findings demonstrate how the multiple sources of information interact in diverse linguistic and audiovisual contexts.

Article-noun agreement in the parafovea does not affect skipping in Spanish

Marina Serrano-Carot, Bernhard Angele

University of Nebrija

This study investigates how Spanish native speakers utilize parafoveal information to guide eye movements during reading. Readers often skip short and common words, like the article "the" in English, even when encountering a preview of the word that conflicts with the preceding context. This implies that the oculomotor system prioritizes parafoveal information over contextual cues. However, this may not hold true when both the high-frequency word and the conflicting information are in the parafovea. In Spanish, there is mandatory gender agreement between articles and nouns. We manipulated the preview readers received of the article in article-noun phrases such that there either was agreement between the article and the noun (e.g. "la mesa") or not (e.g. "el* mesa"). After readers crossed an invisible boundary at the left of the article the display changed to show the correct article. We find that readers do not take article-noun agreement into account when making the skipping decision; however, the mismatch affects fixation times on the noun and the subsequent word. This suggests that either parafoveal preprocessing before skipping exclusively involves the next word (the article) or parafoveal processing is very superficial and does not involve higher-level information as syntactic relationships between the upcoming words.

Neural bases of proactive and predictive processing of meaningful sub-word units in speech comprehension

Suhail Matar, Alec Marantz

Basque Center on Cognition, Brain and Language (BCBL)

To comprehend speech, human brains identify meaningful units in the speech stream. But whereas the English sentence ‘She believed him.’ has 3 words, the Arabic equivalent ‘šaddaqathu.’ is a single word with 3 meaningful sub-word units, called morphemes: a verb stem (‘šaddaqa’), a subject suffix (‘-t-’), and a direct object pronoun (‘-hu’). It remains unclear whether and how the brain processes morphemes, above and beyond other language units, during speech comprehension. Here, we propose and test hierarchically- nested encoding models of speech comprehension: a Naïve model with word-, syllable-, and sound-level information; a Bottom-Up model with additional morpheme boundary information; and Predictive models that process morphemes before these boundaries. We recorded magnetoencephalography (MEG) data as participants listened to Arabic sentences like ‘šaddaqathu.’, and used two complementary analyses to study morpheme-level processes in speech comprehension. A temporal response function (TRF) analysis revealed that in bilateral temporal and left inferior frontal brain regions Predictive models outperform the Bottom-up model, which outperforms the Naïve model. This is in line with other work implicating these regions in speech processing and in predictive processing during language comprehension. Moreover, verb stems were either length-Ambiguous (e.g., ‘šaddaqa’ could initially be mistaken for the shorter stem ‘šadda’=‘blocked’) or length-Unambiguous (e.g., ‘qayyama’=‘evaluated’ cannot be mistaken for a shorter stem), but shared a uniqueness point, at which stem identity is fully disambiguated. Evoked analyses revealed differences between conditions even before the uniqueness point, suggesting that, rather than await disambiguation, the brain employs Proactive Predictive strategies, processing the accumulated input as soon as any possible stem is identifiable, even if not unique. These findings highlight the role of morpheme processing in speech comprehension, and the importance of including morpheme-level information in neural and computational models of speech comprehension.

Oral session 2. Memory

Enhancing retrieval-based learning with concept mapping

Maria Teresa Lechuga, Juana M. Ortega-Tudela, Carlos J. Gómez-Ariza

University of Jaén

Retrieval-based activities, which require students to actively recall previously studied information, have been shown to contribute to conceptual learning sometimes more so than other more popular techniques such as rereading and elaborative study. Importantly, some studies have claimed that different retrieval formats (free recall by writing down as many ideas as possible and creating a concept map in the absence of text) are equally effective as learning tools. In the present talk, we will present results from a few experiments that support the idea that concept map construction in the absence of materials (i.e., demanding memory retrieval operations) makes a difference as a retrieval practice activity. Specifically, we show that: 1) although paragraph writing and concept mapping can lead to similar learning outcomes, 2) when the order in which the activities are performed is compared, retrieval-based concept mapping prior to free recall via paragraph writing leads to better learning. Importantly, 3) this latter finding is observed in college adults under laboratory conditions, but also in adolescents in a more naturalistic school setting.

Thus, our results support the idea that concept learning from instructional texts can be modulated by the sequence of retrieval activities performed and point to the educational value of retrieval-based concept mapping as the first learning activity in a series across learners and educational settings. In addition, these results speak against the idea that all retrieval formats are equally effective and recruit similar cognitive operations.

Early findings from a local dataset in a Multisite Replication of the Think/No-Think effect

María Villar Navales, María Aimée Reyes Vargas, Javier Pacios García

University Complutense of Madrid (UCM)

Over the past two decades, investigations within Cognitive Neuroscience have shown that forgetting is a highly adaptive capacity that seems to allow us to regulate the accessibility and the impact of our memories, thereby ensuring a proper functioning of the cognitive-emotional system. The Think/No-Think paradigm, wherein participants try to actively avoid the recalling of a particular unwanted word associated with a given cue, has been used to experimentally model how cognitive inhibition processes can be engaged to downregulate the accessibility of an undesired memory, a phenomenon referred to as suppression-induced forgetting (SIF). Nevertheless, there exists some contention regarding the robustness and magnitude of this effect, as several studies have encountered challenges in its replication. Results derived from a recent meta-analysis suggest that the size of the SIF effect may be smaller than the one reported, due in part to the presence of a publication bias. In light of these considerations, an international consortium of researchers, The Memory Control Consortium, has endeavoured to conduct a replication study of the TNT paradigm, with contributions from laboratories all over the world. Specifically, the study uses a consensual version of the original TNT task (Anderson, 2001), with the two more common instructional variants (i.e., Thought Avoidance -TA- and Thought Substitution -TS-) being manipulated between subjects. Of interest, retrieval suppression has been proposed to contribute to emotional regulation mechanisms, with the size of SIF negatively correlating with rumination scores, and people receiving a short retrieval suppression training reporting improvements in their mental health. Here we will present one of the Spanish local datasets within the Memory Control Consortium study (n=48). In addition, we are currently increasing the sample size to better study the association between individual SIF and rumination, emotional regulation strategies and mental wellbeing. Results from the main analysis (SIF in both, TA and TS strategies) and from correlations between SIF and mental health factors will be discussed as replications of some important findings in the field of active forgetting.

Exploring the relationship between active forgetting and resting-state brain dynamics. An EEG study

María Aimée Reyes Vargas, María Villar Navales, Pablo Cuesta, Ricardo Bruña, Javier Pacios
University Complutense of Madrid (UCM)

Motivated forgetting refers to the reduction in memory recall as a result of inhibitory mechanisms, a phenomenon related to the adaptability of the memory system. Specifically, retrieval suppression is known to induce global hippocampal suppression, leading to forgetting as a consequence of process inhibition.

This memory process inhibition may be part of the default-mode network (DMN) suppression observed during tasks that require focused attention and minimizing interfering content. Therefore, in this study, we aim to explore potential relationships between individual ability in suppression-induced forgetting (SIF) effects and brain-state dynamics. To this end, 48 healthy university students will complete a standard Think/No-think (TNT) task, followed by a resting electroencephalography (EEG). The analysis plan includes using a cluster-based permutation test to identify clusters that significantly correlate with the forgetting measure. Results from this analysis may contribute to shed light on the role of memory suppression in regulating behavior, potentially, as part of some of the described resting-state brain dynamics.

Intentional forgetting, false recognition and associated subjective experience in young and old people

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The effects of intentional forgetting on false recognition in young and older adults, as well as the associated subjective experience, are analyzed using the DRM paradigm. Eight lists of words were presented, each list associated with a critical word not presented. Backward associative strength (BAS) was manipulated such that in half of the lists the critical words had a high BAS and the other half had a low BAS. Half of the participants received whole-list learning instructions (control condition) while the other half received directed forgetting instructions (item method). In the recognition test, all participants made a Remember/Know/New judgment on each word. With respect to veridical recognition, the older adult group recognized significantly fewer words than the young group in the control condition. However, in the directed forgetting condition the magnitude of the forgetting effect was similar in young and old people. In both groups the directed forgetting effect was associated with the Remember judgments but not with the Know judgments. Furthermore, the Remember instruction was associated with Remember judgments and the Forget instruction was associated to a greater extent with Know judgments. Regarding false recognition, no significant differences were found between both groups in the control condition, however in the young group the subjective experience was associated to a greater extent with Remember while in the group of older adults no significant differences were found between the judgments of Remember and Know. The forgetting manipulation did not reduce false recognition significantly in either group, although the subjective experience was modified in the young group from Remember in the control group to Know in the directed forgetting group. In the older group there were no differences between Remember and Know judgments. False recognition in the directed forgetting condition was higher in the older group than in the younger group. Finally, critical items with BAS generally provoked greater false recognition than critical items with low BAS but did not interact with the directed forgetting manipulation or the associated subjective experience. The results indicate that false recognition persists even though the forgetting manipulation affected the veridical recognition of both groups equally and that, furthermore, false recognition was higher in the older group.

Negation-induced forgetting: Assessing its extent and the involvement of inhibitory processes

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Negation production (i.e., responding “no” to questions) has been observed to induce forgetting for recently acquired information (Mayo et al., 2014; Zang et al., 2023). However, it remains uncertain whether this effect results from inhibitory processes triggered by negation or from basic associative interference mechanisms. This issue arises because, in previous studies, negation consistently targeted information with a more complex set of semantic associations than affirmation. Recently, we minimized associative interference by matching the semantic complexity of “yes” and “no” responses, and we failed to reproduce the negation-induced forgetting effect (Martin et al., in preparation). In this follow-up study, we used the same experimental paradigm as before. First, participants read and visualized a story about the typical activities of a university student. Unlike the previous study, the story included sentences describing both factual and counterfactual situations for the same event (e.g., “You wash your face with hot water, although you would have liked to wash it with cold water”). Next, in a verification task, participants were shown a sentence in the past tense and asked to respond with “yes” if it described an actual action performed in the story (e.g., “You washed your face with hot water”) or “no” if it described a desired but not performed action (e.g., “You washed your face with cold water”). Finally, after a brief distractor task, participants were asked to freely recall as many words as they could remember. The results showed an interaction between the type of response (yes, no) and the situation (factual, counterfactual) on forgetting rates. However, in a complementary experiment where the verification task (response condition) was removed, it became apparent that the situation alone could explain the observed interaction, as counterfactual situations exhibited higher forgetting rates than factual ones. This suggests that the epistemic status of the situation, rather than the response type, plays a crucial role in our memory paradigm. Thus, in line with our prior study, responding “no” does not increase forgetting once semantic associative complexity is fully controlled. In addition, the current findings highlight the importance of considering the impact on memory of the epistemic status of the information.

Oral Session 3. Language

The role of different articulators in cortical tracking of sign language

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In sign languages the linguistic information is transmitted through the simultaneous movement of several bodily and facial articulators. This study investigates cortical tracking of sign language and disentangle the contribution of the different articulators. We used a motion tracking system to record videos of semi-spontaneous sign language narratives (by native deaf signers) while tracking the position in 3D space of 21 body points. These videos served to characterize the temporal periodicity of the sign language visual signal and as stimuli for the subsequent experiment: using magnetoencephalography (MEG) we recorded the neurophysiological activity of two groups of hearing participants – 15 proficient signers of LSE (Spanish Sign Language) and 15 sign-naive individuals – while they watched videos in a known (LSE) and unknown sign language (Russian Sign Language). We selected six linguistic signals: a combined visual signal (calculated with PCA on all upper-body points), four linguistically relevant articulators (left hand, right hand, head and torso) and one point with no linguistic relevance (base of the torso) as a sanity check. We calculated coherence between the preprocessed MEG data and each visual linguistic signal, and used cluster-based permutation tests to assess statistical differences in coherence between different conditions. Source reconstruction was used to better characterize the spatial distribution of cortical tracking. The results show that neural activity tracks sign language input in delta frequency band (0.5 - 2.5 Hz), reflecting the slower periodicity associated with articulators movements, and that tracking is dependent upon sign language knowledge. Proficient signers show stronger synchronization compared to sign-naive controls for head, left hand, right hand and combined visual signal in the right temporal cortex, while no difference is found in occipital areas. Proficient signers also show greater tracking for the known compared to the unknown sign language for combined visual signal and right hand only. These findings confirm that cortical tracking of language is a feature of language processing beyond the auditory domain, and is modulated by language experience. Furthermore, the neural activity tracks the movement of those articulators that are linguistically most informative.

Postlexical locus of semantic interference: evidence from bimodal bilingual picture-word interference

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This work aimed to adjudicate between two competing hypotheses of word production: Lexical Selection by Competition (Abdel Rahman & Aristei, 2010) and the Response Exclusion Hypothesis (Navarrete & Mahon, 2013). We conducted two picture-word interference (PWI) tasks, one with 27 unimodal bilinguals (Spanish-Basque) and another with 29 bimodal bilinguals (Spanish-Spanish Sign Language). In the PWI task, the participant names a picture as quickly and accurately as possible while ignoring a superimposed word. If the target picture and the word belong to the same semantic category, participants usually take longer to name the picture than when the picture and the word are unrelated. This semantic interference effect can be explained by both hypotheses. The Lexical Selection by Competition Hypothesis claims that the two concepts prime each other, increasing competition between the two representations at the word-form level and causing longer naming latencies. In contrast, the Response Exclusion Hypothesis states that to name the target picture, the word production system first needs to exclude the response to the superimposed word from the phonological buffer, a postlexical component. This exclusion process is guided by response-relevant criteria: gross semantic and lexical information. When the two concepts belong to the same semantic category, they share a substantial number of these criteria, which in turn makes it difficult to exclude the response to the distractor. Bimodal bilingualism is a valuable test case for these hypotheses because the two languages, spoken and signed, involve different articulatory systems and thus buffers. A semantic interference effect in a bimodal bilingual PWI task would show that signs and words compete for selection at the lexical level, thus supporting the Lexical Selection by Competition Hypothesis. On the other hand, the absence of this effect would support the Response Exclusion Hypothesis: the two languages employ different buffers, so no exclusion is required to name the target picture. Our findings showed the expected semantic interference in the unimodal group but not in the bimodal group, which can only be accounted for by the Response Exclusion Hypothesis. Overall, the results suggest that the locus of semantic interference is postlexical and that lexical selection itself is not a competitive process, and highlight the utility of researching different modalities for gaining insight into language mechanisms.

The perception of iconicity in a visual language: the LSE lexicon shows more limited use of location for iconicity compared to handshape and movement

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The received view that the relationship between form and meaning of a linguistic sign is arbitrary has been undermined by iconicity: form may be motivated by meaning (Taub, 2001; Sidhu et al., 2020). The lexical units of sign languages are not entirely arbitrary or iconic (Dingemanse et al., 2015; Perniss & Vigliocco, 2014) but fall on a spectrum ranging from highly arbitrary to extremely iconic depending on various features, and how direct the form maps on to meaning.

Iconicity can be conceptualized as a matter of degree or of type. To evaluate how iconic different signs are, we collected iconicity ratings for 600 lexical signs of Spanish Sign Language (LSE) from native and non-native deaf signers (35-90 raters per sign) on a scale from 1 to 7, providing a measure of how language users themselves perceive iconicity.

For type of iconicity, we categorized the same 600 LSE signs based on the contribution of different sublexical units (handshape, location and movement) to each sign's visual motivation. For each unit we developed a classification system based on whether the hand/location/movement represents itself (e.g. the handshape shows how the hand itself manipulates an object) or maps more indirectly onto the referent (e.g. the signer's mouth stands in for a letter box), or some property of the referent (e.g. the movement outlines the shape of the object). The results reveal that each individual sublexical unit is exploited for iconicity less than half of the time, with location (30% of signs) less amenable to iconicity than handshape or movement (both around 40% of signs). Furthermore, looking at the sublexical units in combination, over 40% of signs make no use of iconicity in any of the three.

The interrelation between these categories and the iconicity ratings provides insight into how iconicity is constructed and perceived: there were no significant differences in the mean ratings for the main types of iconicity for handshape or movement. In contrast, signers perceived locations on the body that denoted the body part (e.g. the sign tie articulated on the chest) as significantly more iconic (adjusted $p=.005$) than signs articulated on the non-dominant hand, which stands in for some other object or concept (e.g. a cup in the sign coffee). These findings unveil a close tie between handshape and movement, while location is limited in its iconic possibilities. What the hands do provides a stronger mapping than where they do it.

Orthographic effects in L1 speech production

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Orthography is known to influence first language (L1) speech perception and second language speech production and perception. Research into orthographic effects in L1 production is scarce and yielded mixed results. No research has yet examined orthographic effects on phonetic characteristics of L1 speech production. The present study addressed this gap by testing whether inconsistent orthographic forms affect speech sound production in L1. To this end, we investigated L1-Dutch speakers' and L1-Spanish speakers' production of critical sounds elicited in a pseudoword reading task. Critical sounds were /s/, consistent in Spanish (spelled <s>) and inconsistent in Dutch (spelled <s> or <c>); /x/, consistent in Dutch (spelled <g>) and inconsistent in Spanish (spelled <g> or <j>); /k/, inconsistent in both languages (spelled <c> or <k>). We explored whether speakers produce the same sound differently (in acoustic features, speed and variability) depending on its spelling. We considered four measures: center of gravity (CoG) in Hz (or VOT in ms for plosive-/k/), category compactness (coefficient of variance values [COV] of the CoG/VOT), duration in ms, speech onset time (SOT) in ms, and their respective variability (COV of duration and SOT). Results on 37 L1-Dutch and 32 L1-Spanish speakers revealed no significant effect on acoustic measures. Significant effects were observed on SOT, in L1-Dutch speakers, and those effects were driven by spelling frequency more than consistency: Dutch-/s/ was produced with slower and more variable SOT when written <c> (less frequent spelling) than <s> and Dutch-/k/ was produced with slower and more variable SOT when written <c> (less frequent spelling) than <k>. These findings demonstrate that orthography influences the speed and variability of L1 speech production, based on spelling frequency: what makes an inconsistent sound slower to be produced is not the fact that it is written with an inconsistent letter, but the fact that it is written with the less frequent of two possible letters. Those results are consistent with the few studies showing that inconsistent words are produced slower than consistent ones. They add that, for inconsistent sounds, the less frequent spelling is produced slower and with larger variability than the most frequent one. Spelling frequency effects being observed in Dutch and not in Spanish could be due to relative spelling frequencies being larger in Dutch than in Spanish.

Brain oscillatory activity adaptations to speech syllabic timing: MEG and behavioral evidence

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In order to comprehend speech efficiently, humans have to rapidly adapt their neurocognitive model for language processing to the characteristics of the incoming speech signal (e.g., timing, pitch, noise).

Relevantly, in the adaptation to speech timing, listeners make use of acoustic temporal regularities to make predictions about when will likely occur the relevant units for speech comprehension, such as syllables, words or phrases. A big proportion of these temporal regularities is embedded in the amplitude modulations of the speech envelope, which bear the syllabic and prosodic structure information. A wealth of studies in the past decade have attested that, during speech comprehension, the brain entrains to the amplitude modulations of speech mainly within the prosodic and syllabic timescales by leveraging cortical oscillatory activity within the delta (1-3 Hz) and theta (4-8 Hz) frequency bands respectively. Given the relevance of the syllabic temporal regularities for this cortical mechanism involved in speech comprehension, the so-called cortical tracking of speech or speech-brain entrainment, we investigate two interrelated questions. First, whether there is a fast or slow adaptation to speech syllabic timing. To achieve this, we forced the naturally uttered speech of the Harvard corpus of Spanish sentences into 3 experimental conditions: natural speech, isochronous (perfectly regular at syllabic timing) speech and anisochronous (irregular) speech. Second, what is the relationship of such brain oscillatory activity (collected by magnetoencephalography, MEG) with speech comprehension, in order to assess the behavioral relevance of cortical adaptations to the syllabic timing. In this MEG study, we analyzed the brain activity (i.e., oscillatory phase) at sensor and source level as well as the behavioral responses of 45 adults in a within-participant design, in order to obtain robust metrics of cortical oscillatory activity in speech tracking. We found fast cortical activity adaptations to isochronous speech that, although being unnatural, offers a regular template on which oscillatory activity can capitalize in order to extract syllabic information. We also found a relevant interplay between delta and theta oscillatory activity that is balanced in different ways depending on how (un)natural or (ir)regular the speech being listened is. Our research offers an empirical proof that helps grounding recent theoretical and computational models of speech processing about the interplay of delta and theta oscillatory activity for speech comprehension.

The long-term impact of music experience on cortical tracking of speech and music: a MEG investigation on professional musicians

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Cortical tracking is proposed to be a crucial mechanism for processing rhythmic and quasi-rhythmic auditory input such as speech and music. In this study, we examined how a particular type of sensory- motor training, i.e., regularly practicing playing an instrument, impacts cortical tracking. Previous studies have shown that musical training enhances tracking of music and that this advantage can transfer to the speech domain in difficult listening situations (e.g., when speech is embedded in noise). However, most previous studies used artificially manipulated speech and music to obtain a steady rhythm, which gives little insight into the process of cortical tracking of natural speech and music as we experience them in daily life. Specifically, for natural speech, tracking in theta band (4-8 Hz) has been proposed to reflect perceptual processes driven by the acoustic regularities in the signal, whereas tracking in delta band (0.5-2 Hz) has been associated with higher-order processes involving speech-specific information, such as lexical and prosodic information. In our study, we asked whether the advantage in auditory tracking conferred by musical training would also be elicited by naturalistic stimuli. We also examined speech tracking in theta and delta bands to assess whether any advantage reflects an improvement in purely perceptual processes or additionally involves higher-order linguistic processes. We compared MEG data from expert musicians (> 15 years of experience) and controls with no playing experience, while they listened to two-minutes short stories and excerpts of classical piano music. We quantified cortical tracking by computing the coherence between the MEG signal and the auditory stimuli, and found that musicians tracked more faithfully than controls both speech and music in theta band, suggesting a domain-general advantage in tracking acoustic features occurring at these rates (i.e., syllables, notes). Moreover, musicians showed different lateralization patterns: while controls showed right-lateralized auditory tracking, irrespective of stimuli and frequency bands, musicians showed additional involvement of the left hemisphere in speech tracking in delta band, and in music tracking in both delta and theta bands. These results indicate that musical training sharpens perceptual processing of rhythmic input across different domains, and changes the cortical networks involved in both low-level and higher-level processing of auditory stimuli.

Oral Session 4. Attention

Unveiling the stress symphony: Analysis of acute stress as orchestrator of startle response and prepulse inhibition

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Recent studies have highlighted that prepulse inhibition (PPI hereafter) of the startle reflex response to an intense stimulus (pulse) when temporally preceded by a weaker stimulus (prepulse) appears to be altered across multiple psychological disorders. However, it is unknown whether the deficit in PPI is intrinsic to psychopathology or modulated by other transdiagnostic factors such as insomnia or stress. Given that previous studies on the impact of stress on this psychophysiological response are inconclusive, this study aims to systematically analyze the effect of experimental acute stress induction on the startle response and PPI in a healthy young-adult population. To this end, 108 participants were divided into two groups depending on whether they were exposed to the standardized Maastricht Acute Stress induction protocol or a non-stressful control task, conforming the stress ($n=54$, mean age=21.1, $SD=4.02$, men-women ratio=21/33) and control groups ($n=54$, mean age=21.06 $SD=3.96$, men-women ratio=21/33) respectively. Following exposure to the stress induction task or the control task, participants' electromyographic startle response was recorded in the orbicular muscle of the right hemiface (BIOPAC Systems). Results revealed that participants in the stress group exhibited a higher magnitude of baseline startle response ($F(1,104)=4.78$; $p<.05$, $\eta^2=.04$) and reduced prepulse inhibition ($F(1,103)=8.99$; $p<.01$, $\eta^2=.08$) compared to participants in the control group. Our findings support the hypothesis that during acute stress, increased startle response and reduced PPI may play an adaptive role by enhancing the processing of information from potentially threatening stimuli for survival (e.g., the pulse). Similarly, it is confirmed that deficit in PPI is modulated by acute stress, underscoring the importance of considering this variable in clinical and experimental contexts.

Understanding the influence of relevance of salient items on attention

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Studies investigating the impact of salience on attention often focus on isolating bottom-up, top-down, or selection history factors. However, real-world attention is influenced by all of them. To study the connections between these three factors on attention, we created a letter search task version of the additional singleton paradigm (Theeuwes, 1992) to integrate bottom-up effects of salient items with top-down processes. This was done by inducing either a singleton detection or feature search mode strategy (Bacon & Egeth, 1994). Critically, without providing explicit instructions to participants, we measured the impact of selection history by manipulating the probability of the salient item being a target vs a distractor (Relevance: 0, 25, 50, 75 or 100% of trials where the salient item is the target). By measuring reaction times (RT) and event-related components of attentional processing such as N2pc (reflecting attentional selection) and Pd (as a measure of), we observed significant effects of relevance of the salient item on attention. Specifically, we observed an early positivity component to all salient items (Ppc), independently of their identity, reflecting a clear bottom-up effect of saliency. Furthermore, although the selection of a salient item is enhanced by its relevance to the task in both search modes, reflecting the impact of selection history on attention, this effect was larger in feature search mode, reflecting the impact of top-down search modes on attention. These observations highlight the dynamic interplay between bottom-up saliency, selection history, and top-down attentional sets, reflecting the complexity of attentional processes.

BeeAttentive Task: An effective tool to assess early trajectories of attentional development

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Given the rapid development of attention during the first years of life and its key role in the development of higher cognitive functions, assessing the early trajectories of attention has been a key point of interest for children's educators and psychologists. However, there remains a scarcity of research and assessment tools to effectively study and evaluate attentional development during early childhood. The BeeAttentive task is a child-friendly assessment tool designed to evaluate fundamental attentional processes in children as young as 3 years old. A total of 275 children aged between 3 and 5 years completed a behavioral evaluation with this task. A subset of this sample also underwent EEG functional assessment using a 128-channel protocol. The behavioral results indicate that early trajectories of attentional development can be categorized into three main cognitive profiles: attentive, distracted, and impulsive. The combination of both behavioral and EEG measures analyzed and discussed in this study offers new insights and approaches to understanding early attentional development. This provides professionals with a valid measure to assess cognitive development in children and offer early intervention and support during this sensitive period of brain development.

Investigating the Influence of Gaze Deviation on the Reversed Congruency Effect: Comparing the Eye-Contact and Joint Attention Hypotheses

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The human ability to perceive the direction of another's gaze is crucial for social interactions and may involve specialized attentional mechanisms. In a study utilizing a variant of the spatial Stroop task, Marotta, Caballero, and Lupiáñez (2018) observed that, unlike arrows, gaze cues cause a reversed congruency effect (RCE), with shorter reaction times in incongruent conditions than in congruent ones. Of the hypotheses proposed to explain the reverse congruency effect (RCE) observed with gaze stimuli, two are notable: the eye-contact hypothesis and the joint attention hypothesis. To discriminate between these hypotheses, an experiment was conducted with gaze stimuli deviated by either 15° or 40°. It was assumed that a 15° deviation might enhance the perception of eye-contact, while a 40° deviation might promote joint attention. Greater RCE was observed in the 15° condition compared to the 40° condition, aligning more closely with the eye-contact hypothesis than with the joint attention hypothesis.

Neuromodulation in the healthy brain: the role of white matter variability

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Spatial orienting is a mechanism that allows the selection of relevant over irrelevant stimuli in space, improving conscious perception of stimuli at the threshold of consciousness. Spatial attentional processes rely on a network of dorsal and ventral fronto-parietal regions, which are structurally connected through long white matter tracts, such as the superior longitudinal fasciculus (SLF), among others. The present study has a dual purpose: 1) To examine the causal role of one of the nodes of the fronto-parietal network (the right Inferior Parietal Lobe, rIPL) in the interaction between spatial orienting and conscious perception using Transcranial Magnetic Stimulation (TMS); 2) To inspect how interindividual variability in the microstructural properties of white matter tracts impacts TMS effects. Fifty-one healthy participants performed a behavioural task, which consisted of the detection and discrimination of a Gabor stimulus that was individually titrated to be detected on ~50% of the trials. A spatially informative central or peripheral cue preceded target onset (predicting target location on 75% of the trials). During the experimental blocks, a train of online TMS pulses was applied during the cue-target period to the rIPL or to an active control condition (i.e., the vertex). Results suggested a successful experimental manipulation, with significant attentional effects that were comparable although increased for peripheral than central cues. rIPL TMS (compared to vertex) reduced accuracy when attention was endogenously as compared to exogenously oriented. Part of this TMS variability was explained by the microstructural properties of white matter tracts. On the one hand, participants with lower integrity of the dorsal and middle branch of the left SLF showed a reduced TMS effect. This result has been previously reported and explained by a neuroprotective or compensatory effect. On the other hand, participants with higher integrity of the ventral branch of the left SLF (on the contralateral hemisphere to the stimulated region) showed an increased TMS effect. This result could be explained through the lateralisation of the ventral attentional network towards the right hemisphere. These results will add valuable evidence to the rising literature exploring individual differences in neuromodulation in the healthy brain.

Integrating brain function and structure in the study of the human attentional networks

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Attention is a heterogeneous function theoretically divided into different systems, including alerting, orienting and executive attention. Brain regions and networks that sustain attentional processes have been extensively characterised with functional magnetic resonance imaging (fMRI). In addition, the role of white matter in attention has gained recent interest due to the development of diffusion-weighted imaging methods. However, most evidence relies on correlations between white matter properties and behavioural or cognitive measures, or in the characterization of brain lesions and their relation to behaviour. In this study, we employed a new method (i.e., the Funtionnectome) that projects the signal from voxels of fMRI images using the probability of structural connection given by high-resolution normative tractography. We analysed three fMRI datasets where participants performed a visual perceptual task with three different attentional manipulations: phasic alerting, spatial orienting, and executive attention, respectively for each dataset. The results of this work showed that the phasic alerting network engaged temporal areas and their communication with frontal and parietal regions, with left hemisphere dominance. The orienting network involved bilateral fronto-parietal and midline regions communicating by association tracts and interhemispheric fibers. The executive attention network engaged a broad set of brain regions and white matter tracts connecting them, with a particular involvement of frontal areas and their connections with the rest of the brain. These results confirm and extend previous knowledge on the neural substrates of the attentional system, offering a more comprehensive understanding through the integration of white matter structure and function.

Oral Session 5. Decision-making support systems

The dilemma of human supervision in biased AI decision support systems

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Automated decision making is increasingly common in the public sector, which has led political institutions to recommend human supervision as a safeguard against potentially erroneous or biased algorithmic decisions (human-in-the-loop decision processes). Despite this, the scientific literature lacks consensus on the benefits and risks of human supervision in these processes, as well as on the factors that influence the final outcome of the decision. We address this problem through two experiments, with a total sample of 410 participants. In these, participants were asked to judge several defendants accused of various crimes, with the support of an AI decision support system that sometimes erred. By manipulating the moment at which algorithmic support was provided -before or after participants emitted their judgment- we investigate the impact of this erroneous AI support on decision accuracy. Our results reveal a notable decrease in accuracy when participants receive biased AI support, and particularly when this support is presented before their own judgments.

The influence of AI bias on human decisions

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Several studies have shown that artificial intelligence (AI) can acquire biases from the data used to train the model or from its human designers. The increasing use of AI in critical areas such as healthcare, raises concerns about its safety and the way it may affect human wellbeing: If AI can learn biases from humans, can humans also learn biases from AI systems? Aiming to answer this question, we conducted two experiments in which participants completed a classification task that simulated a medical diagnosis with or without the help of a fictitious AI. The AI of our procedure was biased and made a systematic erroneous recommendation always for a specific type of stimuli. In Experiment 1 (n=199) AI-assisted participants made more mistakes in the classification task, specifically in the trials where the AI advice was wrong, than the unassisted participants. However, the most significant finding was that the participants previously assisted by the AI exhibited the same bias or systematic error as the AI when they switched to classify the stimuli without AI assistance in a second phase of the task. Experiment 2 (n=197) replicated the human inheritance of AI bias observed in Experiment 1 and also evidenced that an extended previous experience with the classification task before interacting with the AI did not protect participants from following the biased recommendations made by the AI. Our results highlight the potential of AI bias to influence participants' behaviour, even when the AI system was no longer making suggestions.

Resource scarcity and patient classification can bias causal judgement

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Given the limitation of resources in healthcare settings, doctors and health caregivers must often deal with scarcity, which can affect their decisions. At the same time, a widespread practice is using patient classification systems, either explicit or implicit, and despite they are often based on erroneous or incomplete information. We examined the joint influence of these two common conditions (resource scarcity and patient classification) on decisions and causal judgments in a fictitious medical context. One hundred participants recruited from Prolific Academic participated in Experiment 1, and 191 Psychology students participated in Experiment 2. They were randomly assigned to the experimental groups, defined depending on the available budget to buy medicines (scarce and wealthy). Participants imagined they were doctors visiting different patients. For each, they decided whether to administer the treatment or not, and were subsequently informed whether the patient healed. There were two different types of patients, classified according to their supposed sensitivity to the treatment, although (unbeknownst to participants) all patients were equally sensitive (i.e., there were no actual differences between the two patient types). We also varied the treatment effectiveness between experiments: In Experiment 1 the treatment was an effective medicine, whereas in Experiment 2, the treatment was a pseudo-medicine that did not improve the patients' health. At the end of the session, we asked participants to rate the extent to which they thought the treatment was effective for healing each type of patient. Participants confronted with scarcity, both in the case of effective treatment and pseudo-medicine, showed a remarkable inclination to trust the existing patient classification system despite the evidence that there was no difference between patient types. Our findings have implications for both healthcare professionals and patients, and highlight the importance of critically evaluating classification systems, especially in resource-limited settings.

Oral Session 6. Emotion

Music-induced emotions in older people

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Prior research has shown differences in emotional processing during aging. Specifically, older people present a bias towards positive affective stimuli. Nevertheless, most of the past literature has focused on emotional scenes or expressions but not on other affective stimuli such as music, even though its emotional power. This study aimed to explore the emotional processing in older people during a music listening task. A total of 13 volunteers listened to standardized unknown soundtracks (14 pleasant, 14 unpleasant, 14 neutral) from the Film Music Stimulus Set (FMSS) presented during 8 s. Afterwards, affective dimensions (valence and arousal) and discrete emotions (happiness, fear, and sadness) were collected using a 9-point Likert scale. Results showed that self-reports varied according to the affective valence of the music. More specifically, older people rated unpleasant music as less arousing in comparison to neutral and pleasant music and evaluated neutral music (that mostly expressed sadness) as less sad. By contrast, they evaluated pleasant music as high arousing and with high levels of pleasantness and happiness in comparison to neutral and unpleasant music. Taken together, these results support the theory that older people have a bias towards positive information, which could explain the improvement of the emotional state during this stage of life.

Emotional processing and response time. A quasi-experimental study

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The purpose of this study is to evaluate the impact on reaction times of the experimental conditions for the evaluation of valence and arousal. To carry it out, 55 volunteers, aged between 18 and 27, participated in the experiment. The experiment consisted of three parts: emotional processing through the visualisation and subsequent evaluation of emotional images; a working memory task, which consisted of performing mathematical operations; and a distractor task through the identification of geometric figures. The results suggest that when participants are rating high valence, they take longer to respond in the high valence/high arousal condition than in the high valence/low arousal condition. Similarly, in the arousal assessment, participants take longer to respond in the high arousal/high valence condition than in the high arousal/low valence condition. However, this is not the case for either the low valence or the low arousal condition, where no significant differences in reaction times were found. On a general level, it has been observed that reaction times for valence ratings are longer than for arousal. This could be due to the fact that valence rating comes first, which could be a training effect for the next condition, arousal. Another possibility could be that participants have more difficulty in identifying how pleasant or unpleasant the visualised images have been for them rather than the level of activation or relaxation they have experienced with each condition.

The emotional content of words is prioritized over syntactic mismatches in bilinguals with higher emotional resonance in L2

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Previous research has demonstrated the influence of emotions during linguistic processing, indicating the interactivity of both processes in the brain. However, little is known regarding such interplay in a second language (L2). This study addressed this question by examining the effects of syntactic violations in reading while processing emotional and neutral statements in the L2. Forty-six Spanish-English bilinguals with various levels of L2 proficiency and emotional resonance (i.e., capability for emotional experience) participated in a self-paced sentence reading task. Sentences contained positive, neutral, and negative verbs, half of them presented in agreement and half in disagreement with the preceding pronoun.

Participants were encouraged to read attentively the sentences in preparation for a subsequent, unspecified memory task. Analysis of verb reading times using linear mixed effects modeling revealed a significant interaction between syntactic violation, verb valence and L2 emotional resonance. Thus, increases in L2 emotional resonance were related to slower reading times for negatively valenced verbs in agreement (e.g., he suffers from headaches), contributing to reducing the violation effect (differences between match and mismatch conditions) for those participants with higher L2 emotional resonance.

Additional analyses revealed that the valence of verbs influenced the processing of subsequent sentence words (i.e., determiners/prepositions and nouns). In particular, reading times were significantly faster for determiners/prepositions following negative verbs. Moreover, participants with higher L2 emotional resonance exhibited longer reading times for the final words (nouns) in sentences with positive and negative verbs. These results suggest that the emotional content is prioritized in bilinguals with stronger emotional resonance in L2, capturing their attention to a larger extent than syntactic mismatches. The results obtained in the recognition task do support this idea, since these bilinguals were less accurate in identifying whether the sentences had previously been presented in agreement or disagreement, regardless of the valence of the verb. Overall, our findings highlight the need to consider individual variability in emotional engagement when addressing the interplay between emotions and language in the L2.

Emotion and Salience in the anticipatory brain activity of catastrophic events

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Introduction: Anticipatory brain activity allows predicting the occurrence of expected situations. However, some events, such as traffic accidents, are statistically unpredictable and can generate serious consequences. Despite their importance, the study of the brain mechanisms underlying the anticipation of unexpected and unavoidable events in ecological contexts has received little attention in the literature. The present study investigates brain activity and effective connectivity associated with the occurrence of simulated driving accidents. Methods: 161 participants drove in a motorcycle simulator while their electroencephalographic activity was recorded. 90 participants experienced at least one accident while driving. Both within-subject (accident vs baseline) and between-group (accident vs non-accident) comparisons were performed. Results: From 900 to 60 milliseconds before the occurrence of accidents, the right inferior parietal lobe, left anterior cingulate cortex and right insula showed higher activity in the accident condition. Greater effective connectivity within the nodes of the limbic network and between the nodes of the attentional networks was also observed for the accident condition in that period. Conclusions: Our results support the existence of anticipatory brain activity to catastrophic events and suggest that the activation of internal processes related to salience and emotional processing allows the anticipation of accidents.

Emotional processing impairment in individuals with ADHD: A Bayesian meta-analysis study

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Attention-Deficit/Hyperactivity Disorder (ADHD) is a heterogeneous and complex disorder, involving emotional difficulties in a high percentage of affected individuals. The extent to which emotional processing is affected and its underlying mechanisms remain unclear. We aimed to pool evidence on the impaired performance of people with ADHD in emotional processing/recognition, compared to those without the disorder, using a wide range of tasks, questionnaires and outcome measurements. Following the PRISMA 2020 guidelines, we carried out two Bayesian meta-analyses. The first meta-analysis compared the performance of individuals with and without ADHD, analysing overall emotion outcome measurements (i.e., accuracy, reaction time and other) and the type of stimuli used (i.e., scale, face, eyes, scene, voice and word), as well as the effect of age, gender, and ADHD medication status as moderators. The second meta-analysis compared the performance of individuals with and without ADHD, analysing outcomes measurements and type of stimuli used across emotional categories (i.e., happiness/positive, negative, anger, fear, disgust, sadness, neutral, and surprise). In the first meta-analysis, we found that people with ADHD perform significantly poorer than controls on measures of emotional processing. The deficits were more evident when scales were used as stimuli. Regarding outcome measurement, we found larger effect sizes for accuracy than for reaction time and other categories. In the second meta-analysis, we found consistent results across emotional categories, with smaller effect sizes. In both meta-analyses, no effect of age, sex, or medication status was found. Altogether, it is concluded that individuals with ADHD showed difficulties in emotional processing, which should be systematically assessed to provide appropriate treatments suited to their needs.

The use of differential outcomes for improving dynamic morphing facial expressions recognition in clinical populations

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The Differential Outcomes Procedure (DOP) is a simple method to improve recognition memory by associating each target stimulus with a specific outcome. By contrast, non-differential outcomes (NOP) involve randomly assigning reinforcers for each correct response. Recently, it has been found a better recognition of expressions of basic emotion when applying the DOP in a dynamic morphing task. The objective of this study is to assess whether the DOP can be used to improve the recognition of dynamic morphing facial expressions of emotion in clinical populations that present deficits in emotion processing; namely people diagnosed with anxiety, mood, or obsessive-compulsive disorders.

Participants ($n = 72$; of which $n = 36$ diagnosed with anxiety, obsessive-compulsive, or mood disorders, and $n = 36$ matched controls) completed a dynamic morphing basic facial expression of emotion recognition task and were randomly assigned to either a non-differential or a differential outcome condition.

Participants were instructed to stop, as soon as they believed they recognized the emotion, and label a video that started from 0% to 100% expression intensity. Participants in the DOP condition received the same unique reinforcer each time they successfully labelled the stimuli of a specific emotion. Participants also completed the revised version of the Benton Face Recognition Test (BFRT-R) to control for worse performance in face recognition.

A Bayesian generalized linear model was employed to analyse the data. The results showed that: (a) higher Benton scores were related to better correct identification in some conditions, (b) the control group had better overall performance in the DOP than NOP relative to the clinical group and (c) the clinical group exhibited poorer accuracy compared to the control group in some conditions. We also found that the clinical group required more intensity to correctly identify stimuli in the NOP condition relative to the control group. Finally, that the clinical group required less intensity to recognize emotions in the DOP condition relative to the NOP in 4 of the 6 basic emotions.

These results are in line with previous literature and suggest that this procedure can be used to improve the recognition of facial expressions of emotion in dynamic conditions in populations that present difficulties with emotion processing.

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Oral Session 7. Language

Gender identity and sexist attitudes bias arbitrary gender word activation

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Grammatical gender appears in language to reflect the distinction between male and female categories existing in nature. Some language systems extend the gender dichotomy to inanimate entities by applying an arbitrary distinction, and Spanish is one of them. Previous studies demonstrated that grammatical gender is activated automatically at the lexical level, even when not needed for agreement, thus showing that gender is a very important feature that can modulate word processing and production. In this study we wanted to explore whether the automatic activation of grammatical gender was modulated by social factors related to gender. In particular, our objective was to explore whether gender identities and attitudes modulated the categorization of arbitrary gendered words. To this aim, 112 Spanish native speakers performed a gender decision task in which they decided whether 32 written words were either feminine or masculine. Moreover, all participants filled-in questionnaires about gender identity and sexist attitudes. The results showed that while biological sex did not play a role, the gender identity did: participants gave more accurate responses when their gender profile matched the gender of the word.

Particularly, those participants with more masculine profiles were more accurate with masculine vs. feminine words. Moreover, the sexist attitudes modulated the performance of the task, especially when negative: the higher the score in hostile sexism, the less accurate responses with feminine vs. masculine words. Altogether, the results indicate that biological sex per se does not modulate the processing of gendered words, but gender identity and sexist attitudes do. It seems that masculine identity and negative attitudes towards females reduced the activation of the feminine gender, even when arbitrary. Thus, male oriented attitudes impoverish language processing by triggering attentional bias towards masculine gender category, in consequence diminishing the activation of feminine words. In sum, the results indicate that social factors influence language processing, and consequently each different profile will have a different perception of the words, which could lead to an overshadow of the female figure. Importantly, stronger attention should be paid to the subjective gender identity rather than to biological sex.

Anchoring accessibility tools in preferred spatial reference frames: a study with audio description for blind and partially sighted museum visitors

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The way we represent spatial information may depend on our everyday perceptual and somatosensory experiences with the world (Flumini & Santiago, 2016; Muraki et al., 2023). For blind and partially sighted people, this could mean that their preferred and less cognitively taxing mode of navigating or imagining a new space would be anchored in an egocentric reference frame (Job et al., 2022; Pasqualotto & Proulx, 2012). This increased reliance on egocentric reference frames should be considered when developing accessibility tools such as audio descriptive guides for museum settings. These texts aim to help blind and partially sighted visitors build accurate mental images of the described exhibits (Hutchinson & Eardley, 2019). In representational paintings, the intersemiotic translation of the space depicted in the artwork usually takes center stage (Soler Gallego & Jiménez Hurtado, 2013; Soler Gallego, 2021), often described from an allocentric reference frame. Here, we hypothesized that audio descriptive guides conveying spatial information from a first-person perspective, adopting an egocentric reference frame congruent with the everyday experiences of blind and partially sighted people, are more accessible and aesthetically pleasing. These hypotheses were tested in a within-subject study involving 53 Spanish-speaking blind and partially sighted participants. In addition, the impact of art knowledge and interest, along with mental imagery vividness as measured by the Plymouth Sensory Imagery Questionnaire (Psi-Q; Andrade et al., 2014; Pérez- Fabello & Campos, 2020), was controlled for. Results revealed that the salience of the egocentric reference frame enhanced the representation of the described information only for those with lower scores in the Psi-Q. However, these immersive audio descriptive guides were overall more aesthetically pleasing. This study provides insight into how the portrayal of spatial information can influence the accessibility of museum audio descriptive guides and their potential to elicit a satisfactory aesthetic experience through language alone.

Can motor interference change how people construct meaning from language?

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Across eight experiments (four pre registered), we tested whether interfering with the motor system changes meaning construal during action sentence comprehension. Participants (total $N = 880$) moved rhythmically the hands or feet while they were presented with sentences describing hand and foot actions (e.g., "turning on a light") and asked to choose between two interpretations of their meaning: one more concrete (e.g., "flipping a switch") and another more abstract (e.g., "going to sleep"). Despite not all the experiments showing significant results, an integrative data analysis revealed significant effector-specific effects of motor interference on meaning construction, which were further modulated by the amount of delay between the sentences and their interpretations: when the delay was short (200 ms), participants chose more concrete interpretations for those actions that involved the same effector being moved, while in presence of a long delay (15 s), this pattern reversed. Subsequent simulations suggested that the instability of the effect could be explained by limited power to detect a small effect, but not by a rate of false positives larger than 5%. These results provide preliminary evidence that motor interference can change how people interpret sentences about actions, consistent with the functional role of the motor system in language processing suggested by embodied accounts of semantics.

Users of sign language do not show the body-specificity effect

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Can linguistic influences affect the manifestation of the association between emotional valence (the good and the bad) and lateral space (left and right)? Although most oral languages and cultures of the world have expressions and conventions that associate good with right space, this association seems to be body-specific: right-handers associate positive concepts with the right side and negative concepts with the left side, left-handers have the opposite association, and the size of the effect of body specificity does not vary with linguistic and cultural conventions. Thus, it is widely believed that this conceptual metaphor only depends on the body. However, sign languages do not seem to have any conventional association between lateral space and valence, and a recent study has shown that signers do not associate valence with lateral space, opening the possibility of a causal influence of language. We here set to replicate this surprising and controversial finding by comparing a sign language group, consisting of Spanish and Chinese Sign Language users, with an oral Spanish control group on the widely applied in this field “Bob task”. Supporting the prior finding, Spanish language participants associated the good with their dominant side of space, but signers did not. We discuss potential interpretations of this result.

Automaticity in the lateral space-time congruency effect: Still no convincing evidence

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It is now widely accepted that temporal thought recruits spatial representations. Probably the most studied of them is a mental timeline that runs along the lateral (left-right) axis. A central, but unsolved issue in the literature is whether this space-time mapping can be automatically activated in implicit tasks (i.e., when the temporal dimension is irrelevant for the goals of the task). We here focus on paradigms that use a lexical decision task with Spanish verbs and pseudoverbs, both marked for past or future tense. We report one exploratory study that assesses the space-time congruency effect in reaction time and mouse trajectories, both in an explicit time judgment task and an implicit lexical decision task. Moreover, we report the first confirmatory study in this field of research using long sideways movements as response. The general pattern of the results showed a clear congruency effect in the explicit task and a non-significant and negligible effect in lexical decisions. All in all, we conclude that there is no convincing evidence for an automatic activation of the lateral mental timeline in lexical decision tasks.

Oral Session 8. Working memory

Optimal Timing to Maximize the Pretesting Effect

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The pretesting effect is a learning strategy that implies the use of testing on unfamiliar information followed by corrective feedback that significantly enhances long-term memory. This counterintuitive finding suggests that even unsuccessful retrieval attempts during a pretest can improve later memory recall compared to traditional errorless study methods. However, the effectiveness of this approach may depend on timing factors regarding when the corrective feedback is given and when the final test is performed. Determining the optimal time to provide the feedback and the final test is therefore critical. This study explored two key factors: first, the timing of feedback after an unsuccessful pretest (immediate versus delayed feedback after 24 or 48 hours), and second, the timing of the final test (immediate versus delayed 24 hours). Experiment 1 was a mixed factorial design with a pretest group that completed an initial cued-recall test in which they were asked to guess the targets of weak-semantically related Spanish word pairs. Half of the pairs received immediate feedback, while the remaining pairs were shown after a one-day delay; and half of the pairs were tested immediately or after a one-day delay. The control group had an errorless read-only session with equivalent learning time to the pretest group and half of the pairs were tested immediately or after a 24-hour delay. Experiment 2 was similar to Experiment 1 but employed a fully within-subjects design, with half of the pairs being pretested or read, and half of the pairs receiving immediate feedback or after a 48-hour delay. Our results showed the following: (1) Pretesting outperformed the read-only learning condition; (2) Immediate feedback led to better performance compared to delayed feedback; (3) Immediate testing after feedback resulted in better recall accuracy than delayed testing; and (4) the benefits of pretesting persisted even after 24 and 48 hours of feedback delay. Additionally, participants' errors were analysed and categorised into four types: commission (incorrect responses), omission (no response), confusion (responses to a different cue), and intrusion (repetition of initial errors). Analysis revealed differences between learning conditions and test timing: fewer commission errors in the pretest group with delayed final tests, fewer omission errors regardless of timing, higher confusion errors with immediate final tests, and no difference in intrusion errors based on feedback or timing in the pretest group. Importantly, errors made in pretest led to little proactive interference. Overall, the study provides valuable insights into the pretesting effect, and highlights the importance of timing in improving this effect. This adaptability in timing holds promise for educational settings where logistical constraints may necessitate delays in providing corrective feedback or conducting tests.

Dissociation of the functional role of anterior and mediodorsal thalamus in familiarity and recollection processes from childhood to senescence

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Basque Center on Cognition, Brain and Language (BCBL)

Human episodic memory relies on binding individual elements to create contexts, attending to associative, spatial and temporal dimensions of events. These relational memory dimensions have rarely been examined together and their neural substrates remain to be ascertained. Higher-order thalamic nuclei may be critical in modulating the interplay between the medial temporal lobe (MTL), critical in binding processes, and the PFC which supports mnemonic control during memory retrieval. Moreover, anterior and mediodorsal thalamic nuclei might be differentially involved in recollective- and in familiarity-related processes. Here, we investigated the involvement of these thalamic nuclei in episodic memory and in their interactions with MTL and PFC across the lifespan. Forty-two children, thirty-seven young adults and forty-four older adults underwent MRI scanning during a memory retrieval task comprising item memory, and associative, spatial and temporal relational memory for semantic and non-semantic materials. Results revealed strong impact of semantic memory on episodic memory, especially with age. Stronger involvement of anterior thalamus in recollection-related and of mediodorsal in familiarity-related retrieval processes was observed in children and young adults, but not in older adults. Anterior thalamus exhibited significant functional coupling with PFC and MTL regions. Results are discussed in line with Aggleton and Brown's episodic memory model.

The Subtle Power of Everyday Words — Incidental Reading in Bilingual Environments

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Given the overwhelming presence of linguistic stimuli that surround us in the form of traffic signs, brand names, or event posters, reading becomes an almost nonstop activity as we navigate our everyday environments. The present study aims to shed light on the subtle influence of incidental reading and processing of both Spanish and English words within a naturalistic real-world scenario. Thirty-two Spanish (L1) and English (L2) bilinguals unaware of the experiment's real aim navigated across a pre-established exploration route rich in linguistic stimuli of both languages. While navigating the environment, participants' eye movements and video were recorded. After the exploration, a distractor phase and an evaluation phase were carried out to test memory retrieval of incidentally processed lexical items. This included free recall and a word recognition task. Eye-tracking results revealed that both the total viewing time and the number of fixations were higher for L2 words compared to L1 during navigation. Although no significant differences in recall accuracy were found between L1 and L2, results on the recognition task showed that L2 words were recognized more accurately and rapidly than Spanish words, likely because they captured more visual attention in a predominantly Spanish-speaking environment.

Additionally, total viewing time did not significantly impact recall or recognition, implying that while visual attention is crucial for initial word processing, it may not directly influence memory performance in bilingual contexts under incidental reading conditions.

These findings underscore the importance of linguistic context and visual attention in bilingual word processing in naturalistic contexts, suggesting that the novelty of linguistic stimuli can enhance memory performance. The study's implications extend to language learning and education, emphasizing the need for strategies that leverage incidental exposure to enhance bilingual memory.

Future thinking and positivity: Exploring academic expectations in first-year university students

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The central concept of this research is individuals' positivity or our preference for positive information as opposed to negative information when performing attention and memory tasks. The main objective of this study is to examine this preference in relation to the academic expectations of first-year Psychology students who, after a period of uncertainty in the future derived from the Covid-19 pandemic, begin their academic life, which will determine or direct their professional careers. Based on a previous normative study and the results of studies on autobiographical memory, recovery cues were elaborated. The participants received 30 cues to help them produce academic expectations and to evaluate on a scale the emotional level of each situation produced. Thus, for the production task, they had 15 positive cues (e.g., achieve, collaborate, succeed) and 15 negative cues (e.g., be afraid of, fail at, feel embarrassed). After several distractor tasks, they were asked to recall freely and in any order the produced expectations. Finally, participants completed different questionnaires measuring their level of academic satisfaction, resilience and self-concept. In production and recall, there was a higher proportion of positive than negative academic expectations, suggesting the presence of positivity bias in future thinking related to the academic domain. Participants produced and recalled expectations with high levels of emotional intensity, but the emotional level of expectations did not differ as a function of positive or negative valence. Errors in production and recall were not very common, but prominent among them were valence changes (i.e., negative-to-positive cue changes), showing a tendency toward positivity. These errors were observed in both production (e.g., in the face of the cue "Abandon" producing the expectation "Abandon my fears") and recall (e.g., producing "Argue with classmates" and recalling it as "Get along with classmates and don't argue"). In those students who were more satisfied, more resilient and with higher levels of academic self-concept, a greater tendency to present positivity bias was observed. This research helps to advance scientific knowledge about future thinking in the academic domain and its relationship with personal well-being. Likewise, this research will also allow us to identify the most common negative expectations, and provide students with the necessary support to address them and overcome the challenges they may face during their first year of university.

Thalamocortical contributions to working memory

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The cortical substrates of working memory (WM) have been extensively investigated. However, less research has investigated the role of the thalamus and thalamocortical pathways in WM in humans. This could be due to the lack of detailed probabilistic atlases of the human thalamus or the small size of the thalamic nuclei as compared to regular voxel sizes. In the present MRI study, twenty-six participants performed a variation of a standard WM task with maintenance and manipulation components. In this task, participants were presented with a sequence of three images and were asked to remember them either in ‘forward’ or in ‘backward’ order. We investigated the involvement of thalamic nuclei and to what extent thalamocortical functional and structural connections were related to WM abilities. Our results revealed that the mediodorsal thalamus is involved in WM manipulation during the delay period, whereas the anterior nucleus and frontoparietal cortical regions are involved in WM manipulation during both the delay and retrieval periods. These findings highlight the relevance of the thalamus and thalamocortical connectivity in models of human WM.

Negation impairs memory for newly learned world-knowledge regardless of familiarity and valence

Gabriele Zunino, José Antonio Hinojosa, David Beltrán Guerrero

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Recent research indicates that responding ‘no’ to questions (e.g., “Did Rocío attend a conference on bilingualism?”) induces forgetting of the denied information (e.g., conference; Mayo et al., 2014; Zang et al., 2023). However, whether this memory disruption is due to negation-induced inhibitory processes or an alternative mechanism, such as associative interference, remains unresolved. Recently, we contrasted these alternatives using a new memory paradigm in which participants learned new world-knowledge information (e.g., “Romen was a photographer”), which was later either confirmed (e.g., “Romen was indeed a photographer”) or denied (e.g., “Romen was not a photographer”). Results from an incidental cued recall test confirmed that, compared to affirmation, negation (denying) increases forgetting, and this effect cannot be explained by a purely associative mechanism (in preparation). In this communication, we present a new experiment aimed at 1) replicating the previous finding, and 2) determining whether it depends on information familiarity and/or valence. To this end, we created a new set of materials that varied along the valence dimension (e.g., “Jeckelen was a Nazi”, “Nantan is a meteorite” and “An azukuma is an ice cream”). Like in the previous experiment, the procedure consisted of several phases: participants rated the familiarity and valence of the information, received information about its truth value (e.g., “Jeckelen was indeed a Nazi” or “Jeckelen was not a Nazi”), confirmed or denied the information themselves, by writing down ‘yes’ or ‘no’ response, and completed, after a distracting task, a cued recall test. Results showed information was better remembered (e.g., the word nazi from the cue Jeckelen) when previously confirmed than when denied, regardless of information perceived familiarity and valence. Thus, negation (denying) disrupts memory by itself, possibly through its suppression (inhibitory) effects on negated information.

Oral Session 9. Perception

How and when do expectations shape sensory processing?

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Perception and behavior are significantly molded by expectations derived from our prior knowledge. Hierarchical predictive processing theories provide a principled account of the neural mechanisms underpinning these processes, casting perception as a hierarchical inference process. While numerous studies have shown stronger neural activity for surprising inputs, in line with this account, it is unclear what predictions are made across the cortical hierarchy, and therefore what kind of surprise drives this upregulation of activity. Leveraging neuroimaging techniques, such as fMRI and EEG, and visual dissimilarity metrics derived from a deep neural network we arbitrate between two hypotheses: (1) prediction errors may signal a local mismatch between input and expectation at each level of the cortical hierarchy, or (2) prediction errors may be computed at higher levels and propagate down the visual cortical hierarchy. Our fMRI results are in line with the second hypothesis. Prediction errors in both low- and high- level visual cortex primarily scaled with high-level, but not low-level, visual surprise. This scaling with high- level surprise in early visual cortex strongly diverges from feedforward tuning, indicating a shift induced by predictive contexts. Mechanistically, our results suggest that high-level predictions may help to constrain perceptual interpretations in earlier areas thereby aiding perceptual inference, and thus bolster a core hypothesis of hierarchical predictive processing theories, that predictions are relayed top-down to facilitate perception.

The influence of cognitive load on implicit time-on-space interference?

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University of Montpellier

Space and time are intimately linked in the human mind. The word "long" can be used interchangeably to describe either the size or the duration of an event. The close relationship between space and time is expressed by space-time interferences. Duration perception is highly influenced by the spatial characteristics of the to-be-judged event; the longest the traveled distance, the longest the experienced duration. Reciprocally, perceived distance is also colored by time, such that physical distance is overestimated for long compared to short durations (referred to as the Tau effect; Vidaud-Laperrière et al., 2022). While cross-dimensional interferences have mostly been accounted for by a common magnitude system (AToM theory, Walsh, 2003), a recent study suggests that cross-dimensional interferences occur in working memory (Cai et al., 2018, Hallez & Falci, 2024). Space-time interactions would be the result of memory interference and depend on the memory noises of the target. To directly test this assumption, in our study, participants were presented with 2 briefly flashed dots on a black empty screen. They were to judge the distance separating the two dots that varied in 5 steps. To trigger time-on-space interference, the temporal gap between the two flashes varied. We expected to replicate the distance overestimation for the 600ms compared to the 100ms interval. To test the role of working memory in time-on-space interference, the cognitive load was manipulated on a trial-by-trial basis. Specifically, participants were required to judge at the end of each trial whether a displayed letter belonged to a sequence of four letters that they were instructed to memorize at the beginning of the trial. In the Low load condition, only one letter (BBBB) was repeated four times, whereas the High load condition involved the presentation of different consonant letters (BRQM). Each condition was repeated 16 times, resulting in 2 cognitive load conditions (low/high), 2 duration conditions (100ms/600ms), and 5 different distances. Overall, participants overestimated the distance separating the two dots for the 600ms interval. The manipulation of cognitive load also had a significant impact on performance, revealed by slower response times in the high load compared to the low load condition. The increased cognitive load hindered their speed of response in the task. In addition to its impact on response times, cognitive load also influenced distance estimation.

Ten years of experimental studies on visual preference for curvature

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University of Illes Balears (UIB)

In 2014, we presented “Visual Preference for Curvature as a Potential Aesthetic Primitive” at the conference of the International Association of Empirical Aesthetics. Ten years later we have published 14 studies directly related to preference for curvature. We will show some conclusions. First, “aesthetic primitive” is not much used in the scientific literature and is not always used with the same meaning. We are especially interested in the phylogenic emergence of the aesthetic trait as an internal experience, and its relation to neuro-cognitive processes, that gave rise to particular behaviors. In this line, “aesthetics primitives” are constituents that give rise to the aesthetic trait and refer simultaneously to properties of our world and resonations in our brains. Concerning the preference for curvature, we found the effect in small-scale societies relatively uninfluenced by Western culture (Gómez-Puerto et al, 2017). We also found it in great apes (Munar et al, 2015). The effect size is bigger in meaningless patterns than in images of real objects (Corradi et al, 2018). We found that we react faster to circles than triangles, contrary to some studies (Chuquichambi et al, 2020). We also found that the effect is mainly caused by an inclination toward curved contours and not by a rejection of sharp-angled contours (Chuquichambi et al, 2021a). We showed that familiarity does not explain the effect (Chuquichambi et al, 2021b). We found that curved drawings are preferred to draw than sharp-angled ones (Chuquichambi et al, 2022a). We also found the effect in paintings, both in the lab with digital paintings (Ruta et al, 2023) and in museums, with the original artworks (Munar et al, 2023). We also have found a remarkable breadth of variation among participants (Corradi et al, 2019) in most of our studies. In a systematic meta-analysis, we found a medium effect size of the visual preference for curvature that is moderated by presentation time, stimulus type, expertise, and task (Chuquichambi, 2022b). The results suggested that the effect is a reliable but not a universal phenomenon. However, we advocate that it is a universal inherent trait, that is, a trait that is part of our biological and evolutionary baggage but only manifests itself behaviourally in certain situations that favor its appearance. We will propose the next steps to try to solve this disagreement between the conclusion of the meta analysis and our proposal.

Looking for syntax in the early visual processing of multidigit numbers: it is not there

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University of Malaga (UMA)

According to some views, early visual processing of letter and number strings follow common processes (e.g., García-Orza et al., 2010). However, in a recent model of multi-digit numbers reading, Dotan and Friedmann (2017) proposed the existence of separate and qualitatively different cognitive processes.

Specifically, one difference between these stimuli would be that, in early stages of visual processing, digit strings are organized into triplets, following the recursive structure of the decimal system. The aim of this study is to test this hypothesis by comparing the effect of transposing elements between triplets (e.g., 875246 – 872546) and within triplets (e.g., 875246 – 857246 and 875246 – 875426) in strings of digits and letters. Sixty-six participants performed an experimental masked priming same-different visual task with strings of letters and Arabic digits. A probe string and a target were presented, and the participants were requested to decide whether they were the same or not. A masked prime that could be identical to the target, unrelated to the target or three transposed versions of the target, in positions 2-3 or 4-5 (within triplets) and positions 3-4 (between triplet), was presented between the probe and the target. According to Handelsman and Dotan's (2017; see also Dotan & Friedmann, 2017) triplet hypothesis, if digit strings are processed in a triplet-based manner, when the masked prime contains a transposition between the triplets (positions 3-4), it should be more costly for them to decide whether the two strings were the same or different. Such difference in contrast, is not expected with letter strings. Conversely, if the processing of Arabic digits follows the same mechanisms as those for letter strings, then no differences between digit and letter strings were expected. Analyses showed a similar response pattern for both letters and numbers. Unrelated strings were more costly, whereas transposed primes, independently of the position of transposed elements, had similar effects to identity primes. Further analyses discarded differences between letters and digits in between/within transposition primes. Our results support a position coding mechanism that works similarly for letters and digits, as no evidence was found supporting the triplet hypothesis.

Active sensing is coupled to internal bodily cycles

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Most of what we know about cognition stems from studies in which participants sit in laboratories while researchers measure their reactions to automated stimuli. Yet, this approach does not reflect conditions outside laboratories, where we move our bodies (and sensors) to actively sense stimuli in the world. In this more ecological framework: does it matter that active sensing unfolds from an ever-changing body (i.e. heart and lungs expanding and contracting)? Here, we reveal original evidence for this association. In a series of studies involving visual and tactile processing, we recorded participants' cardiorespiratory activity while they freely moved their eyes and fingers to sense stimuli. Our results showed that participants actively moved to sense the stimuli during specific cardiorespiratory phases. Specifically, they avoided sensing the stimuli during periods of the cardiorespiratory cycle with maximal afferent activity, which has been associated with decreased perceptual sensitivity. Conversely, they actively aimed to sense the stimuli during periods of the cardiorespiratory cycle with minimal afferent activity (silent period) and greater perceptual sensitivity. Thus, we showed that people actively adjust the acquisition of sensory data based on how their internal bodily cycles alter their senses. We reason that stimuli sensed during periods of minimal afferent activity may garner more cognitive resources through two processes: by increasing the strength of the sensory signal and by reducing its degradation due to internal sources of variation. These results fit well with signal detection theory, suggesting a signal-to-noise ratio account between the processing of external sensory signals and internal bodily signals.

Heart rate modulations of correct and incorrect feature integration

María I. Cobos, Pedro M. Guerra, Ana B. Chica

Mind, Brain and Behaviour Research Centre (CIMCYC, UGR)

The brain needs to monitor the external environment and our own body and reactions. It maintains continuous communication with the different body organs, thanks to the peripheral nervous system (PNS). The brain-body communication and its relation to conscious perception are acquiring special relevance in recent times (Cobos et al., 2019; Park et al., 2014; Tallon-Baudry et al., 2018). In this oral communication, we present two studies in which a feature integration paradigm was used while electrocardiogram (EKG) was registered. The EKG allowed us to explore heart rate modulations when color-shape features were correctly integrated (approximately 70% of trials) or incorrectly (approximately 30% of trials). Participants had to report the color of a target letter surrounded by distractors, and trials were categorized as hits (reporting the target's correct color), illusions (incorrectly reporting the color of the distractor), errors (incorrectly reporting a color not presented in the display), or unseen (being unable to report the color). In both studies, the heart rate showed the typical deceleration pattern, which was more pronounced for hits than illusions. This results indicate that PNS modulations are observed for cognitive processing beyond emotion perception and regulation, supporting the models that conceive perception as a complex process involving environment-brain-body interactions, and inviting further research on this topic.

Oral Session 10. Learning

Visual statistical learning predicts literacy difficulties in children with dyslexia

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Introduction: Orthographies contain regularities at many levels, and identifying how readers develop sensitivity to these regularities provides insights into how written information is processed in the brain. This implicit learning of regularities is known as Statistical Learning (SL), and its relationship with reading in deep orthographies such as English has been described, showing that children with reading difficulties, including dyslexia, tend to show lower performance in SL. However, the relationship between SL and reading in transparent orthographies such as Spanish, characterized by more consistent grapheme-phoneme mappings that may require less use of implicit strategies to facilitate reading, remains poorly understood. The aims of the present study were (1) to identify whether Spanish-speaking children with dyslexia show worse performance on SL tasks compared to their controls, and (2) whether there is a relationship between SL and literacy performance (reading and writing tasks) in children with and without dyslexia. Method: This study involved 50 Colombian children aged 9–12 years with dyslexia who responded to four experimental SL tasks created in *E-prime* involving two modalities (visual/auditory) with two types of stimuli (verbal/nonverbal). All the participants underwent standardized reading and writing tests. Data analyses were performed using non-parametric statistics. Results: Children with dyslexia showed significantly lower performance on SL tasks than the control group, with higher differences on visual SL tasks. Correlations showed that accuracy, but not response time in SL tasks, correlated with reading and writing scores in the dyslexia group and when the analysis was conducted for the whole group, but not when the analysis was only carried out for the control group. A linear regression analysis revealed that accuracy in visual SL tasks explains for a portion of the variance observed in word and pseudoword reading as well as word writing tasks within the dyslexia group. However, SL performance did not explain the variance observed in literacy tasks among the control group. Conclusions: Our results suggest that Spanish-speaking children with dyslexia perform less well in SL tasks than their controls, specifically in visual tasks. This pattern of results suggests that the ability to extract implicit patterns from sensory input plays a significant role in shaping reading proficiency in this population. By identifying SL as a potential explanatory factor, our study contributes to a deeper understanding of the mechanisms underlying dyslexia. The implications of SL performance in dyslexia in transparent orthographies are discussed.

The role of heart-rate variability (HRV) and sports practice in learning allocentric spatial relationships

Joaquín Castillo-Escamilla, Irene Ruffo, María Carrasco-Poyatos, Antonio Granero-Gallegos, José Manuel Cimadevilla

University of Almería (UAL)

Heart-rate variability (HRV) is increasingly regarded as one of the key biomarkers for an optimal physical function, widely considered in the sports practice research field. In recent times, several studies have also linked HRV to enhanced executive functions and attention. These cognitive measures are connected to spatial memory, as well as the benefits of sports. Despite this connection, little is known about how HRV could directly influence spatial navigation. This mainly occurs due to a lack of studies using ecologically valid tasks for assessing it. As spatial memory is a basic capability in our daily lives and also in sports practice, better understanding its functioning can have a positive impact. Thus, in order to assess this, 43 female undergraduates from the University of Almería (X Age = 18.76; SD = 2.02) participated in the study. Their HRV levels were registered using the smartphone app Welltory. The sample was divided depending on their scores on HRV (extreme groups design, with $n = 11$ for high/low HRV). They were tested in their spatial memory navigational performance with a computerized task. Physical activity levels were obtained with the Physical Activity Questionnaire (IPAQ), accounting their sports practice habits. Participants with higher HRV were able to perform better in the spatial computerizing task, having less errors per trial when identifying the correct stimuli. Moreover, a simple lineal regression showed that HRV scores could predict performance on the early trials of this virtual task, which is the moment were spatial relationships are still forming. Sports practice did not directly influence performance, and groups were equivalent in their physical activity levels. In conclusion, even after controlling for sports practice, HRV plays a role in the early stages of spatial processing. Better indicators in this variable allow for a more precise and faster spatial learning.

That's my cue! The effect of retrieval cues on the prevention of the return of fear

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It is widely known that fear extinction is more vulnerable than the original fear memory, as relapse phenomena have systematically shown. One strategy that could be potentially useful to prevent the return of fear is the introduction of retrieval cues associated with the extinction phase, which may help promoting the retrieval of that safety memory. Although previous studies have shown mixed results about the effectiveness of this strategy, more human studies are needed to fully disclose the impact of retrieval cues. For this reason, we conducted a preregistered experiment in which 112 participants underwent acquisition, extinction and were then tested after a 15-minute interval (spontaneous recovery). We online asked for participant's confidence ratings regarding US presentation and evaluated CS valence and distress after each phase. After applying the preregistered exclusion criteria and conducting the analyses with the data from 47 participants, we did not find any relapse preventive effect produced by the inclusion of retrieval cues. However, when a less conservative criteria was applied, we did observe some tendency towards a beneficial effect at test. We discuss our results in relation to previous evidence as well as considering various procedural characteristics of our task.

How to promote self-regulation of response speed and learning? The relevance of instructions and task feedback

Cristina Casadevante, Julia Mayas, María José Contreras, Miriam Romero

European University of Madrid (UEM)

Previous studies using an objective learning test (Category Learning Test) have found that response speed correlates strongly with performance: acting too fast prevents learning. Moreover, external regulation of speed significantly increases learning. In the present study, we tried to promote self-regulation of speed without external constraint, in order to test its effects on learning. To this end, two variables were manipulated: instructions and feedback, in order to encourage participants, all of them university students (N=110), to act faster or slower depending on the condition to which they were assigned. Results indicate that participants who experienced slowness-inducing instructions and feedback performed significantly slower and learned significantly more than participants in the control group and participants in the high-speed inducing experimental condition. It is concluded that by manipulating instructions and feedback, self-regulation of response speed can be induced and thus improve performance in a learning task.

Effectiveness of extinction with response prevention on costly and costless avoidance behavior

Paula Balea, Diego Alaminos, Francisco José López, Pedro Luis Cobos

University Rey Juan Carlos (URJC)

Eliminating avoidance responses is central to treating anxiety disorders, yet prior experimental research suggests that conventional therapies like exposure with response prevention may not fully eradicate avoidance when the avoidance response incurs no cost. This study aimed to determine the impact of introducing a cost on the avoidance response and whether costly and costless responses are differentially affected by extinction with response prevention (ERP). Participants (134 undergraduate psychology students from the University of Málaga) underwent fear conditioning where an aversive sound was paired with two stimuli. A neutral stimulus (CS-) was never paired with the sound. Participants were then allowed to avoid the sound by clicking a button. Midway through this phase, a cost for avoiding was introduced. Introducing a cost reduced, but did not eradicate, avoidance. Participants subsequently underwent an ERP phase during which clicking on the button was made ineffective. Finally, at test, they were allowed to use the button again. The presence or absence of a cost for avoiding was manipulated between-stimuli. In line with prior research, ERP did not eliminate costless avoidance. However, it was effective in reducing costly avoidance to the level of the CS-. Prospective Intolerance of Uncertainty was positively associated with the size of the effect of introducing a cost. These findings underscore the importance of addressing avoidance costs in therapy, either by introducing them or by increasing patients' awareness of the adverse consequences of avoidance, to promote more adaptive coping strategies and enhance exposure-based treatment outcomes for anxiety disorders.

Oral Session 11. Language

Immediate semantic integration of newly learned words in children's native and second language

Marta Almería-Morena, Carlos Romero-Rivas

Autonomous University of Madrid (UAM)

Despite several studies in adults, there is a gap in the literature on semantic integration of newly learned words in children, in both their native (L1) and second language (L2). It is essential to know how these processes work in children as they are at a crucial point in their linguistic development, as well as to guide educational practices accordingly to their capacities. To this end, in the present study, a semantic priming experiment was conducted, specifically a lexical decision task with a mixed design incorporating both priming within the L1 and cross-language priming from L2 to L1. 40 Spanish native children (Mage = 11.37) participated in the study. They were presented with new words linked to an image and a description that could appear either in their L1 or in their L2. Subsequently, in the semantic priming task, the new words acted as primes, while L1 words (semantically associated or non-associated to the primes) and pseudowords were presented as targets. The results reveal immediate semantic integration, irrespective of the language of learning, and point to a more immediate pattern of integration than in adults.

Spread the word: Semantic memory and unwarranted beliefs

Daniel Huete-Pérez, Robert Davies, Javier Rodríguez-Ferreiro, Pilar Ferré

Rovira i Virgili University (URV)

Enhanced spreading of activation through semantic memory has been proposed to be one of the mechanisms underlying some of the symptoms observed in schizophrenia spectrum disorders. Evidence for this explanation comes from, but is not limited to, associative/semantic priming studies. However, the literature on priming effects in schizophrenia spectrum disorders is inconsistent. In addition to methodological differences and limitations, the discrepancy of results between priming studies could be due to the within-diagnostic heterogeneity problem: not all individuals under the same categoric diagnostic label (e.g., schizophrenia, schizotypal personality disorder) present the same symptoms and psychopathological mechanisms. This problem can be bypassed by focusing on specific traits of schizophrenia spectrum disorders, such as unusual beliefs. Accordingly, the purpose of this research was to examine the potential modulation of associative/semantic priming effects by individual differences in epistemically unwarranted beliefs (EUB). To this end, participants varying on their degree of belief in paranormal phenomena, pseudoscience and conspiracy theories performed a primed lexical decision task, which included related prime-target pairs (e.g., clock-hour) and unrelated ones (e.g., chair-hour). Response times were analysed with Bayesian linear mixed-effects models. Apart from the typical priming effect, the most relevant finding was that EUB facilitated performance: the higher the level of EUB, the faster the response to both related and unrelated prime-target pairs. This pattern of results was consistent to the predictions made from the enhanced spreading of semantic activation hypothesis.

The role of semantic feedback in the recognition of emotional words

Juan Haro y Pilar Ferré

Rovira i Virgili University (URV)

There is considerable evidence that emotional words are processed differently from neutral words in the lexical decision task (i.e., a task in which participants are asked to discriminate between words and nonwords). However, the locus of the effects of emotional content in word recognition is still unclear. One possibility is that the emotional content of words is part of their semantic representation and thus contributes to word recognition in a similar way to other semantic variables (e.g., concreteness, number of semantic features, number of meanings, etc.). If so, the effects of emotional content on word recognition should be modulated by experimental manipulations that affect the semantic processing of words. The present study investigated whether the effect of emotional content on word recognition is sensitive to semantic feedback processes, i.e. the mechanism of backpropagation of activation from the semantic representation level of a word to its orthographic representation. In three experiments, emotional (negative and positive) and neutral words were presented in lexical decision tasks of varying difficulty. The difficulty of the task was manipulated by the type of nonwords used: easy task (illegal nonwords; e.g. 'bcncc'), normal task (legal nonwords; e.g. 'bunco') and difficult task (pseudohomophones; e.g. 'vanco'). It was hypothesised that the more difficult the discrimination between words and nonwords in the lexical decision task, the greater the contribution of semantic feedback effects to word recognition. EEG activity was recorded during the task, focusing on evoked potentials associated with semantic processing (N400). Results showed an interaction between task difficulty and N400 amplitudes of emotional words, suggesting that emotional content effects in word recognition are sensitive to semantic feedback processes. These findings have important implications for our understanding of the locus of effects of the emotional content of words and its representational encoding.

Enhancing Digital Reading: Insights from Eye Movements and Brain Activity

Mario Romero, Clara Soberats, Ladislao Salmerón

University of Valencia (UV)

Recent literature, including multiple meta-analyses, shows that reading comprehension is inferior on screens compared to print. Behavioural and neural evidence also links digital reading with poorer attentional control. Given the crucial role of attentional mechanisms in text meaning construction, reading interventions focused on improving attentional control during reading seem a promising endeavour to enhance digital reading comprehension.

Last year, a 16-week national reading intervention was conducted in several high schools to enhance digital reading. Students read high-quality texts weekly on an online platform, receiving tailored feedback on their performance and progress. To assess changes in students' reading processes after the intervention, an additional experimental study was conducted. This submission discusses the study, which included the joint use of electroencephalography (EEG) and eye tracking (ET) to investigate the intervention's effects.

Data from 47 high school students (aged 14-15) were used. One group ($n = 22$) participated in the digital reading intervention and was assessed before (pre-test, October 2023) and after (post-test, February 2024) the programme. A control group ($n = 25$) was assessed in April 2024. Participants were randomly assigned based on question placement (end of the text vs. after each paragraph) and feedback type (none vs. simple vs. elaborated).

In each assessment, participants read two long expository texts (approximately 1500 words each) not included in the intervention. Nine multiple-choice questions were generated for each text to assess reading comprehension. General reading skills (Complec) and attentional capacity (CARAS-R) were also measured. Eye movements were recorded using a LogicOne LD250 (Eyelogic GmbH, Berlin, Germany) with a sampling frequency of 250 Hz, and brain activity was collected using a 32-channel R-Net cap (Brain Products GmbH, Germany), sampled at 1000 Hz.

As data preprocessing is still underway, we aim to discuss the findings of this novel use of EEG and ET at the Conference. This innovative approach is crucial for providing deeper insights into how digital reading interventions impact students' reading processes, offering valuable information that could significantly enhance educational strategies and outcomes.

What makes brand names special? An electrophysiological approach

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University of Valencia (UV)

Previous research has shown that lexical access is quite robust to changes in surface elements (e.g., font, letter case, color, size), which has led scholars to assume that lexical memory is composed of abstract representations. However, recent behavioral experiments have shown that brand names, a type of word that is consistently presented in the same format (e.g.,), are sensitive to surface elements. In semantic categorization and lexical decision tasks, response times to brand names are longer when presented in a modified font or letter-case than in their standard format. The present study examines the underlying neural mechanisms behind the identification of brand names in a semantic categorization task (brand related to transportation or not). We recorded the electrophysiological response (via event-related potentials; ERPs) to brand names in three conditions: (1) in their original visual format, (2) with a modified letter-case, and (3) with a modified font. Results showed a different pattern for those brands presented in a modified font in early (N170) and late (N400) processing stages when compared to the brands that were presented in their original format. These findings reveal that the impact of surface elements of brand names is not encapsulated in early visual processes, posing problems for purely abstractionist models to visual-word recognition.

The relevance of top-down processes in the recognition of incomplete words: an ERP study

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In behavioral experiments, words composed only of their upper halves are effective in masked priming tasks, reinforcing the Perceptual Closure effect (i.e., incomplete stimuli can be recognized as a whole). However, these studies cannot address the interplay between bottom-up and top-down processing for these stimuli. To track the electrophysiological signature of upper-half word processing, we presented high- and low-frequency words (a lexico-semantic factor) in two different displays (full words, upper-half words) in an Event-Related Potentials (ERPs) lexical decision task. Results showed an effect of display in three early ERP time-windows: P100, N170, and the Negativity Closure component (NCI; 260–330 ms).

Word frequency influenced earlier processing stages for upper-half words (around 350 ms post-stimulus) compared to full words (around 450 ms post-stimulus). This pattern demonstrates that (1) lexical feedback helps disambiguate perceptually difficult stimuli and (2) the interaction between bottom-up and top-down processes varies as a function of perceptual ambiguity.

Oral Session 12. Attention. Learning

Attentional hemispheric specialization through the right frontal eye field: a TMS-EEG study

María Melcón, Gabriela Cruz, Matias Palva, Satu Palva, Gregor Thut

University of Glasgow

Mechanisms of attentional control have been extensively studied but the specific role of each cerebral hemisphere is still debated. Two main theories have been proposed to explain their involvement: the rivalry theory and the hemispatial theory, both assuming a contralateral control of the attended space. While the rivalry model suggests that this control is shaped in the form of inhibition between hemispheres, the hemispatial model relies exclusively on contralateral activation, acknowledging the right hemisphere's ability to attend to the ipsilateral visual field as well. Our goal was to explore the hemispheric engagement in spatial attentional control through the study of the right-Frontal Eye Field (rFEF) excitability by combining Electroencephalography (EEG) and online Transcranial Magnetic Stimulation (TMS) in a TMS- evoked potential (TEP) approach. We recorded EEG in 32 volunteers while they performed in a visuospatially cued target detection task. Single-pulse TMS was applied to the rFEF and a control area (right M1 foot area) in the cue-target interval, i.e. while participants were deploying covert attention to the left or right visual field in anticipation of an upcoming target (80% validity, directional cues) or did not deploy attention (no-attention cue, no target presented). FEF-network excitability was inferred from TEPs across the three conditions (left cue, right cue, no-attention cue), after artifact removal. The behavioural results revealed a validity effect for target detection, indicating that participant deployed covert attention as instructed. Analysis of TEPs using Global Field Power measures revealed five components: P25, N40, N100, P185 and P300. Comparisons of TEPs across all three cue conditions using dependent-samples cluster- based permutation on the two-dimensional data (channel-time) revealed significant differences in excitability during spatial orienting relative to the no attentional control, spanning from 67ms to target onset, involving the late TEP components N100, P185 and P300. The results show that relative to the no- attention control, rFEF-network excitability is changed to the same degree and direction during left and rightward attention. This supports the hemispatial theory, that is, a similar involvement of right hemisphere in attentional orienting to the two visual fields, as opposed to the rivalry model for which opposite involvement (excitability enhancement and suppression) would have been expected.

Target or not? Eye movements as a tool to understand visual search

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Search is one of the central functions of vision. Unfortunately, it has often been studied through covert attention paradigms that require participants to fixate on a central location while performing a visual search task in the periphery. However, analyzing gaze strategies in visual search might help us understand how we determine what is relevant in a scene. In this talk, we will present the results of three experiments in which we recorded eye movements while participants performed different types of visual search tasks. In all experiments some aspects of the visual search display were repeated over trials while other aspects were irrelevant for the task. In the first study we used a comparative visual search paradigm. In each trial the screen was divided into two halves, each displaying an identical configuration of 8 elements.

Participants had to find the only item that differed between both sides of the screen. Eight configurations were repeated 12 times during the experiment. In the second study we employed a repeated search paradigm, presenting the same search display in all trials. Participants searched for 12 items a total of 6 times, but we manipulated the order in which targets were presented. A 'critical' item was presented for the first time after 5 trials or after 55 trials. Our goal was to determine if previous fixations on this item while searching for other targets facilitated search. In the third study we employed a contextual cueing paradigm, manipulating the number of relevant and irrelevant distractors. Configurations of relevant distractors were repeated, but irrelevant distractors were always placed randomly. Eye movements in these three tasks showed interesting patterns. In all experiments we found variations in scan-paths and fixation durations over trials. Specifically, the number of fixations needed to find the target decreased significantly over repetitions. Context repetition also led to optimized scan-paths. Moreover, fixation durations differed depending on whether the fixation was on the target item or on distractors. Previous incidental fixations on an item did not seem to facilitate search later, but, at the same time, participants could not avoid making fixations on irrelevant distractors either. These results provide some insights into how items are classified as relevant for the task and the limitations of memory and attentional selection during search.

Still searching for an effective way to produce trial-by-trial congruency cueing in a Stroop task

Luis Jiménez, David Gallego

University of Santiago de Compostela (USC)

Humans are able to regulate the intensity with which they exert cognitive control in interference tasks in terms of factors such as how much control was required on the previous trial, and the overall frequency with which conflicting trials appeared over a previous series. However, recent research has shown that the ability to follow explicit cues predicting the required level of control is more limited than previously assumed. Jiménez et al. (2021) showed that participants in a color Stroop task did only take advantage of pre-cues informing them about the color-word congruency on the following trial when the cue was presented in the interval between trials, but not when the information was conveyed by the preceding trial. Here we explore the boundary conditions of these sequential cueing effects and show that there is no effect of trial-by-trial cueing neither in conditions in which the proportion of high-conflict trials is increased, to improve practice with the rules, nor when that proportion is decreased, to make it easier to follow them. This cueing effect is neither observed when the cue is conveyed by neutral trials, thus reducing the conflation between the current conflict and the expected requirements of control. As a whole, this evidence reinforces previous results illustrating how difficult it is to adjust control parameters based on sequential explicit cues.

Neural mechanisms of attentional integration and selection across time

Blanca Aguado-López, Ana F. Palenciano, María Ruz

Mind, Brain and Behaviour Research Centre (CIMCYC, UGR)

The perception of a complex world requires multiple steps in information processing, including the selection of relevant information and the integration from various sources. Previous research has studied the mechanisms supporting selection and integration separately, with different experimental paradigms. Attentional selection is known to enhance the processing of selected stimuli even during the preparatory stages. Meanwhile, studies examining integration have focused on rule integration, revealing activation in the prefrontal cortex. Nonetheless, activity related to the integration of stimuli and its preparatory coding has not been explored, and a detailed comparison of the neural coding of stimuli in these two types of contexts has not been made. To study this, we collected EEG data during a cue-target paradigm to examine how information coding unfolds temporally as a function of the cognitive demands of selection or integration. Our hypothesis predicts that selection vs. integration demands will influence the way in which information is encoded, both in anticipation and during target processing, making the stimuli more distinguishable in selection conditions and more similar in integration. Representational similarity analysis (RSA) indicated that during the target processing, the exact exemplar to attend to and the task to perform structured the encoding space, but not the general stimuli category coding. We did not find an interaction showing possible differences between the way of processing stimuli on selection vs. integration contexts. These preliminary results reflect the different patterns of brain activity, during target processing the coding of the stimuli is more detailed and it does not need the category coding, while the representation of the task might contribute to perform it well. The fact that we did not find preparatory activity linked to the task or the stimuli might be due to sustained activity during the task. These results will contribute to the understanding of preparation and target processing, exploring the relationship between attention directed to one stimulus and several ones.

Enhancement of the prediction error in extinction through compound presentation with novel stimuli

Paula Nogueiras, Fernando Rodríguez-San Juan, Gabriel Rodríguez & Unai Liberal

University of the Basque Country (UPV/EHU)

We present some experiments that tested whether learning during pavlovian extinction of a target stimulus (A) can be enhanced by presenting novel stimuli (N) in compound with it. This hypothesis is derived from our theoretical model (Hall and Rodríguez, 2010), in which we assume that the presentation of a novel stimulus induces the activation of the expectation that an event will occur. It follows that under conditions of nonreinforced exposure, where no relevant consequence occurs after the presentation of the stimuli, this initial expectation will be contradicted by experience, thus producing a prediction that drives learning. We have obtained evidence for this assumption by studying latent inhibition, a phenomenon in which nonreinforced exposure takes place prior to conditioning. Our recent studies have shown that the presentation of novel stimuli during the preexposure of a target stimulus A can enhance the inhibitory learning to the extent that it endow such a latent inhibitor with net inhibitory properties, allowing it to pass both the retardation and summation tests. Extrapolating this to extinction, we expect that the presentation of novel stimuli could also enhance inhibitory learning during nonreinforced exposure after conditioning. We assessed this prediction in experiments using appetitive and aversive conditioning procedures with rats and human associative learning procedures.

Oral Session 13. Decision making. Thought. Language

Neural correlates in the time course of inferences: costs and benefits for less-skilled readers at a university level

Mabel Urrutia, Esteban Pino, María Troncoso-Seguel, Claudio Bustos, Pamela Guevara, Karina Torres-Ocampo, Sandra Mariángel, Yang Fu, Hipólito Marrero

University of Concepcion, Chile

Inferences are an indicator of a greater reading comprehension, as they imply a combination of implicit and explicit information that usually combines a textual representation with background knowledge of the reader. The aim of this study is to explore the costs and benefits of the time course of inferences in university students with reading comprehension difficulties at 3 stages during a narration. The method used was the event-related potential (ERP) technique in order to register the brain activity of 63 teaching program students while they read familiar, less-familiar and neutral stories. Results show a slow negativity potential component with greater negativity in words coming from familiar contexts when compared to less familiar and neutral ones in the first locus, corresponding to the first moment of the narrative related to the context; an N400 component and a Post-N400 component in the second locus, corresponding to a second moment of the narrative related to the critical phrase, reflecting greater negativity in familiar contexts when compared to less-familiar ones; and, lastly, through the use of a lexical decision task, FN400 and N400 components were found in the third locus, corresponding to the third moment of the narrative, that is, the closing phrase. The effects found were especially for pseudowords. These results are interpreted as a preferably bottom-up processing, which is characterized by lexical access difficulties in less-skilled readers.

On the nature of the inhibitory neighbourhood effect: A masked priming study with European Portuguese-English bilinguals

Ana Isabel Fernandes, Juan Haro, Ton Dijkstra, Montserrat Comesaña

University of Minho

Computational models of bilingual visual word recognition, such as the Multilink+ (Dijkstra et al., 2023), assume that lexical access is language non-selective. When presented with a visually presented target word, words that share form and/or meaning are coactivated independently of the language they belong to and compete for lexical access. This assumption has been tested in several masked priming lexical decision studies using orthographic substitution neighbors in literature (i.e., words that share all letters but one). Although results are inconsistent, studies often find an inhibitory effect of orthographic neighborhood, i.e., decision latencies are longer when a target is primed by a higher-frequency neighbor than when primed by an unrelated word (beau-BEAM > donc-BEAM; Bijeljac-Babic et al., 1997). However, the nature and locus of this effect are not clear. Examining these issues was precisely the aim of the present masked priming lexical decision study with 152 European Portuguese (L1)-English (L2) bilinguals who varied in their L2 proficiency and L2 daily use. The orthographic (O) and phonological (P) neighborhood size of prime words was manipulated in an orthogonally way creating four conditions: i) high O and P neighborhood size; ii) high O and low P neighborhood size; iii) low O and high P neighborhood size; and iv) low O and P neighborhood size. Results showed an inhibitory effect which was modulated by the orthographic and phonological neighborhood size of prime words and participants' L2 daily use, evidencing that the effect is not only orthographic in nature, but that it occurs in the early stages of visual word recognition.

The influence of bilingualism on verbal memory in patients with Parkinson's Disease

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Objective: Studies with healthy and dementia populations evidence that bilinguals present better executive and global performance compared to monolinguals (Ware AT., 2020). It has been documented that bilinguals with Alzheimer's disease perform similarly to monolinguals in verbal memory tasks despite greater damage to the circuits of the medial temporal lobe (MTL) (MF. Mendez, 2019). The present study compares verbal memory performance between monolingual and bilingual patients with Parkinson's Disease (PD). Method: 17 monolinguals with PD, 12 bilinguals with PD, 17 healthy bilinguals and 10 healthy monolinguals participated. All underwent a complete neuropsychological evaluation including the Test de Aprendizaje Verbal España-Complutense and the Rey–Osterrieth Complex Figure. The age of PD diagnosis was recorded. Results: significant differences were only observed in short-term ($p=.017$), and long-term ($p=.019$) verbal memory tasks between bilinguals with PD and control bilinguals. No differences were observed in visual memory tasks between any group. A tendency for bilinguals to be diagnosed a year later was identified. Conclusions: This study provides evidence on the involvement of bilingualism in areas of the left LTM associated with the declarative memory system in PD. However, bilingualism doesn't seem to affect cognitive performance of visual memory associated with right LTM areas. The results reveal that the onset of the disease is delayed by one year for bilinguals with PD. This could be at the expense of a higher degree of neuropathological damage, specifically in areas of the left LTM.

Machine learning for analysing oral production in primary progressive aphasia

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Introduction: Artificial intelligence (AI) is making significant advances as a tool to aid in the diagnosis of various diseases, and one of the most researched approaches in the health field is machine learning. In the case of degenerative dementias, AI is being used to identify early symptoms, mainly from speech and voice. Some research has proposed models for detecting Alzheimer's disease by analysing spontaneous speech. Patterns of language use have also been found in patients with Parkinson's disease and primary progressive aphasia (PPA). Aim. The aim of this study is to find the language task that most effectively classifies the different types of PPA using a machine learning technique applied to speech analysis. Method. The study included 4 patients with PPA and 2 healthy controls. Subtests of the ACE-III test and the MLSE test were used to assess and analyse speech production. Recordings were made of the assessments, the audios were processed and approximately 3 hours of audio were obtained. Verbal fluency (ACE-III), picture naming (ACE-III) and word and sentence repetition (MLSE) tasks were analysed for this study. Results. Eleven machine learning algorithms were applied to all the audio recordings after removing the silences. The results show that the verbal fluency task is the best discriminator between patients and healthy controls. Conclusions. Verbal fluency is the task that provides the most information to train the algorithms and classify between the two groups of participants.

Language processing networks to analyze the semantic system in Parkinson's disease on/off dopamine medication in a verbal fluency task

Elena Herrera, Paz Suárez-Coalla, Virginia Ahedo, José Manuel Galán

University of Oviedo (UNIOVI)

Introduction: Parkinson's Disease (PD) is a neurodegenerative disorder marked by dopaminergic dysfunction, impacting motor and non-motor functions, including language processing. This study aims to study language processing networks to enhance comprehension of the semantic system in PD patients on/off dopamine medication during a verbal fluency task, employing a core-periphery structure and investigating the interaction between psycholinguistic variables and network structure.

Method: A total of 21 non-demented PD patients and 24 matched healthy controls participated, with PD patients assessed on and off dopamine medication. Employing Bayesian stochastic block models within a core-periphery network framework, the study evaluates verbal fluency performance across semantic, phonological, and action categories. Data analysis includes directed networks (indicating one-way relationships) and undirected networks (representing mutual connections), crucial for modeling word sequences and co-occurrence frequencies. Psycholinguistic variables such as lexical frequency, familiarity, imageability, concreteness, Age of Acquisition (AoA), and motor content were also analyzed.

Results: Semantic networks exhibit a core-periphery structure, with central words more frequent, concrete, and familiar, contrasting with peripheral words. These results are consistent across groups, except in the PD off group, where higher imageability in semantic fluency occurs in the periphery, and in phonological fluency, more concrete words are generated peripherally. Additionally, phonological fluency in PD patients without medication yields significantly less familiar words than controls. Notably, action fluency demonstrates the most discrepancies between core and periphery, with all variables significant in both network types. **Discussion:** few studies analyze psycholinguistic traits in verbal fluency tasks, especially in PD. This study uniquely combines lexical and semantic analyses with core-periphery assessment in PD patients on/off medication, unveiling significant differences in network core and periphery and across participant groups and tasks. These findings endorse a hierarchical organization of word generation, with central words linked to accessible concepts in the lexical-semantic system. Exceptions in PD patients without medication suggest dopamine's crucial role in semantic organization. Furthermore, this group exhibits higher production of frequent verbs in action fluency, particularly in the core, emphasizing dopamine's influence on action fluency.

Oral Session 14. Executive Functions

Urban experience alters lightness perception

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Our perception of the lightness of a surface is often regarded to be driven not by experience, but by aspects of our visual physiology that are so fundamental as to be universal. The role of experience in lightness perception was investigated through a cross-cultural comparison of two visual contrast phenomena: simultaneous lightness contrast and White's illusion. The Himba, a traditional semi-nomadic group known to have a local bias in perception, showed enhanced simultaneous lightness contrast but reduced White's illusion compared with groups that have a more global perceptual style: Urban-dwelling Himba and Westerners. Thus, experience of the urban environment alters lightness perception and we argue it does this by fostering the tendency to integrate information from across the visual scene.

Executive functioning in convergent and divergent creativity

Maravillas Sánchez Tudela, Isabel Carmona Lorente, Carmen Noguera Cuenca

University of Almeria (UAL)

The role of executive functions in creative thinking is under debate. Some authors argue that the role of higher functions, such as high attentional control, interfere with the creative pathway. Others consider that higher cognitive functions are indispensable in creative problem solving. On the other hand, there is disagreement about which mode of thinking or processes underlie creativity. Therefore, the present study explores the relationship between creativity and higher cognitive functions, such as attentional control and cognitive flexibility. In addition, as a novel contribution, the different patterns of convergent (Remote Associates Task; Mednick, 1962) and divergent (CREA; Corbalán et al., 2003) thinking styles considered interdependent with creative thinking have been explored. The sample was 78 students from the University of Almería (18-34 years old). Participants completed tasks to assess their cognition prior to the creative thinking tests. For this purpose, the Visual Change Locating Task was administered to assess WM capacity, an Engle battery (Stroop Task, Flanks and Simon) to assess inhibitory control ability and the Test of Changes to assess cognitive flexibility ability. Data were standardised and composite scores of higher functions were calculated to obtain a single measure. The results show a combined contribution of executive functions and creativity in both modes of thinking. It is suggested that convergent thinking is influenced to a greater extent by cognitive flexibility and processing speed. Whereas divergent thinking requires, in general, greater inhibitory control, and, particularly in terms of fluency, cognitive flexibility and less inhibitory control.

Nature's influence on attentional control processes: behavioral and electrophysiological results

Javier González-Espinar, Isabel Carmona, Juan José Ortells

University of Almería (UAL)

A recent study from our research group found that performance in the Stroop task can be improved through the mere visualization of natural (but not urban) images. Based on this finding, we have chosen a related executive task, the flanker task, aiming to replicate the behavioral results and to extend them by also measuring relevant electrophysiological components. The flanker task used here simply consists of a set of five arrows to which participants must respond to according to only the central arrow's direction. In order to increase executive function demands the ratio of congruent trials is of 75%. We expect to obtain meaningful electrophysiological evidence, namely, certain event-related potentials (ERP), to help us understand the mechanisms underlying the enhancement that participants experience during natural exposure. An additional, but complementary objective of this work involves the measurement of the attention control ability (AC) of our participants with the squared tasks developed by Burgoyne et al. (2022). We hypothesize that people with lower attentional control (AC) abilities could see greater performance enhancements when exposed to nature, in contrast to those with higher AC abilities, as there are reasons to believe that this exact process is the main cognitive function that benefits from the nature enhancement effect.

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Evaluation of the relationship between cognitive reserve and experience in the practice of Aikido with executive functions: a pilot study

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Executive functions play a crucial role in daily life by affecting people's ability to perform tasks efficiently, and their development and strengthening directly impact the quality of life. Both internal and external factors can influence the performance of these functions, with physical activity being one of them.

Although it has been shown that physical activity provides significant physical and psychological benefits, research in the field of martial arts, such as Aikido, has been limited. This discipline, which combines physical movements with a philosophy of harmony and self-control, emerges as a particularly interesting and underexplored area of study.

This study, conducted with Aikido practitioners, examined the relationships between cognitive reserve and experience in Aikido practice with executive functioning. Experimental tasks were used to evaluate inhibition, cognitive flexibility and decision-making, as well as self-report measures to assess cognitive reserve and other relevant variables, such as impulsivity, aggressiveness, anxiety and depression. The results showed a moderately significant relationship between experience in Aikido and a measure (mixing costs) of cognitive flexibility related to a higher level of vigilance in a task switching paradigm. Likewise, low negative correlations were found between the length of practice and the level of Aikido achieved with certain components of impulsivity, aggressiveness and anxiety. The total cognitive reserve was not significantly related to any variable, but more specific analyses with the groups of indicators that constitute it revealed some significant relationships with impulsivity, aggressiveness, anxiety and learning in decision-making, which needs further research in future studies.

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Novel task assembly across the frontoparietal cortex recruits both generalizable and high-dimensional neural codes

Ana F. Palenciano, Carlos González-García, Paula Pena, Alexandra Woolgar, María Ruz

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In everyday life, humans constantly face and overcome novel challenges through instructed behavior. This complex skill is based on cognitive control mechanisms that organize and maintain the task-relevant information, ensuring readiness. Previous studies examining these control processes have shown sustained neural activity of task components prior to execution, but they often focus on repetitive, highly practiced tasks. To address this gap, we aimed to characterize the temporal dynamics during the preparation and implementation of novel tasks. In an electroencephalography (EEG) experiment, we employed a novel verbal instruction paradigm where three task components (overall integration vs. selection demands, the relevant –animate or inanimate– targets, and the feature –shape or color– to respond to) were orthogonally manipulated to create unique task combinations on every trial. Our main goals were to (1) determine whether the content of novel instructions could be decoded from the neural data, and assess their temporal profile along the trial, using Multivariate Pattern Analysis (MVPA), and (2) examine the underlying organizational geometry of control-related codes, investigating their degree of dimensionality, with Cross-Condition Generalization Performance (CCGP), and abstraction, using Shattering Dimensionality (SD). The MVPA results indicated that decoding the content of the three task components was possible during both preparation and implementation. However, we observed that the coding dynamics varied substantially across components, with more stable and generalizable codes for higher-level variables (Task Demand), and more transient activity patterns for lower-level variables (Target Category and Target Relevant Feature). Moreover, neural patterns exhibited high dimensionality and abstraction, consistent with previous accounts of control representations' geometry, balancing a trade-off between separability and generalization of information. Lastly, additional neural similarity analysis on a low-dimensional manifold revealed that the different Task Demands, integration and selection, were geometrically structured to favor generalization of information.

Oral Session 15. Neurodevelopment + Working memory

Recent findings on the neurodevelopment of language and executive functions in prelingually deaf children

Ana Merchán Carrillo, Laura Fernández García, Nahuel Gioisa Maurno, María Teresa Daza González

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Children with prelingual deafness may be at risk of early language deprivation, which affects the development of higher cognitive processes such as language and executive functions (EFs). Although the use of cochlear implants (CIs) has improved auditory capacity, many studies continue to find difficulties in the development of these cognitive processes in CI-implanted deaf children. The aim of this communication is to explore the neurodevelopment of language and EFs in prelingually deaf children with and without CIs, and to detect potential difficulties to act early in prevention and intervention. The subjects were prelingually deaf children from various studies, aged between 4 to 12 years with (n= 17- 22) and without CIs (n= 16-19), and their hearing controls (n= 19-21). The language aspects evaluated were receptive vocabulary through the Carolina Picture Vocabulary Test, conceptual organization of the semantic system through a forced-choice task developed by Blaye and Bonthoux (2001), and syntactic comprehension through the PROLEC-R Battery's Grammatical Structures subtest. The EFs evaluated were inhibitory control (interference suppression) and cognitive flexibility (shifting) through an abbreviated version of the Child-ANT task, and working memory through the Sequence Learning Task. The results in these tasks indicated that deaf children, compared to their hearing peers, showed a smaller receptive vocabulary size, less comprehension of active and passive sentences, and a greater preference for thematic relationships over taxonomic relationships. In EFs tasks, deaf children showed a greater flanker interference effect in the child-ANT task, and lower accuracy percentages in the working memory load conditions of the Sequence Learning Task. Contrary to our expectations, CI-implanted deaf children had statistically similar results in all tests compared to non-CI children. In conclusion, deaf children may suffer a disadvantage compared to their hearing peers in the neurodevelopment of language and executive functions, regardless of having or not having CIs, which is an aspect to consider for neuropsychological and educational interventions.

Early development of electrophysiological connectivity networks in relation to the emergence of cognitive control

Josué Rico-Picó, Sebastian Moyano, Nines Ballesteros-Duperón, Angela Conejero, Luisa Arrabal, Charo Rueda

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Cognitive control (CC) refers to a form of action selection and monitoring that involves voluntary adjustments to contextual changes. A rough capacity of CC emerges at the end of the first year of life, and there is an extraordinary growth of this ability in the following years. In parallel to this cognitive and behavioral development, the brain is experiencing vast maturational changes in the first years of life in a variety of structural and functional dimensions. High-density EEG is particularly fitted to explore patterns of functional connectivity in different frequencies of brain activation either at rest or linked to the performance of cognitive tasks. In the current study, we have examined changes in patterns of brain functional connectivity with HD-EEG in an initial group of 6-months old babies ($n=137$) who were longitudinally followed at 9 ($n=87$), 16 ($n=58$) and 36 ($n=58$) months of age, and tested the relationship between age-related changes in connectivity with the emergence of cognitive control as measured with the Early Childhood Inhibitory Touch-screen Task (ECITT). Different indices of functional connectivity (i.e. local and global efficiency of connectivity and propensity for a small-world topology) were calculated for oscillatory activity in theta (3-5Hz), alpha (6-9Hz) and beta (10-20Hz) oscillatory activity measured at rest. In addition, participants performed the ECITT at the age of 9 and 16 months. This task provides measures of executive control as babies interact with a tablet in a child-friendly audiovisual display. First, we found significant lineal increases with age in both local and global efficiency measures in all frequency bands, whereas the small-world propensity remained stable for theta and alpha and showed a quadratic age-related increase in the beta band. Also, we found significant improvements in the performance of the ECITT between 9 and 16 months, particularly in indices of flexibility and inhibitory control. Further, we found a positive correlation between connectivity efficiency in the alpha band and the ECITT performance at 16 months, as well as a longitudinal prediction from measures of connectivity at 9 months to performance of the task at 16 months of age. This data provide novel and valuable information on neural markers of the early development of CC. This understanding is of great importance given the key role of this function for typical and atypical cognitive development.

Working Memory Capacity can modulate the space-time interaction

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This research investigates whether the mental space-time association of temporal concepts (e.g., associating the past with a hemispace and the future with the opposite hemispace) can be modulated by cognitive resources, specifically working memory (WM) and inhibitory control capacities, and whether access to this association is automatic.

The participants were required to classify words with future and past meanings while the WM load was manipulated (high vs. low). The temporal concepts were presented in two ways: subliminally (immediate masking condition) and supraliminally (delayed masking condition). They were grouped into quartiles based on their visuospatial working memory capacity (WMC). The results of repeated-measures ANOVA indicated a consistent performance pattern aligned with the left- past and right-future conceptual schema, regardless of both the masking type (immediate or delayed) and WM load. However, an interesting exception was noted among participants with high WMC, where the space-time association effect was absent. This suggests that individuals with higher visuospatial WMC do not rely on the same automatic space-time associations as those with lower WMC under the same experimental conditions.

These findings provide partial support for the automatic and implicit nature of accessing mental space-time associations. The absence of the effect in high WMC participants highlights the potential modulating role of cognitive resources, particularly working memory capacity, in the automaticity of these mental associations. This suggests that while the mental space-time association may generally operate automatically, individuals with higher cognitive capacities might employ different strategies or have enhanced control over such automatic processes.

This experiment underscores the complexity of cognitive processes underlying temporal concept classification and highlights the necessity to consider individual differences in cognitive capacities when examining mental associations. The modulation of automatic space-time associations by cognitive resource availability opens avenues for further research into the interplay between cognitive control mechanisms and implicit mental processes.

Exogenous spatial retro-cues select associated novel stimulus-response bindings in working memory

Águeda Fuentes-Guerra Toral, Juan Lupiáñez, Fabiano Botta, Elisa Martín-Arévalo, Carlos González-García

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Research on exogenous attention has primarily focused on the spatial domain. Nevertheless, in real world environments, exogenous cues are often associated with complex stimuli that require the involvement of different memory systems, including working memory (WM), to perform adaptive behaviors. However, the ability of exogenous retro-cues to select and prioritize not only spatial locations, but also complex novel stimulus-response (S-R) bindings held in WM remains largely unexplored. Departing from the proposed concept of event files (Hommel, 2019) we hypothesized that if a complex novel S-R binding is incidentally encoded at a specific location, a subsequent exogenous non-predictive cue to that location should also trigger the activation of the associated WM content. We found compelling behavioral evidence (N=21; N=23; N=21) that exogenous non-predictive retro-cues can select space and the associated S-R bindings held in WM. Moreover, this effect took place independently of the relevance of the spatial domain in the task to be performed. Last, a drift diffusion model suggested that the mechanisms through which exogenous attention selects and prioritizes WM contents might depend, at least partially, on the hierarchical relevance of the different dimensions encoded within a specific representation. Together, these results highlight the relationship between exogenous attention and complex WM contents which involve action control and inform current theoretical debates about the interaction of attention, perception, memory, and action.

Effect of Working Memory Overload on Emotional Responses and Recognition Memory: Subjective and Brain Correlates

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University of Castilla La Mancha (UCLM)

The aim of this study was to investigate the impact of working memory overload on emotional processing and recognition memory. Firstly, to study emotional processing, subjective and fNIRS correlates were measured while inducing emotions using affective pictures presented for 6 s. A recognition memory task was then administered, in which participants were required to indicate whether each affective stimulus was new or had previously been used in the passive viewing task. A sample of 70 healthy volunteers (44 women) were divided into an experimental group in which working memory was overloaded using a mathematical calculation update task during the emotion induction procedure, and a control group in which working memory was not overloaded. Regarding the effect of working memory overload on emotional processing, the results showed that the experimental group rated negative stimuli as less unpleasant and less arousing. Additionally, this group presented higher fNIRS activations in the dorsolateral prefrontal cortex (DLPFC), particularly to high arousal stimuli. Meanwhile, the findings revealed better recall for negative and high arousal stimuli in the experimental group. Overall, our findings provide further evidence on the modulation of emotional processing and recognition memory as a function of working memory overload, while highlighting the importance of the DLPFC in emotion processing and cognitive load management. We thus open a path to explore practical applications in educational and clinical settings.

Oral Session 16. Other

Exploring the role of perceptual size in the comparison of multi-digit numbers

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The length-digit congruity effect describes the fact that the comparison of multi-digit numbers with different length is faster for congruent pairs (such as 2384 vs. 107, where the leftmost digit of the 4-digit number is larger than the leftmost digit in the 3-digit numbers), than incongruent pairs (such as 2675 vs. 398, where there is incongruent information between the one provided by the leftmost digit of the 3-digit number and the one provided by its length) (García-Orza et al., 2022). A non-solved issue is whether participants choose the number with more digits by exactly computing the number of digits in the string (e.g., 3 vs. 4) or whether they simply choose the perceptually larger item (4-digit numbers occupy more space than 3-digit numbers). To address this question, we presented a sample of 74 participants with number pairs of different lengths (3- vs. 4-digit numbers), following the classical paradigm for number comparison. However, they were asked to decide which multi-digit number starts with the larger digit. Under this condition an interference effect from the number length was expected (e.g., 2384 vs. 107 faster than 2675 vs. 398). More critically, in a second condition, differences in length between 3- and 4-digit numbers were obscured by including a letter at the end of the shortest multi-digit (e.g., 2384 vs. 107M and 2675 vs. 398M). In this letter condition we hypothesized that (H1) if participants automatically compute the exact number of digits in the string, the congruity effect would be similar to that in the no-letter condition; on the contrary, (H2) if length estimation is based on the amount of space occupied by the string no congruity effects would arise in the letter condition in contrast with the no-letter condition.

The statistical analyses conducted have shown a digit-length congruity effect—note that the difference between this and the first mentioned effect lies in the relevant and interfering variables that produce them—that was restricted to the non-letter condition. Thus, our results confirmed the role of number length during leftmost digit comparison, while also indicating that when perceptual length is obscured by introducing a letter at the end of the string, length effects disappear. These findings support the second hypothesis suggesting that perceptual size is used as a proxy to solve the comparison of numbers with different lengths, which indeed seems to drive the responses across all the processing stages.

Advanced MRI protocols to study subcortical contributions to cognition: The thalamus and language function

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There is a strong need in the human neuroimaging field to implement reproducible research methods. Ideally, researchers should be able to replicate experimental data acquisition and reproduce the computational analyses presented in neuroimaging publications. Current scientific practices increasingly promote data sharing among researchers and labs. This facilitates colleagues in the scientific community and clinical practitioners to reproduce, verify, and further explore datasets and computational analyses. Moreover, these practices are evolving alongside continuous and substantial increases in algorithm complexity in functional and structural MRI methods. Over the last decade, our research group has developed MRI protocols for several purposes, such as identifying and segmenting thalamic nuclei at the individual-subject level, obtaining and measuring first-order relay human thalamic white-matter tracts, investigating the white-matter pathways between the human mediodorsal thalamic nucleus and the prefrontal cortex, and understanding the relationship between thalamic nuclei and their white-matter projections across the lifespan. Here, we will provide an overview of these neuroimaging protocols and their results, in particular on characterizing the involvement of the sensorimotor thalamic nuclei in human reading, speech comprehension and speech production language systems. Findings will be discussed in relation to current theories on subcortical contributions to cognition and on the role of thalamocortical interactions in language function.

Structural dynamics of human cortico-subcortical connections across the lifespan: the case of thalamocortical projections

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The study of subcortical structures and their connectivity is under-represented in cognitive neuroscience research. The study of the thalamus and its connections has special interest as it is involved in most cognitive and motor functions, and its dysfunction is associated with highly prevalent disorders such as Parkinson's and Alzheimer's diseases. Thalamocortical projections undergo dynamic maturation and refining during postnatal development, sculpting the neural circuits supporting brain function. A characterization of changes in human thalamocortical and corticothalamic bundle structure across the lifespan is still lacking. Here, we employed validated diffusion MRI protocols to reconstruct and quantify first order (FO) relay thalamocortical white-matter projections and mediodorsal (MD) nucleus-prefrontal cortex (PFC) thalamocortical/corticothalamic projections in a healthy cross-sectional cohort (N = 259), spanning ages 6 to 81 years. We examined differences across lifespan periods in the bundles' microstructure, particularly fractional anisotropy (FA), and its relationship to the volume of the thalamic nuclei they originate from. Our results unveil distinct developmental profiles, with FO bundles showing anatomically-dependent variations in FA between age groups, similar to MD bundles albeit to a lesser extent. Associations between thalamic volumes and FA across the lifespan were only found in MD-PFC bundles, and with different associations along the tract: closer to the thalamus, larger MD volumes corresponded to lower FA of the bundles; closer to the cortex, larger MD volumes corresponded to higher FA of the bundles. These results are discussed in line with current hypotheses on signaling dynamics between higher-order relay thalamic nuclei and cortical areas.

Mayday: AI needs (Cognitive) Psychology, both for Science and Society

Javier Ortiz-Tudela

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Recent advances in Artificial Intelligence (AI) have captured the attention of many branches of science and have permeated into our daily routines. This unapologetic intromission is being received with equivalent amounts of excitement and distrust (often not by the same people). The current state of affairs reflects a tension which could hamper scientific and societal progress. In this talk, I will present an optimistic- skeptical review of current developments on two fronts in which Cognitive Psychology can play a paramount role to alleviate this tension. First, Cognitive Psychology can act as a catalyst for the (proper) use of artificial neural networks (ANNs) as models of the mind and the brain. Second, Cognitive Psychology can act as an informed expert to uncover the immediate and long-term consequences of human – AI interactions. The first roadblock on both fronts is the infamous black-box nature of ANNs. Luckily, this challenging issue can be addressed with approaches either rooted in experimental manipulations from Cognitive Psychology or stemming from the newly born field of explainability. I will present some of our recent experimental work applying explainability approaches to the human – AI interaction to create better and more robust learning. In sum, this talk will be a call to action for researchers on Cognitive Psychology to help shape the development of the next generation of AI-based models of cognition and to inform the advancement of human – AI interactions. This interdisciplinary endeavor will be key in ensuring a sustainable, productive and responsible future.

Speech markers of dementia and depression in older adults

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Background: During aging, changes in human speech may arise because of the neurophysiological deterioration associated with age, or as the result of an impairment in the cognitive processes underlying speech production, or, as recent studies demonstrate, also due to affective processes. Speech analysis allows the exploration of the behavioral consequences of cognitive and affective deficits on vocal performance, making it possible to identify pathologies that affect speech production, such as dementia and depression. In our study, we aimed to observe the evolution of some of these vocal deficits through aging and the influence of cognitive and affective alterations.

Methods: The sample includes 537 people over 55 years old, who were divided into four groups according to their age. A complete neuropsychological evaluation was performed on each participant to determine their possible diagnosis, establishing the presence of mild cognitive impairment, dementia, or depression. They were asked to read a text while being recorded, and the resulting audio was then analyzed using Praat software to extract a series of speech parameters.

Results: Certain temporal and frequency parameters were found to be related to the cognitive and affective state. Some disturbance parameters changed due to age.

Conclusions: Depression and dementia have a complex relationship and mainly affect the elderly population. Understanding how speech parameters are specifically affected by age, cognitive state, and affective state is crucial to advancing the use of speech as a clinical marker for the differential screening or diagnosis of these pathologies.

Single trial analysis of EEG data reveals frontal theta and parietal alpha modulations during navigation in a virtual reality environment

Mireia Torralba Cuello, Angela Marti-Marca, Márta Szabina Pápai, Salvador Soto-Faraco

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Spatial Navigation (SN) is an essential function for animals, including humans. During many years, based on seminal rodent studies, hippocampus was the focus of attention in the study of SN. At present, mounting evidence indicates that human SN is organized in a complex, wide-spread network including (but not restricted to) hippocampus, prefrontal cortex and parietal cortex. Whereas hippocampus has been mostly studied in invasive electrophysiological (EEG) studies in patients, cortical areas can be easily accessed with non invasive EEG. The use of scalp EEG for the study of SN presents many advantages; for instance, EEG systems are more and more comfortable and portable, allowing subjects to perform more realistic navigational tasks. Virtual Reality (VR) has proven to be a valuable tool for the study of SN, allowing to test SN abilities in humans in a realistic, though controlled, manner. Importantly, a decline in SN abilities in VR conditions can be used as a predictor of age related conditions. In the last decades, evidence from virtual or real navigational tasks have further confirmed the key involvement of Theta oscillatory activity (3 to 8 Hz) in SN. For instance, Theta increases have consistently been observed during movement, exploration, navigation in virtual and real environments. On the other hand, there is mounting evidence of the involvement of other frequency bands, as for instance Alpha (8 to 14 Hz) in SN. In the present study, we recorded EEG of healthy human subjects while they were performing an SN in a VR environment consisting on T-junction mazes. We used Linear Mixed Models to evaluate, at single trial level, how oscillatory activity in the Theta and Alpha bands was modulated during the task. Our results confirm the involvement of frontal Theta oscillations in human SN: Theta oscillatory activity appears preferably at more difficult parts of the task, probably indicating the access to navigational information. On the other hand, successful recall of a specific part of the path was not linked to Theta oscillatory activity, but to a higher prevalence of parietal Alpha oscillations that could be linked to increased attentional processes, which could benefit from the blocking of sensory information.

Posters

Anchoring accessibility tools in preferred spatial reference frames: a study with audio description for blind and partially sighted museum visitors

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The way we represent spatial information may depend on our everyday perceptual and somatosensory experiences with the world (Flumini & Santiago, 2016; Muraki et al., 2023). For blind and partially sighted people, this could mean that their preferred and less cognitively taxing mode of navigating or imagining a new space would be anchored in an egocentric reference frame (Job et al., 2022; Pasqualotto & Proulx, 2012). This increased reliance on egocentric reference frames should be considered when developing accessibility tools such as audio descriptive guides for museum settings. These texts aim to help blind and partially sighted visitors build accurate mental images of the described exhibits (Hutchinson & Eardley, 2019). In representational paintings, the intersemiotic translation of the space depicted in the artwork usually takes center stage (Soler Gallego & Jiménez Hurtado, 2013; Soler Gallego, 2021), often described from an allocentric reference frame. Here, we hypothesized that audio descriptive guides conveying spatial information from a first-person perspective, adopting an egocentric reference frame congruent with the everyday experiences of blind and partially sighted people, are more accessible and aesthetically pleasing. These hypotheses were tested in a within-subject study involving 53 Spanish-speaking blind and partially sighted participants. In addition, the impact of art knowledge and interest, along with mental imagery vividness as measured by the Plymouth Sensory Imagery Questionnaire (Psi-Q; Andrade et al., 2014; Pérez- Fabello & Campos, 2020), was controlled for. Results revealed that the salience of the egocentric reference frame enhanced the representation of the described information only for those with lower scores in the Psi-Q. However, these immersive audio descriptive guides were overall more aesthetically pleasing. This study provides insight into how the portrayal of spatial information can influence the accessibility of museum audio descriptive guides and their potential to elicit a satisfactory aesthetic experience through language alone.

Attentional hemispheric specialization through the right frontal eye field: a TMS- EEG study

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Mechanisms of attentional control have been extensively studied but the specific role of each cerebral hemisphere is still debated. Two main theories have been proposed to explain their involvement: the rivalry theory and the hemispatial theory, both assuming a contralateral control of the attended space. While the rivalry model suggests that this control is shaped in the form of inhibition between hemispheres, the hemispatial model relies exclusively on contralateral activation, acknowledging the right hemisphere's ability to attend to the ipsilateral visual field as well. Our goal was to explore the hemispheric engagement in spatial attentional control through the study of the right-Frontal Eye Field (rFEF) excitability by combining Electroencephalography (EEG) and online Transcranial Magnetic Stimulation (TMS) in a TMS- evoked potential (TEP) approach. We recorded EEG in 32 volunteers while they performed in a visuospatially cued target detection task. Single-pulse TMS was applied to the rFEF and a control area (right M1 foot area) in the cue-target interval, i.e. while participants were deploying covert attention to the left or right visual field in anticipation of an upcoming target (80% validity, directional cues) or did not deploy attention (no-attention cue, no target presented). FEF-network excitability was inferred from TEPs across the three conditions (left cue, right cue, no-attention cue), after artifact removal. The behavioural results revealed a validity effect for target detection, indicating that participant deployed covert attention as instructed. Analysis of TEPs using Global Field Power measures revealed five components: P25, N40, N100, P185 and P300. Comparisons of TEPs across all three cue conditions using dependent-samples cluster- based permutation on the two-dimensional data (channel-time) revealed significant differences in excitability during spatial orienting relative to the no attentional control, spanning from 67ms to target onset, involving the late TEP components N100, P185 and P300. The results show that relative to the no- attention control, rFEF-network excitability is changed to the same degree and direction during left and rightward attention. This supports the hemispatial theory, that is, a similar involvement of right hemisphere in attentional orienting to the two visual fields, as opposed to the rivalry model for which opposite involvement (excitability enhancement and suppression) would have been expected.

Speech markers of dementia and depression in older adults

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Background: During aging, changes in human speech may arise because of the neurophysiological deterioration associated with age, or as the result of an impairment in the cognitive processes underlying speech production, or, as recent studies demonstrate, also due to affective processes. Speech analysis allows the exploration of the behavioral consequences of cognitive and affective deficits on vocal performance, making it possible to identify pathologies that affect speech production, such as dementia and depression. In our study, we aimed to observe the evolution of some of these vocal deficits through aging and the influence of cognitive and affective alterations.

Methods: The sample includes 537 people over 55 years old, who were divided into four groups according to their age. A complete neuropsychological evaluation was performed on each participant to determine their possible diagnosis, establishing the presence of mild cognitive impairment, dementia, or depression. They were asked to read a text while being recorded, and the resulting audio was then analyzed using Praat software to extract a series of speech parameters.

Results: Certain temporal and frequency parameters were found to be related to the cognitive and affective state. Some disturbance parameters changed due to age.

Conclusions: Depression and dementia have a complex relationship and mainly affect the elderly population. Understanding how speech parameters are specifically affected by age, cognitive state, and affective state is crucial to advancing the use of speech as a clinical marker for the differential screening or diagnosis of these pathologies.

Modulating Emotional Responses to Music by Transcranial Direct Current Stimulation (tDCS) of the Ventro-Medial Prefrontal Cortex (vmPFC): Magnetoencephalographic Correlates

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Previous research has shown that non-invasive excitatory stimulation of the vmPFC by tDCS increases the positivity bias toward pleasant scenes and faces in comparison to unpleasant emotional stimuli. As music is often highly emotional, we here investigated whether neuromodulation via vmPFC-tDCS could modulate music induced emotion processing. A total of 30 healthy volunteers (15 women) participated in two laboratory sessions, in which an excitatory and inhibitory vmPFC-tDCS was administered. Before (i.e. at baseline) and after stimulation, participants listened to 60 music excerpts (30 pleasant, 30 unpleasant) from the Film Music Stimulus Set (FMSS), each 8 seconds long, while the induced neural activity was recorded using whole-head magnetoencephalography. Results showed a relative increase/reduction of neural vmPFC activity in the alpha frequency band during the listening to unpleasant/pleasant music after excitatory compared to inhibitory stimulation. As increased alpha typically correlates with reduced arousal related neural activity, these results confirmed our hypothesis that excitatory compared to inhibitory vmPFC-tDCS evokes an enhanced/reduced positivity/negativity valence bias in healthy individuals. Our findings recommend clinical interventions using non-invasive neuromodulation in patients with depression or other affective disorders with altered vmPFC default mode activation.

Auditory Distraction: Deviant Sounds Hinder Response Repetition and Facilitate Response Change

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Previous studies have found that deviant sounds cause longer reaction times than a repeated or predictable (standard) sound. Evidence also suggests that deviance distraction is greater when repeating a response compared to changing it, but the mechanisms underpinning this effect remain unexplored. We aimed to explore if deviant sounds impair the repetition response, facilitate a change response, or both.

We used oddball tasks where participants reported the visual location of the same target stimuli using either 2 or 4 response options (between-participants). The variation aimed to allow us to measure the potential impact of deviant sound on response selection. If deviant sounds impair response repetition, larger distraction should be observed in such trials, regardless of the number of response options. If deviant sounds facilitate response change, distraction in response change trials should be less in the 2- compared to the 4-response task (because in the 2-response task, only one response alternative is available, whereas in the 4-response task, three alternatives are). The results support both hypotheses: Deviant sounds both hinder the repetition of one's response while potentiating the selection/execution of an alternative response. These findings provide new insights into how deviant sounds impact cognitive decision-making processes by uncovering two distinct mechanisms.

Eyes only: The reversed spatial Stroop effect cannot be generalized to head targets

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Spatial Stroop tasks have been used to evaluate a unique social processing of eye gaze. In the spatial Stroop task, participants judge the direction of gaze or arrow targets presented in the peripheral visual field. Gaze direction judgments become faster when the gaze direction is incongruent with its location (a reversed spatial Stroop effect). In contrast, those of the arrow become faster when the arrow direction is congruent with its location (a spatial Stroop effect). The present study investigated whether other social stimuli, such as head orientation, produce the reversed spatial Stroop effect. The results showed that gaze direction elicited the reversed spatial Stroop effect while head orientation produced the spatial Stroop effect. These results suggest that the reversed spatial Stroop effect is unique to gaze stimuli and not readily generalizable to other social stimuli.

An exception to the exception: meta-analysis on syntactic skills in Williams syndrome

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Williams syndrome (WS) is a rare genetic neurodevelopmental disorder caused by a micro-deletion of chromosome 7, band q11.23. In addition to usually mild to moderate intellectual disability, the cognitive phenotype of WS is characterised by a number of weaknesses (visuospatial skills) and strengths (nonverbal reasoning skills). In terms of language skills, while some subcomponents of language processing seem to be relatively preserved, other subcomponents may present more pronounced deficits, obtaining sometimes contradictory results. To gain more clarity in this area, a recent meta-analysis from our lab explored the status of lexico-semantic skills in WS. Thus, as a continuation, in this study we performed a systematic search and meta-analysis of syntactic skills in SW. We conducted a systematic search in 6 databases of peer-reviewed articles in English or Spanish published from 1985 to 2024. In a first screening we found 383 articles and after revision, we finally were left with 38 articles that met the selection criteria, and in total, 93 effect sizes were included in the meta-analysis. The results showed that people with WS have worse syntactic skills compared to typically developing (TD) people, both when matched by chronological age and mental age. Furthermore, unlike in the lexical-semantic area, there are no differences in their performance compared to people with other disabilities. These results continue to support the neuroconstructivist model of development, in which different language skills would develop differently, with some lexical-semantic skills being spared and syntactic skills being impaired.

Context-based distraction by deviant sounds does not correlate with ADHD symptomatology

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Several studies have shown the importance of visual context in modulating distraction by unexpected sounds. Others have related distraction with symptoms of Attention Deficit/Hyperactivity Disorder (ADHD). In the present study, 49 second-year psychology students completed the BAARS-IV questionnaire measuring ADHD symptoms in adults, and performed a visual categorization task while instructed to ignore task-irrelevant sounds (A, B, or C) and background pictures (forest or city scenes). The critical manipulation centered around the probability of the sounds conditioned by the visual context. Sound A was rare in the forest context and frequent in the city context, while the opposite was true for sound B. In contrast, sound C was rare throughout the task. Hence, sounds A and B constituted deviant sounds within specific contexts but not at task-level, while sound C constituted a deviant sound at task-level and within each of the two contexts. We examined (1) whether distraction varied as a function of whether sounds violate predictions at both task and context levels as opposed to task level only and (2) whether distraction correlated with ADHD symptomatology. The results revealed the existence of task- and context-level deviance distraction, which did not differ from each other. Finally, we found no correlation between our measures of distraction and any of the measures of ADHD symptomatology. We discuss these findings in relation to the recent literature on deviance distraction and suggest avenues for research.

Inhibition Dynamics in Survival Memory: Investigating Forgetting's Influence on Survival-Relevant Stimuli

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In survival-related environments humans tends to exhibit enhanced processing and recall of information. This phenomenon arises from the distinct processing mechanisms of memory systems driven by the adaptive value of such scenarios. This is known as the survival processing effect. The researchs has shown that this effect can manifest regardless of a survival context, highlighting the intrinsic adaptive value (fitness relevance) of the information itself. However, little is known about how this advantage, focused on generating a superior recall of information may be affected by inhibition processes. The aim of this study was to investigate how intentional forgetting impacts the recall of survival-relevant stimuli. Two experiments were conducted focusing on a survival-related factor: avoiding dead. Experiment 1 (n = 48) the participants studied a list of these words high and low in avoiding dead and subsequently engaged in a recall test. The findings unveiled distinct recall patterns based on survival value [$F(1, 47) = 99.26, p < .001, \eta^2 = .679, P(\alpha = .05) = 1$], indicating a superior recall performance for high-value words. In Experiment 2 (n = 26), the inhibition processes were examined using the directed forgetting paradigm with the item method. Participants studied high and low survival value words followed by an instruction indicating whether they should be remembered (RRRR) or forgotten (FFFF). They then completed a free recall test and a recognition test. The recall results replicated those found using the directed forgetting paradigm with the item-method [$F(1,25) = 43.90, MCE = 2.87, p < .001, \eta^2 = .64, P(\alpha = .05) = 1$], the words marked to remembered (M = .41) were better recalled than those marked to forget (M = .08). The survival value variable was also significant [$F(1,25) = 6.05, MCE = .104, p = .0201, \eta^2 = .20, P(\alpha = .05) = .66$]. High-value words was better recalled (M = .28) than low-value words (M = .21). The interaction was not significant [$F < 1$]. Additionally, in the recognition task was observed a significant effect of the instruction type [$F(1,25) = 49.35, MCE = .042, p < .001, \eta^2 = .66, P(\alpha = .05) = 1$]. The results are discussed in the context of the directed forgetting paradigm and survival processing.

Reducing Correspondence Bias: the effect of Moral Elevation on social perception

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Witnessing acts of moral goodness elicits the moral emotion of Moral Elevation. While evidence shows that experiencing moral elevation has a positive effect on people's prosocial behavior, whether this emotion also affects the social cognitive processes involved in perceiving others' behavior is unclear. Using a video induction procedure to elicit moral elevation (and other control emotions), three studies (total N= 267 adults from Spain; 79.03% female) explore the relationship between moral elevation and Correspondence Bias: an attributional bias by which people tend to attribute others' behavior to internal causes to a greater extent than to external causes. The results show that a) moral elevation trait correlates with internal causal attributions about others' behavior, b) experimental manipulation of moral elevation affects causal attributions about others' behavior, and c) experimental manipulation of moral elevation can reduce correspondence bias. These results are congruent with the widely evidenced prosocial effect of moral elevation. Future research should address the question of whether this debiasing effect of moral elevation can be extrapolated to other phenomena within the field of social perception.

Speech error classification, production performance study, and successive response analysis using

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Both manual classification of production errors and scoring of spelling/pronunciation performance are acknowledged to be time-consuming, laborious, and error-prone tasks, even when they are conducted by clinicians (such as expert neuropsychologists and speech therapists) or specialized researchers (Themistocleous et al., 2020). With the aim of mitigating these errors and possible inconsistencies induced by criterion shifts during these tasks, which is rather than usual, I am building—as it is a currently ongoing (yet already functional) project—the “sunflower” R package. This R package is being written to help with three main tasks. First, the data wrangling of transcriptions (orthographic or phonemic) of multiple response attempts, which often occur in patients with articulatory problems or phonological impairments, to allow for further work and analysis. Second, the computation of various formal similarity measures and related indices between a target word and a given response, such as the longest common subsequence (e.g., mangrove:mango → mang), the number of common characters or their proportion, as well as edit distances, such as Damerau–Levenshtein’s (that works by counting insertions, deletions, substitutions and transpositions), required to transform one string of elements into another (e.g., letters or phonemes), in the same way as it is done in computational linguistics or genetics. And third, the general classification of errors involves both formal (mentioned above) and semantic similarity measures (where the latter relies on pre-trained neural network models), according to traditional criteria in the field. Thus, “sunflower” might serve as an elemental tool to rely on for the study and research of production errors in aphasia. And, while it has been primarily developed to facilitate the study of *conduite d’approche* (i.e., a repetitive verbal behavior in which people with aphasia produce successive attempts while trying to access a target word) helping to determine whether production quality improves throughout attempts and which parts of patients’ individual productions are most affected by their impairments, other applications might include exploring whether there are improvements in a patient’s production quality after a given treatment, distinguishing between cases of apraxia of speech and conduction aphasia, or simply using it to facilitate and speed up the classification of speech/spelling errors in an automated way with large datasets.

Affects Explicit and Implicit Negation on attitudinal sentences: a tDCS study

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Introduction: Language effectively captures interpersonal cognition by facilitating the expression of attitudes through approach and avoidance verbs. Avoidance, depicted using attitudinal verbs like "exclude," inherently carries negative connotations. In the process of comprehension, linguistic negation induces the inhibition of negated scenarios, a function mediated by brain regions such as the right Inferior Frontal Gyrus (rIFG). This study hypothesizes that transcranial direct current stimulation (tDCS) targeting the rIFG can modulate the interplay between explicit negation and the implicit negativity of avoidance verbs. We discuss results on the frame of the two-step model of negation processing. Method: Thirty-two participants underwent a 20-minute anodal tDCS session over the rIFG, adding fade-in and fade-out phases lasting 15 seconds. They were then prompted to read sentences expressing approach or avoidance towards an object or task, each presented in affirmative and negative forms (e.g., "Anne included (did not include) meat in her diet" versus "Anne excluded (did not exclude) meat in her diet"). In addition, to control for superficial processing of the texts, we employed alternative synonym verbs. Reading times were measured for analyses. Another group of thirty-two participants received sham tDCS. Results: Under anodal stimulation, negative sentences exhibited prolonged reading times for the verbs mentioned, implying an augmented inhibitory influence on the verb. In avoidance sentences, anodal stimulation led to decreased reading times for alternative verbs in negative sentences compared to alternative verbs in negated approach sentences. Discussion: Longer reading times were observed for mentioned verbs in negated sentences compared to affirmative sentences, supporting the inhibitory impact of negation on the mentioned verb. in line with the second step of negation processing. Additionally, we found shorter reading times for alternative verbs in negative avoidance compared to negative approach sentences under anodal conditions. This suggests that the inhibition from explicit negation influences the implicit negation in avoidance sentences.

The ratio “fixations/ saccades” in eye movements: It is useful to detect the strategy used while solving a Mental Rotation task?

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The analysis of eye movements while solving a Mental Rotation (MR) task has been applied as an indication of the use of different strategies. Some studies have observed an increase in the number of fixations when participants are induced to solve with a piecemeal strategy, rotating by parts, with respect to a holistic strategy that rotates the object globally. To analyze these strategies some authors have proposed to calculate the ratio between the number of fixations in each area of interest (AOIs) and the number of saccades between two AOIs. A ratio of 1 would indicate the use of a holistic strategy and values greater than one would indicate a piecemeal strategy. The use of the ratio is under debate, as some authors consider that it is not sensitive to detect the strategies used. The present study analyzes the ratio as an indicator of strategies in MR performance in two experimental blocks.

The study presented 220 total trials, with a first block of free execution (110 trials) and a second block of strategy induction (110 holistic or piecemeal trials, intergroup condition). It was hypothesized that participants would increase the ratio in piecemeal induction while the ratio would decrease in holistic induction. Of the total 85 participants ($M = 27.63$ years; $SD = 10.83$ years), 42 (21 males and 21 females) performed the second block with holistic execution instructions, while 43 (22 males and 21 females) received instructions for piecemeal execution. Results showed that in both inductions lower ratios were observed without deterioration in accuracy. Additionally, participants were divided as low vs. high ratio rotators to analyze whether both showed differences in reaction times and accuracy in the free execution block. The results supported the initial hypothesis, where low ratio rotators had shorter reaction times as well as greater accuracy in the task compared to high ratio rotators, in line with the complexity hypothesis. These results could contribute, given the limited literature about the topic, to better understand the ratio application as an index for exploring the use of strategies in solving MR tasks.

Exploring the second language lexicon through the N400 ERP component

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In our globalized world, the amount of people who speak more than one language is becoming increasingly common. Therefore, gaining insight into second language (L2) lexicon and their differences from first language (L1) lexicon is crucial for comprehending bilingual cognition. To contribute to this evolving research domain, we present a study aimed at investigating the associative priming effect in the L1 and the L2 by means of both reaction times (behavioural measures) and the N400 event-related potential (ERP) component (electrophysiological measures). A total of 65 undergraduate students, whose native language was Spanish and who acquired English as an L2, participated voluntarily in this study. Participants completed a lexical decision task in which the prime-target relationship (i.e., strong, weak, and unrelated pairs) was manipulated as a within-subject factor, and language (i.e., L1 and L2) served as a between-subject factor. To ensure experimental control, variables such as word length, frequency, orthographic neighbourhood, orthographic similarity, and participant's knowledge of the meaning of the L2 words were kept under control among the experimental conditions. Specifically, participants were presented with 160 prime-target pairs (80 word-word pairs and 80 word-nonword pairs) either in Spanish (L1) or in English (L2). Regarding the 80 word-word pairs, participants responded to 20 targets preceded by a strongly associated word (e.g., smoke-FIRE), 20 by a weakly associated word (e.g., river-BOAT), and 40 by a non-associated word (e.g., lunch-HAIR). The findings revealed that, in the L1, both the associative priming effect and the N400 effect were evident across strongly and weakly associated word pairs. However, when processing words in their L2, second language learners exhibited priming and N400 effects solely with strongly associated word pairs. This convergence of behavioural and electrophysiological measures suggests that the associative network in the L2 lexicon exhibits less organization and fewer connections compared to the L1. Lastly, our results also indicated that the magnitude of the N400 effect did not differ between the L1 and the L2 for strongly associated word pairs. This observation might suggest that second language learners may be able to access the meaning of (at least) some L2 words automatically, without the mediation of L1 translation, thus challenging some of the predictions of the Revised Hierarchical Model.

Value-modulated attentional capture depends on explicit awareness

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Value-modulated attentional capture (VMAC) reflects a process by which a priori neutral stimuli gain attentional priority when associated with reward, independent of goal- or stimulus-driven attentional control. That is, when a neutral distractor is associated with reward, it becomes more difficult to ignore. Although VMAC has classically been considered an automatic and implicit process, the nature of its learning process remains unclear. For instance, some authors have suggested that VMAC depends on Pavlovian learning and that only the stimulus-reward contingency is necessary to observe VMAC. Another possibility relies on the instrumental relationship that the associated stimuli might have with reward during learning, such that producing an instrumental response to the stimulus becomes automatic with sufficient practice. Although recent paradigms to study VMAC have demonstrated that it is possible to observe VMAC without the need to direct a response to the associated stimulus, to our knowledge, no study to date has clarified the role of the informative value in VMAC. In other words, no study has demonstrated that VMAC can occur whenever the associated stimulus is both response irrelevant and uninformative regarding the possibility of obtaining reward. In a well-powered replication of a previous study, we observe that VMAC disappears when participants are not explicitly informed about the distractor-reward contingency in the pre-task instructions. In a second experiment, we show that when instructions are manipulated between groups, only the instructed group shows VMAC. Interestingly, although the no- instruction group did not show VMAC at the group level, individual differences in contingency estimation also affected the temporal dynamics of VMAC, with only participants with high contingency estimation showing a progressive increase in VMAC. Our results suggest that the learning process behind VMAC depends on explicit awareness of the stimulus-reward relationship. A re-analysis of a previous meta- analysis further supports this claim by showing that when stimulus-reward contingencies are included in the instructions the effect size of reward-driven distraction increases. These results suggest that the learning process behind VMAC may not be entirely implicit.

Extinction Burst and Response Competition

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Although the extinction burst (EB) phenomenon was first reported in 1938 by Skinner and has since been discussed in behavior analysis, the exact definition of an EB is vague and variable. Recent basic research has raised doubts about the ubiquity and generality of the extinction burst, and, moreover, points out that there is a surprising lack of empirical data available on the phenomenon. Recently, Shahan postulated the theory of the Temporally Weighted Matching Law (TWML) claiming that EB can be explained using the general principles of the matching law and the competition and distribution of responses. The aim of the present experiments was to gain insight into the basic learning processes that give rise to this phenomenon. Specifically, we sought to generate competition between responses and then released it to observe the effect on the extinction burst. According to TWML, the greater the release of competition, the greater the prevalence and magnitude of the extinction peak. Two experiments were conducted with 36 male Wistar rats and nine operant conditioning chambers. In both, rats were trained to press two chamber levers (right and left). In the first experiment, a concurrent schedule with the two levers was used in an RF1 reinforcement schedule with 60 trials and the baseline was created with strict stability criteria and then transitioned to extinction. In the second experiment, a response chaining procedure was performed with the same stability criteria and then transitioned to extinction. There were several groups controlling for the degree of competition release in both experiments. The results seem to provide some control on the phenomenon and support what has been documented in the literature so far. In addition, the present work suggests future lines of research.

Speech Recognition from a Familiar Speaker Engages the Person Identity Network

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The characteristics of a speaker's voice condition speech perception and, in turn, speech recognition is facilitated by voice familiarity. Such interactions between voice and speech processes are unexpected when considering their neural dissociation. Voice sensitive regions are primarily located along the right temporal lobe and are functional constituents of the person identity network. Phoneme recognition predominantly engages regions in the left temporal lobe which are part of the language network. Previous studies suggest that interactions between voice and speech processes could be supported by (i) interhemispheric functional connectivity and (ii) regions sensitive to both voice and phonetic information. Whether the same neural mechanisms enable the use of voice priors during speech perception has not been yet investigated. In a task-based fMRI experiment, twenty-seven right-handed adult participants (15 female) conducted a speech recognition task before and after being familiarized with the voice and autobiographic details of one of the two speakers featured in the task. Speech recognition from the familiar speaker led to an increase in interhemispheric connectivity between an independently localized Voice Sensitive Area (VSA) and regions involved in phoneme processing and verbal working memory; the left Frontal Pole and left Superior Frontal Gyrus. Furthermore, voice familiarity also led to an increase in functional connectivity between the VSA and regions involved in person identity recognition: the Cingulate Gyrus, and the right Supramarginal Gyrus. Notably, the latter is a region where voice and speech processes exhibit neural overlap as it is sensitive to the typicality of the pronunciations of speakers. Our results converge with those of previous studies which suggest that interactions between voice and speech information is supported by interhemispheric connectivity and the engagement of regions sensitive to both voice and speech information. Importantly, we show for the first time that regions of the person identity network other than the VSAs are recruited for speech recognition. We propose that the person identity network builds predictions about the incoming speech input and that the neural underpinning of said predictions is a network of higher-order regions which not only encode properties of the speaker's voice, but semantic speaker knowledge as well.

Unlocking Speech: Brain-Computer Interfaces for Communication Restoration in Speech Disorders

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Human speech, one of the most essential abilities, can be impaired by traumatic injuries or neurodegenerative diseases such as Amyotrophic Lateral Sclerosis (ALS), which is projected to increase globally by 69% between 2015 and 2040 due to population aging and improved public healthcare. As ALS progresses, individuals lose their ability to communicate verbally, relying on non-verbal communication devices. Some diseases may lead to a state known as locked-in syndrome, where cognitive abilities remain intact, but individuals are unable to move or communicate verbally due to near-total paralysis of voluntary muscles. This project aims to investigate the use of Brain-Computer Interfaces (BCIs) to restore verbal communication in individuals with speech disorders. Previous studies have demonstrated that the use of deep learning and machine learning algorithms can be used to decode speech from invasive EEG recordings directly from the brain's cortex. Our study aims to complement this work by evaluating the feasibility of decoding overt and covert speech from non-invasive EEG recordings while participants produce phonemes or words from different semantic categories. The research comprises three phases: EEG and voice data collection, development of deep learning algorithms for speech decoding, and dissemination of results. Preliminary results from healthy adult participants show the potential and limits of this approach in designing assistive technology to restore speech in individuals with speech disorders. This study, conducted in collaboration with experts in machine learning, neuroscience, signal processing, and neurophysiology, aims to initiate innovative research with real-life impact on individuals with severe communication problems. This work has been supported by the Spanish State Research Agency (SRA) and European Regional Development Fund (ERDF) project no. PID2022-141378OB-C22 (PI: José Andrés González López).

Semantic Processing in Population over 60 years: The Role of Body-Object Interaction (BOI)

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The Body-Object Interaction (BOI) assesses a person's perception regarding their body's ability to establish physical interaction with the objects around them. Research conducted in the field shows that the environment (Body-Object Interaction; BOI) modulates the lexical and semantic processing of terms associated with objects. The present study aims to further explore the nature of these effects in people over 60 years. For this purpose, BOI ratings were obtained from 46 participants over 60 years for a total of 500 Spanish nouns. The task for the participants involved assigning a score to each word using a 7-point scale, where 1 reflected a low BOI and 7 a high BOI, considering solely the ease of physical interaction of the body with the object represented by the word and not the ease of maintaining a sensory experience with it. These scores were compared with those obtained in previous research with a group of young university students. Statistical analyses showed a moderate positive correlation between the responses of the group over 60 years with the group of young participants. Furthermore, a significant correlation was found between the group of elders and other lexical variables. High-BOI words showed a tendency to be more familiar, more concrete, more imaginable, to elicit more pain, and to have an early age of acquisition (AoA). The ratings from the study allow for an approach to understanding this body-object interaction in people over 60 years and could be useful for researchers interested in manipulating and controlling BOI effects, thus fostering new perspectives in this area of research.

Do affective properties vary across languages? A comparison between emotion-label and emotion-laden words

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Emotional words can be classified into two types: emotion-label words (EM words, e.g., “happy”) and emotion-laden words (EL words, e.g., “wedding”). Emotionality is part of the denotative meaning of EM words (i.e., they refer to emotions), but not of EL words, which probably get their affective connotation from association with emotions (i.e., a wedding is commonly associated with happiness). Therefore, the affective properties of EL words may vary more across individuals, languages, and cultures than those of EM words. This work aimed to test this hypothesis by comparing the affective properties of EM and EL words across several languages. To this end, we relied on existing datasets of affective norms in various languages. In Study 1, we compared the original Affective Norms for English Words (ANEW) with their adaptations to Spanish, Portuguese, and Italian. In Study 2, we added three additional (typologically different) languages: Croatian, Indonesian, and Chinese. To compare the ratings across norms, we first identified EM and EL words. We also classified the words according to their affective polarity or valence (positive, negative, and neutral). We then computed three measures of similarity (Euclidean distance) between the ratings in all the languages included in each study. One measure was based on valence scores, another on arousal scores, and the third measure was based on a composite score of valence and arousal. Contrary to our expectations, there was not any difference in similarity across languages between the affective ratings of EM and EL words. However, both studies showed a clear effect of affective polarity: affective ratings were less consistent across languages for positive words than for negative and neutral words. These results suggest that people vary more in what they consider to be positive stimuli than negative stimuli.

Assessing fitness-to-drive using the Orienting Hazard Prediction Test: Data from stroke survivors

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Attentional capture occurs quickly and its effects are short-lived. Attention and peripheral vision deficits may significantly impact driving ability in stroke survivors. This study pioneers the exploration of the orienting effect in experienced drivers who suffered a stroke compared to healthy drivers. To achieve this goal, we used the Orienting Hazard Prediction Test (HP) (Muela et al. 2019). This test consisted of 39 short videos shot in a naturalistic way from the point of view of a driver in a car, including a target hazard situation just before the end of the video. The appearance of the hazard requires the driver to make an avoidance manoeuvre to prevent a crash. Three experimental conditions were manipulated: simple (only one hazard appeared), valid (a quasi-hazard directed attention to the place where the target hazard was going to appear), and invalid (a quasi-hazard directed attention to a location where nothing significant was going to appear). A total of 69 experienced drivers took part in this experiment: a healthy control group (N=37, age M=50,) and a stroke group (N=32, Age M=54). After watching each video, participants responded to the question: "What happens next when the video is cut?" (participants responded by selecting 1 of 3 possible options). The results replicated the expected main effect of orientation in complex driving situations, with an increased performance in simple trials, followed by valid trials, and decreased performance in invalid trials. A significant group effect was also found: Healthy experienced drivers performed better (M=80.23% HP accuracy) than experienced drivers who suffered a stroke (M=68.26%). Moreover, the drop in performance in the invalid trials was enhanced in the stroke group compared to the healthy group; that is, the interaction between group and orienting was also significant. These results suggest that attentional orienting is altered after a stroke, and this can be measured using this ecological Hazard Prediction driving test. In addition, by observing the performance of stroke survivors on this test, we can find its concurrent validity with other Neuropsychological Assessments. In this respect, it is especially worth mentioning the negative correlations obtained between accuracy in invalid trials and UFOV measures (-.723 divided attention; -.669, focused attention and -.529, selective attention, respectively) as well as TMT-A (-.514) and B (-.405) reaction times. However, when the multiple regression analyses were conducted for the stroke survivor sample, the UFOV Subtest 2 (Divided attention) was the only significant predictor of accuracy in invalid trials as a dependent variable, explaining a variance of 71% of these Orienting Hazard Prediction trials. As has been demonstrated, this naturalistic Hazard Prediction driving test can be used to predict driving-related visual attention in healthy and impaired drivers.

Learning new vocabulary in L2: the role of context of learning, proficiency, and proactive control

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Learning new vocabulary in a second language (L2) is necessary to achieve excellent proficiency. However, it is unrealistic to think that the number of words needed to reach this level can be taught explicitly (de Groot & van Hell, 2005; Schmitt, 2010). Previous research has pointed out that new vocabulary might be learned through incidental learning (Bisson et al., 2013;2014). In this experiment we explore whether implicit and explicit vocabulary learning in a language already familiar to the participants (English) could achieve similar levels of learning in the long-term. Thus, 78 Spanish native-speakers with B1 (or lower) English proficiency were asked to learn new vocabulary in two learning sessions. In the first session, participants were distributed between an explicit or implicit learning condition where they were exposed to a set of word-image pairs in English. In the second session, all participants completed a translation recognition task with the same word-image pairs and new ones. In this session all participants received explicit feedback for their answers. Finally, one week after the second learning session, participants conducted a free recall and a translation recognition test. Additionally, individual differences in cognitive control (measured with the AX-CPT task) and proficiency in English vocabulary were explored to assess their role in new vocabulary learning. Overall, results of the free recall test showed that participants learning under the explicit condition in the first session had significantly better performance than those who learned under the implicit condition. Interestingly, that was true just for participants with low proactive profiles (near 0 score in the BSI index), no differences were found between groups for participants with high proactive profiles (near 1). Additionally, English proficiency was correlated with the translation recognition test, with high proficient learners showing better performance in the test. No differences were found between learning conditions for this test. Overall, our results support the idea that learning new vocabulary produce better long-term learning under explicit conditions than under implicit conditions, especially when tested in a free recall test.

Assessing the effectiveness of the Maastricht Acute Stress Test for stress induction: Final outcomes in the Spanish population

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Stress has gradually become one of the most studied variables in the field of experimental psychology over time, primarily because it is increasingly recognized to influence many other psychological variables. However, despite the existence of multiple protocols in non-human animals to induce and study this process, protocols in human participants are limited. Additionally, these protocols often include a social stress factor that is known to affect different cultures differently. Therefore, the present study aims to validate the standardized Maastricht Acute Stress Test (MAST) protocol in a healthy young Spanish population. To this end, 96 participants were divided into two groups depending on whether they were exposed to the standardized Maastricht Acute Stress protocol or a control non-stressful task: stress group ($n=47$, mean age=20.55, $SD=3.16$, men-women ratio=18/29) and control group ($n=47$, mean age=21.29, $SD=4.19$, men-women ratio=16/33) respectively. To control for other dispositional variables, depression, anxiety, and stress symptoms (DASS-21) and trait anxiety (STAI-Trait) were measured at baseline. To analyze the effectiveness of MAST in inducing stress, measures of psychological stress (state anxiety with STAI-State and positive and negative affect with PANAS scale) and physiological stress (diastolic and systolic blood pressure and heart rate) were taken both at baseline and immediately after protocol exposure. At baseline, there were no differences between groups in trait anxiety or indices of depression, anxiety, or stress from DASS-21. Regarding stress induction, it was observed that the stress group showed a significant increase from baseline to post-induction period in state anxiety ($F(1,92)=26.71$, $p<.001$, $\eta^2=.03$), negative affect ($F(1,92)=10.92$, $p=.001$, $\eta^2=.008$), and both systolic ($F(3,276)=8.07$, $p<.001$, $\eta^2=.08$) and diastolic blood pressure ($F(2,224)=6.13$, $p=.001$, $\eta^2=.062$). There were no differences between groups in heart rate or positive affect. The results indicate that MAST is an effective protocol for inducing both psychological and physiological acute stress in healthy young adults, validating it as a stress induction protocol suitable for the Spanish population.

Random sequences, experienced coincidences and pseudoscientific beliefs

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Previous studies have observed a positive association between endorsement of paranormal beliefs and both reporting having experienced a greater number of “meaningful” coincidences (e.g., thinking of someone and then running unexpectedly into that person) in their daily lives, and showing a more biased representation of randomness, as expressed by a stronger repetition avoidance bias. We tested whether these effects are also characteristic of individuals holding pseudoscientific beliefs. A group of 108 volunteers responded to a scale measuring pseudoscience endorsement and reported the frequency with which they had experienced different kinds of coincidences, and which they thought was the explanation for their occurrence (e.g., chance, destiny, divine intervention...). They also completed two randomness representation tasks respectively based on trying to replicate the sequence resulting from tossing a fair coin and from rolling a fair die. Those scoring higher on the pseudoscience endorsement scale reported more frequent experiences of meaningful coincidences in daily life and were more prone to attribute them to causes other than chance. Moreover, they also tended to more often avoid the consecutive repetition of the same outcome when trying to replicate a random sequence, though only in the case of the coin toss task. The coincidences and repetition avoidance effects did not correlate with each other, suggesting that both a lower threshold for causally connecting events and a biased representation of randomness could be independent contributors to the endorsement of pseudoscience. Our results pave the way for the development of interventions aimed at reducing pseudoscientific beliefs based on improving the interpretation of coincidences and the representation of randomness.

Susceptibility to persuasion as a predictor of belief in pseudoscience

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There is a concerning rise in the prevalence of pseudoscientific beliefs, despite the potential risks they pose. Prior studies have hinted at a link between embracing pseudoscience and being easily persuaded, indicating a propensity to accept dubious claims despite warning cues. To explore this relationship, we conducted research employing a pseudoscientific belief scale, an evaluation of scam emails, and a self-report on gullibility. Our findings revealed positive correlations between endorsing pseudoscience and susceptibility to persuasion, particularly evident in assessments of less authentic scam emails. This underscores a connection between pseudoscience acceptance and susceptibility to deception, specifically when the deceit is more apparent. By shedding light on the factors influencing pseudoscientific belief, our study lays the groundwork for interventions promoting critical thinking and informed decision-making.

The mediating role of learning in the relationship between goal orientation, time management, and academic performance

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This study aims to replicate and extend the findings of previous research by demonstrating that learning serves as a mediating variable between motivation, competence and academic achievement. Employing an experimental approach, this research employs objective tests to assess goal orientation, time management, and their impact on learning outcomes and academic performance. Specifically, we use the Mastery Performance-Goal Orientation Test (MP-GOT) to measure goal orientation, the My Schedule task to evaluate time management behaviors, and The Safe task as a behavioral measure of learning. Structural equation modeling (SEM) was employed to analyze the relations among these variables. The results confirm that mastery-oriented individuals exhibit better time management skills, which in turn significantly influence their learning outcomes. Moreover, both goal orientation and time management showed direct effects on learning task performance, and learning outcomes directly impacted academic grades. These findings underscore the importance of fostering mastery-oriented behaviors and effective time management strategies to enhance learning and academic success.

Language and Numerical Cognition: A Predictive Relationship Based on Componential and Holistic Processing

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In this study, we propose two shared mechanisms in language and numerical cognition: holistic processing (related to the lexical-semantic route and the cohort models of auditory processing in language, and holistic processing in mathematics) and componential-analytical processing (associated with the sublexical route and goodness-of-fit models in language, and local processing in mathematics). To this end, 41 participants completed two linguistic tasks (a classical lexical decision task in the visual modality and a lexical decision task with priming in the auditory modality; Macizo et al., 2012) and a mathematical task (i.e., number comparison task; Nuerk et al., 2001). We hypothesize that holistic processing in language (i.e., the word frequency effect) will predict holistic processing in magnitude access (i.e., the global distance effect). Similarly, we expect that componential-analytical processing in language (i.e., the syllable frequency effect and the access to embedded words such as “bone” in “trombone” to index goodness-of-fit models) will predict componential processing in magnitude processing (i.e., the unit-decade compatibility effect). We will first use mixed-model analyses to confirm the expected effects in these tasks, and then we will evaluate our predictions by performing correlations on the random slopes estimates, as these should provide reliable measures of individual differences. Our findings will be discussed in the context of our previous studies that have examined the existence of holistic and componential-analytical mechanisms in language and numerical cognition.

The role of semantics and morphology in the affective content of Spanish pseudowords: A normative study on wordlikeness, valence and arousal

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In this normative study we collected data from 1,210 Spanish native speakers for 4,800 pseudowords and 1,200 words in wordlikeness (i.e., the resemblance of a string of letters with a word), valence, and arousal. We selected positive, negative, and neutral words and, for each of them, we created four types of pseudowords with different a morphological composition: 1) Baseword: relojero; 2) Root + real suffix (reloj-ado), 3) Pseudo-root + real suffix (reloj-oda); 4) Root + pseudo-suffix (jerol-ero) and 5) Pseudo-root + pseudo-suffix (jerol-oda). The relationship between the type of pseudoword and the ratings on the different variables was explored through correlations and regressions. The results of these analyses revealed that pseudowords composed of root + suffix showed higher wordlikeness, valence and arousal ratings, while those composed of pseudo-root + pseudo-suffix presented the lowest ratings on these variables. These findings may have implications for our understanding of the role of semantics and morphology in word processing.

The effect of eco-friendly labelling on estimations about environmental impact of human actions

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As some research indicates, psychological biases can influence human involvement on climate change. This study aims to investigate biases that are induced by eco-friendly product labels, and specifically how this eco-friendly labelling affects environmental impact perceptions. To this end, we developed a new computerized task in which participants were presented with monthly records of a community household carbon footprint before and after new houses were built (training phase). The new houses were presented either as environmentally certified and eco-friendly (Experimental group) or as unlabeled (Control group). After training, participants were required to (1) rate how the new houses affected the household carbon footprint of the community (impact rating) and (2) to provide a value that represented the monthly household carbon footprint before and after the new buildings were added. One hundred and ninety-nine adults were recruited via Prolific Academic and randomly assigned to the Experimental (n=106) or Control group (n=93). Individuals in the experimental group judged the carbon footprint of the new houses to be weaker than participants in the control group, an instance of “green halo effect”. This biased perception occurred even despite participants in both groups received and accurately learn identical information. These results suggest that causal inferences are shaped not only by the actual information provided to participants but also by their pre-existing expectations and belief systems. Implications for the design of strategies aimed at promoting better understanding of the environmental impact of human actions are discussed.

Taming the wandering mind with mindfulness training: A meta-analysis of causal evidence

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Mind-wandering—the cognitive process by which we engage in thoughts unrelated to the current demands of the external environment—becomes maladaptive in contexts where sustained attention is critical. Current theory portrays mindfulness meditation as an effective means of reducing mind-wandering, proposal for which there is a growing body of supporting evidence. However, no meta-evaluation of this relationship has yet been conducted, and the potential impact of biases in this literature thus remains unknown. Here, we present preliminary results from an ongoing systematic review and meta-analysis of randomized controlled studies addressing the influence of mindfulness meditation training on mind-wandering, as assessed by subjective (self-report and thought probe) and objective (cognitive-behavioural) indices. The systematic search procedure includes both published and unpublished studies (grey literature). Dependencies between effect sizes are dealt with by using multi-level modelling. Publication bias is accounted for by using a battery of methods including trim-and-fill, 3SPM, PET-PEESE, and RoBMA. Methodological weaknesses identified in the reviewed literature and recommendations for future research are discussed to conclude.

Conduite d'approche in Conduction Aphasia: Which psycholinguistic and experimental variables drive it – A case study

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Conduite d'approche (CdA) is a classic repetitive behavior that is frequently reported in individuals with conduction aphasia. However, relatively little is known about it, both at the brain and cognitive level. For example, it is unclear whether it is a self-correcting mechanism based on comprehension or rather on production. This study aims to identify the psycholinguistic and experimental variables that contribute to the occurrence of CdAs and achieving a successful CdA. Here, we present the case of ANC, a 79-year-old male with a high sociocultural background who is affected by a conduction aphasia, which has resulted in frequent instances of CdAs. The efficacy of ANC speech performance (as evidenced by the number of correct answers, the number of successful CdAs, and the overall quality of the speech) was evaluated. 1) Naming, repetition, and reading of 240 (out of 260) pictures (Snodgrass & Vanderwart, 1980); 2) Repetition of 3-syllable words, varying in lexical frequency; 3) Repetition of words of increasing length varying in the frequency of the 1st syllable; 4) Repetition of pseudowords varying in length (2 to 5 syllables) and syllable frequency. The results indicate that the errors made by the ANC were primarily phonemic in nature, with occasional instances of phonological paraphasias. These errors led to both successful and unsuccessful CdAs. Additionally, the analysis revealed that length (longer words) and low lexical frequency significantly increased the proportion of CdAs in words, with syllabic frequency not exhibiting a clear role. In pseudowords, length was only a marginal predictor of CdAs, with no role for syllabic frequency. In terms of access to phonological information, reading proved to be a more effective task than repetition. This was evidenced by the observation that reading led to a larger proportion of correct responses than repetition, with length emerging as the most significant variable in both words and pseudowords. Successful responses were more likely in stimuli of shorter length. However, there was a lower frequency of accurate responses in naming tasks. This suggests that lexical impairment may be a contributing factor in ANC. It appears that the variables that influence the generation of CdAs are also associated with their resolution.

Beware of gender agreement errors: They can affect emotional processing!

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The relationship between syntax and emotion has recently emerged as an area of interest in affective neurolinguistics. Several ERP studies have addressed this topic mainly analyzing if the grammaticality effect reflected in the LAN wave -larger amplitudes in grammatically incorrect (*elm camareraf) than correct items (laf camareraf)- can be affected by the emotional connotation of words. While some studies have found a cancellation of this effect in emotional words (*elm asesinaf), others have reported a lack of interaction between grammar and emotionality. A recent behavioral study on gender agreement has shown that this interaction may be limited to natural gender nouns (elm camarerom) and absent in arbitrary gender nouns (elm tornillom), pointing towards the semantic nature of the first as the reason behind the permeability of syntactic processing to emotion. These studies were designed so that the participants had to indicate if a sentence or phrase was grammatically correct or not without revealing the emotional manipulation. Hence, the main goal was to test whether emotional information can influence morphosyntactic processing. But what would happen if participants were asked to categorize the items as emotional or neutral regardless of their grammaticality? Would grammaticality affect emotional processing?

In the present ERP study, 41 female university students read noun phrases (NPs) composed by a determiner and a noun. They performed an emotional categorization task, pressing one of two buttons to respond if the NP was emotional or neutral. In addition to emotionality, grammaticality (grammatically correct vs incorrect) and gender type (arbitrary vs natural) were manipulated. Results revealed a facilitatory and sustained emotional effect in arbitrary and natural gender NPs, showing reduced N400 amplitudes and increased LPC amplitudes in unpleasant conditions compared to neutral ones. While no main effects of grammaticality were observed in either arbitrary or natural gender NPs, an interaction between grammar and emotion was obtained for the former. In this condition, the emotional effect emerged in grammatically correct trials but not in trials with an agreement violation. Interestingly, for natural gender NPs such interaction was not found, evidencing that grammaticality did not impact the emotionality effects. These results suggest that agreement errors may interfere with affective processing, yet this interaction is modulated by gender type.

An evaluation of the iconicity of 1,525 pictograms from the Aragonese Portal of Augmentative and Alternative Communication (ARASAAC)

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Pictograms are graphical symbols that transmit a message by virtue of their resemblance to their corresponding referents and are used in multiple contexts, due to their great applicability. Critically, pictograms can vary in their iconicity, which represents the degree of relationship between the pictogram and its referent. Iconicity is usually conceived in terms of transparency and translucency. Transparency reflects the degree to which the actual meaning of a pictogram can be guessed by a person in the absence of its referent whereas translucency reflects the degree of perceived relationship between the pictogram and its referent when the latter is present (Fuller & Lloyd, 1991; Lloyd & Fuller, 1990). In this study, we evaluated the iconicity of a set of 1,525 pictograms from the Aragonese Portal of Augmentative and Alternative Communication (ARASAAC, by S. Palao) catalog in a large sample of participants. To assess the transparency of the pictograms, 254 participants were asked to write the word that best described the meaning of each pictogram. In addition, translucency ratings were obtained by asking a sample of 267 participants to rate the degree of relationship between the pictogram and its corresponding verbal label, by means of a 7-point scale. Overall, the results showed modest levels of transparency and high levels of translucency. In addition, extensive analyses were carried out to study the iconicity of the pictograms in detail. For example, the correlation of the transparency and translucency indices with imageability and concreteness can be highlighted. The present study provides relevant and useful data for the selection and use of pictograms in various applied contexts. Furthermore, the analyses carried out contribute to academic knowledge about the perception and interpretation of pictograms.

Letter processing in sentence comprehension: influence of case alternation and letter-like symbols on reading efficiency

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Accurate processing of letter identity and position is essential for understanding printed words. There is still disagreement over the mechanisms underlying access to abstract letter representations. In this study, we investigate the extent to which characters resembling letters activate appropriate letter representations during sentence reading, and the way case alternation affects sentence reading processes. We looked at reading comprehension using sentences with uppercase-only (“four green deers”), lowercase-only (“FOUR GREEN DEERS”), alternate case (“FoUr GrEeN dEeRs”) and letter-like number insertions (“FOUR GR33N D33RS”) in an online reading task. The task was divided into two sections. First, participants had to read the sentences as fast as possible and indicate it with a button press. This served as a measure of their reading latency. Next, participants had to recognize the core elements mentioned in the sentence by selecting them from an array of options. This served as a measure of their reading comprehension. More than 450 participants completed this online task and results suggested important processing differences influenced by the case of the letters, as well as by the presence of digits that were visually like letters. Surprisingly, the results revealed small but significant differences between lowercase and uppercase sentences at the reading latency level, although the influence of these manipulations on reading comprehension was minimal.

Closed-loop neurofeedback to improve conscious perception

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Brain-computer interfaces (BCIs) are a robust and powerful tool that enables the integration of observed neural activity with direct manipulations of both this activity and behavior. BCIs have been widely used for years in clinical research, particularly with patients suffering from motor deficits caused by strokes or neurodegenerative diseases. Moreover, BCIs also have promising applications in basic neuroscience, with recent literature demonstrating their effectiveness in motor control, mental imagery, and attention. In a previous study we found that relevant information related to conscious perception processes can be decoded from electroencephalography (EEG) data using machine learning (ML) algorithms. Specifically, our results showed that the presence or absence of a stimulus could be decoded from the EEG data after target onset. Similar results were also obtained for participants' reported perception. Furthermore, we also observed significantly different patterns of activation for present targets depending on whether they were reported by participants as seen or as unseen. Based on this perceptual task, we are developing a closed-loop system to detect perceptual failures (i.e. participants reporting a stimulus as 'unseen' when it was presented) to alert participants with an attentional signal in order to improve their performance in the task. This neurofeedback pipeline includes real-time preprocessing of the recorded EEG signal, training of a ML classifier, and deploying the model to continuously analyze registered data. Our closed-loop system is able to perform predictions of the performance on the behavioral task to decide whether to send an alert tone to the participant. Here, we present some preliminary results of this neurofeedback system, and lay the groundwork for future steps.

Factors related to memorability from the mega-study approach: exploring the unique contribution of objective, subjective, associative and emotional verbal attributes

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In recent times, there has been a growing trend in utilizing megastudies to delve into intrinsic factors linked to word memorability. Diverging from factorial studies, megastudies offer a platform to scrutinize the varying influences of different properties across larger word sets, thereby enhancing comprehension of their impact on memory. Here, we present findings from a megastudy wherein 55 sets of 10 words were administered to 400 participants through the DRM-false memory paradigm. These sets were meticulously crafted to maintain a consistent level of backward associative strength (BAS) across the board, enabling the assessment of other variables' relative significance in correct/false recall and recognition. The word sets encompass a broad spectrum of attributes, including emotional valence and arousal among others. Employing diverse analytical approaches, we investigated how these variables function as predictors of accurate and erroneous recall/recognition. Our findings highlight distinct impacts of specific variables on memory performance. These outcomes are discussed within the framework of embodied representation models and hub-and-spoke models.

From Screen to Mind: Understanding how we Remember Mobile App Logos

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Logotypes of mobile applications are stimuli present in our daily lives with which we interact daily, making them suitable for the study of incidental memory. In the present study, 133 participants (undergraduate Psychology students) performed free recall, recognition, and naming tasks for the logos of nine well-known (and massively used) mobile applications. Additionally, we analyzed the relationship between performance on these tasks and metamemory (i.e. confidence judgments), the objective and subjective visual complexity of the logos, and familiarity. Our results showed that while performance on the free recall and recognition tasks was modest, performance on the naming task was virtually perfect. Moreover, participants showed a significant overconfidence in their ability to recall and recognize the logos, while confidence in naming was lower than actual performance. Neither visual complexity nor familiarity predicted performance, but metamemory confidence judgments were found to be a predictor of performance in the recall and recognition tasks. These data agree with previous results in the literature on incidental memory and provide evidence for the idea that when stimuli are processed incidentally, their encoding is shallow, and only those features (e.g., name) that are relevant for the usual type of interaction (i.e., recognize the app) are consistently stored and remembered.

Investigating behavioral expression of habitual control using monetary rewards

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One of the main assumptions when studying habitual behaviour is that the strength of the habit depends on the amount of training. The more often an action has been associated with a reward in the past, the more difficult it will be to inhibit it, even when that behaviour currently leads to unwanted consequences. Proving this hypothesis in the human laboratory has become an arduous task. Although Tricomi et al. (2009) found more habitual responses after overtraining (i.e., more perseverant behaviours even when they were supposedly no longer associated to a wanted reward), this important result has not been replicated in posterior attempts using the same task and design (Pool et al., 2022; Gera et al., 2023). We propose that these conflicting results could be due to flaws in the outcome devaluation procedure. The classical version of the task uses foods as rewards and the devaluation consists of participants eating one type of food until satiation. The results reported by Tricomi et al. (2009) could be due to reasons far removed from habit formation. For example, participants could continue responding even after the devaluation for being aware that they will not be forced to eat the food. They may also not have eaten until full satiation for social desirability or other reasons, thus hindering the devaluation procedure. To clarify this issue, we assessed the effect of the amount of training on habit strength, applying the same experimental design but using monetary rewards instead of food. In the devaluation phase, participants were warned that one of the outcomes would imply losing money. As expected, the response frequency significantly declined in both groups after the devaluation procedure, only for the devalued reward. However, no significant differences emerged in the effect of devaluation due to the amount of training (i.e., both training groups stopped responding to the devalued stimulus similarly). Therefore, the previously trained response faded after devaluation, as expected from goal-directed behaviour, but not from habit. We conclude that this experimental paradigm fails to capture the behavioural expression of habits.

Older drivers have fewer accidents during simulated driving

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Introduction: Society is continuously aging. People aged 65 years and over are becoming more active, so their implication as road users is also increasing. Older drivers are considered a group at risk of accidents due to the physical, cognitive, and mobility particularities of this stage of life. However, further research is still needed to clarify the driving characteristics of this age group and their possible relationship with the occurrence of accidents.

Methods: 103 participants were divided into 3 groups according to age, and drove on a high-fidelity motorcycle driving simulator. The middle-aged group (-65) was comprised of 40 participants ($M \pm SD = 41.33 \pm 8.37$), the over-65 group (+65) of 34 participants ($M \pm SD = 67.97 \pm 3.03$) and the over-75 group (+75) of 29 participants.

Results: The older driver groups (+65 and +75), compared to the -65 group, drove at a lower mean speed, exceeded speed limits less, in less kilometers/hour and for less time, braked for longer and with less braking pressure, showed less handlebar and throttle variation, and had fewer accidents. **Conclusions:** Older drivers use adaptive driving strategies that result in fewer crashes and have a more cautious driving style in simulated driving contexts.

Don't stop me now! A study of habit responses in humans through the degraded contingency paradigm

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Reward-learning theory considers habits as stimulus–response associations formed through extended reward training. Accordingly, animal research using outcome devaluation paradigms has shown that actions that are initially goal-directed can become habitual after operant overtraining. However, a similar demonstration has proved extremely difficult in human research, representing a serious problem for translational research. For this study, we tried to show evidence for habitual operant responses in three preregistered experiments. Habits were measured by using a degraded contingency test. Overall, we did not find evidence of an overtraining effect. To the best of our knowledge, this was the first time the degraded contingency strategy was used to examine habitual behaviour after overtraining in humans. We discuss the theoretical implications of the results and further ways to investigate habitual behaviour are examined.

Processing objects and events in locative sentences in Spanish: An eye-tracking study

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One of the challenges for learners of Spanish as a first and as a second language is the choice between the copular verbs *ser* and *estar*. The *ser/estar* distinction does not exist in other languages (e.g., in English the *ser/estar* distinction has only one counterpart, to be). The present study investigates the on-line processing of Spanish copular verbs in locative constructions. The traditional account of the difference between the Spanish copulas *ser/estar* in locative constructions is that the choice depends on the eventiveness of the noun phrase (NP) to be located. When the NP is [+eventive], the verb *ser* is selected, as in “La conferencia será en la University”; when the NP is [-eventive], the verb *estar* is selected as in “Los documentos están en la University”. Although the *ser/estar* distinction has been studied extensively in linguistics, there are only a handful of studies that have examined the online processing of such a linguistic phenomenon. The present study aims to examine the on-line processing of Spanish locative sentences, by manipulating the eventiveness of the NP to be located, and the copular verb (*ser* vs. *estar*). We focused on eventive and non-eventive syntactic postverbal object NPs in locative sentences (e.g., “Ester sabe dónde está/*es el libro” vs “Ester sabe dónde es/*está el concierto”; literal translation, “Esther knows where isSER/isESTAR the book/the concert”) in an eye-tracking experiment to elucidate the online processing of *ser* and *estar* in locative sentences. The question we aimed to answer was: Do readers quickly anticipate an eventive or non-eventive object NP after the copula verb? If the parser has a rapid access to the information subcategorized by copular verbs, we expect an interaction between verb type and object type. This prediction was confirmed by the results of the study. Eventive objects were read faster after *ser* than after *estar*, whereas non-eventive objects were read faster after *estar* than after *ser*. The interaction was observed at the object NP being significant in gaze duration, regression-path time and total reading time. The interaction was also significant in the spillover region in regression-path duration and total reading times. Our findings show that the parser quickly anticipates an eventive or non-eventive object NP immediately after processing the copular verb. Such anticipation is explained by the parser’s rapid access to the information subcategorized by copular verbs.

Do words burn in a second language?’ Processing literal and metaphorical pain in L2 discourse comprehension: an ERP study

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Comprehension of pain-related language has been shown to influence participants' ratings of pain intensity. This effect has been proven to be dependent on linguistic context (i.e. the way in which pain is expressed either literally or metaphorically) as well as one's individual pain history. The challenge in communicating such a highly individual experience through words can potentially vary depending on the language we use either a first (L1) or second (L2) language. We know that sentence processing is an easy, fast process in an L1 but can be costlier in an L2, especially regarding emotional content. In this study, we will investigate whether language modulates pain perception in different contexts and whether late L2 users are capable of perceiving others' pain during discourse using event-related potential (ERP) measures. To do so, we will present native Spanish speakers with sentences describing literal (a) and metaphorical (b) pain. We will also include, as baseline and control conditions, neutral congruent (c) and neutral incongruent (d) sentences.

- a. Tina was choking on the dense smoke, it felt "suffocating" for a long time.
- b. Tina was in despair over her divorce, it felt "suffocating" for a long time.
- c. Tina went jogging in the summer, it felt "suffocating" in the heat.
- d. Tina went jogging in the summer, it felt "changing" in the heat.

The ERPs will be time-locked to the onset of the critical word (in inverted commas in the examples). We expect different neural patterns in L2 and L1, suggesting that linguistic context affects the way we process different types of information (i.e., literal vs metaphorical). In the ERP data, we expect a larger N400 (a component reflecting semantic congruency) for the neutral incongruent condition compared to the neutral congruent condition in both languages. This will help us ensure that participants understand what they are reading. We also expect a larger N400 for pain-related sentences compared with neutral sentences, the effect being even larger for literal than metaphorical pain descriptors. We anticipate this effect to be present in L1 but reduced/delayed or even absent in L2. Such differences in L1 and L2 patterns would suggest that emotional pragmatic information does not interfere with semantic processing in L2 like in L1. We also predict late re-analysis processes, as reflected by a larger late positive potential (LPP) in response to literal and metaphorical pain sentences compared with neutral sentences in both languages. We hypothesise that when using an L2, users may be less sensitive to emotional content due to extra processing cost and emotional detachment. These findings may contribute to a further understanding of L2 sentence comprehension.

Could direct experience be a vaccine against suggestion?

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In this study we are interested in analyzing how the type of experience (direct or indirect) with an unfamiliar gizmo and the repetition of interviews influence memory performance and the acceptance of suggestive information in 4- to 5-year-old participants. A total of 91 participants complete three individual sessions. In the first session, participants perform (direct experience) or observe (indirect experience) a series of actions with the unfamiliar gizmo. In addition, it is suggested to all participants that they break a piece of the gizmo. Three or four days later, they conduct a first interview where they are encouraged to recount what happened in Session 1 (free recall and in response to open-ended questions) and, in addition to suggesting again that they broke a piece of the gizmo (repeated suggestion), new suggestive information is introduced (non-repeated suggestion). One week later (and between 11-12 days after the Session 1), they complete another interview again. The results show that when open-ended questions are asked, correct recall between sessions 2 and 3 decreases. Furthermore, the effect of the type of experience (direct vs. indirect) on the number of correct inferences about the operating of the unknown device is observed, as the group with indirect experience makes more inferences than the group with direct experience. Regarding the acceptance of suggestive information, an effect of type of experience is observed, as indirect experience makes participants more susceptible to suggestive information (repeated and non-repeated) compared to the direct experience group. Therefore, it seems that, in unfamiliar situations, direct experience may increase resistance to suggestion.

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Semantic distance reduction predicts the intensity of the Aha! experience in one-shot perceptual learning

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Imagine you are staring at a cloud in the sky. At first, it looks like a shapeless mass, and you are not quite sure what you are seeing. Then, as you keep looking, suddenly you notice the cloud forming the unmistakable shape of a heart. In that moment, you might experience an “Aha!” - a feeling of happiness, surprise, and confidence that often accompanies sudden insights. Despite evidence that solutions produced with an Aha! experience are more often correct and better remembered, the mechanisms driving the Aha! experience remain elusive. Recently, the predictive processing framework has been adapted to explain insight, suggesting that the Aha! experience reflects the sudden reduction of uncertainty through current, novel information. This leads to an unexpected jump in precision, explaining the feelings of pleasure and confidence. We test this hypothesis using ambiguous black-and-white degraded images, so called Mooney images (Mooney, 1957), which allow to induce insight experimentally after cueing the Mooney image with its corresponding unambiguous gray-scale image. Participants provided written guesses regarding the main object in the image at each stage (pre-disambiguation, gray-scale, and post-disambiguation). Using semantic embeddings, we calculated the semantic distance (SD) between each participant's guess and the actual verbal label. Additionally, participants reported confidence and intensity of their Aha! experience. Our results show that the reduction in SD from pre- to post-disambiguation reliably predicted the Aha! intensity on a trial-by-trial level. Moreover, high confidence in pre-disambiguation guesses that were semantically close to the actual label reduced the Aha! experience. Lastly, we did not find clear effects of Aha! intensity on subsequent recognition nor solution memory. These findings are discussed in the light of predictive processing.

Neural correlates of the pulvinar and mediodorsal thalamus in visual search guided by explicit and implicit cues

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Extensive research has identified the thalamus as a crucial hub for relaying neuronal signals between higher-order cortical hierarchies in the human brain. Of particular interest is the pulvinar complex, the largest thalamic structure, which boasts extensive reciprocal connections with the visual, temporal, parietal, and frontal cortices. Alongside direct inputs from subcortical sources such as the retina and superior colliculus, the pulvinar's functional contribution to cognitive processes, including attention, remains unclear. Emerging evidence suggests that the pulvinar synchronizes cortical activity according to attentional demands and mediates visual saliency by filtering noisy information. Another highly relevant thalamic complex is the mediodorsal (MD) nucleus, which forms dense pathways with the prefrontal cortex (PFC) and has been found to be implicated in attentional processes. This research explores the functional correlates of the pulvinar and MD nuclei in visuo-spatial attentional processes elicited by a single visual search task manipulated in two paradigms: goal-oriented and contextual cueing. The task involved reporting if a target (i.e., 'T') was either oriented to the left or to the right, amidst 'L'-shaped distractors rotated by 0°, 90°, 180°, or 270°. In the goal-oriented paradigm, participants were shown a spatial cue before the visual search indicating with high probability (71% congruence) the target's location, guiding an explicit search. In the contextual-cueing paradigm, some displays were repeated multiple times (i.e., "old" condition), which induced implicit learned searches; these conditions were combined with other displays that appeared only once (i.e., "new" condition). Both paradigms also manipulated the distractor load (low-medium-high) to investigate the role of the thalamus in filtering out irrelevant information under different demand conditions. Results revealed stronger pulvinar and MD engagement under higher distractor loads, suggesting their participation in selecting relevant information for prioritized processing during endogenous attention. The pulvinar was functionally coupled with regions along the visual stream, and the MD with the PFC, supporting thalamocortical communication to suppress irrelevant information. Incongruent and new searches evoked stronger neural responses in the pulvinar and MD, underscoring a sustained reorientation effect reflected by a shift in the selection of new relevant information.

Examining the impact of participants' baseline working memory capacity and task difficulty on the effects of theta tACS to modulate working memory maintenance

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When item representations are maintained in working memory, oscillations appear to play an important role, with fast oscillations representing specific items and coupling into slow theta waves (Lisman and Jensen, 2013). Based on this theory, previous research has used transcranial alternating electrical stimulation at slow theta frequencies to modulate participants' oscillations, allowing more high-frequency coupling to enable the maintenance of a greater number of items. Given the mixed results of these studies, two factors that determine the effectiveness of stimulation were controlled in the present work: participants' baseline working memory capacity and difficulty of the task. Therefore, the aim was to examine whether the effects of the stimulation would be clearer when controlling for these factors, hypothesizing a stronger effect of stimulation in participants with lower working memory capacity and in the more difficult version of the task. Both behavioral and electroencephalographic results will be presented and discussed.

Compound-RAT as a candidate for semantic control assessment: an fNIRS study

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The present study aims to examine whether the remote associates test (RAT), traditionally used for the assessment of creative thinking, produces changes in hemodynamic activity in areas known to be related to the semantic control network. Twenty-nine participants did three types of RAT problems differentiated by the nature of the association between word triads and the solution, i.e., semantic-RAT, compound-RAT, and expression-RAT. Compound-RAT showed to be more difficult to solve than the other two RATs, reflected in significantly lower hits than the semantic-RAT and expression-RAT. Furthermore, during compound-RAT solution, there was a higher concentration of oxygenated hemoglobin in the left inferior frontal gyrus. No differential hemodynamic activity was found in other areas involved in the semantic control network. The left inferior frontal gyrus might be a brain area oriented to external demands, whereas the middle and posterior temporal areas would participate more as mediators not oriented to specific goals. We suggest that processes involved in compound-RAT could be understood beyond the traditional concept of creativity and be a potential candidate for assessing the semantic control mechanism.

Inhibitory learning in latent Inhibition: more evidence from superconditioning and protection from extinction

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In the latent inhibition effect (LI), the to be conditioned stimulus is presented without consequences prior to conditioning, making it more difficult to learn the association with the unconditioned stimulus when both are subsequently paired. The most common interpretation of this phenomenon alludes to attentional factors: nonreinforced exposure leads to a decrease in attention to the stimuli, resulting in a learning deficit. However, we have gathered some evidence in favor of a more complete interpretation, according to which LI involves an active inhibitory learning process. According to our theoretical model (Hall & Rodríguez, 2010), nonreinforced exposure causes the learning of an inhibitory stimulus-no event association, and this learning is the cause of the loss of attention. We assume that novel stimuli activate the expectation that some event will occur, an expectation that is contradicted by the absence of consequences, thus generating a prediction error that induces learning. Following the predictions of the model, we have found certain exposure conditions that give the target stimulus net inhibitory properties similar to those of a conditioned inhibitor, as assessed by retardation and summation tests. These exposure conditions consist of the presentation of novel stimuli in compound with the target stimulus to generate a constant prediction error that intensifies inhibitory learning. We now present new experiments using the superconditioning and protection from extinction designs.

Bringing Visual Search to Life: how we find colored objects when performing a natural task

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Visual search has been extensively studied under laboratory conditions, but little is known about how we perform visual searches under natural conditions. This issue is important, because there are crucial differences between searching for elements on a computer screen and searching for objects in a three dimensional space. In natural environments, eye and head movements, and very often also locomotion, are required to locate the target object. The response is also very different: in a natural setting search normally occurs as part of a global action, so once found the target object would most likely be picked up and used for some other task. All these differences might lead to variations in visual search strategies. To explore this issue, we designed a repeated visual search task with real objects. Our main aim was to investigate whether visual search characteristics were similar to those found under static conditions (computer-based tasks). Participants searched for different colored plastic pieces on a game board while their eye movements were recorded (using a Pupil Core eye-tracker). A photo of the target item was presented in each trial. Participants located the target among the distractors, picked it up, and placed it in a box. Ten different targets were presented in each block and participants searched for each target a total of 7 times. Target locations were constant except for one block in which the board was rotated. This rotation was included to test whether consistent locations improved search. Our preliminary findings reveal that repeated exposure to consistent target locations enhances visual search efficiency. This was evidenced by an increase in direct fixations to the correct target position over repetitions. Participants also seemed to use color to guide visual search. Rotation of the board also seemed to interfere with performance: occasionally participants first fixated the previous location of the target piece. These results agree with what has been found in other natural contexts, for example when searching for objects in a Virtual Reality apartment. They also shed some light on the role of motor processes in modulating visual search strategies. This study contributes to our understanding of the nuances of visual search efficiency and its implications for real-world tasks.

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Iconic memory in adult dyslexia: reduced accuracy in change identification of pseudoletters

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An accurate, fast identification of letters in words is required for efficient reading. Such identification may be supported by iconic memory (IM), i.e., the brief storage of information about visual features of a stimulus after the stimulus is gone. The goal of the present work was to examine the potential differences in iconic memory between adults with and without dyslexia. A sample of 20 adults with dyslexia and a control group completed three partial report tasks. In all tasks, a circular array of six different 'pseudoletters' were briefly presented on each trial. The pseudoletters were created ad hoc, and were given to participants as visual stimuli, without any verbal labels, nor associated sounds. In one of the tasks (IM duration), participants were asked to identify the pseudoletter placed at a particular location, manipulating the cue delay (17 / 100 / 183 / 277 ms). In the second task (IM capacity), participants were asked to identify the three pseudoletters at the upper or lower part of the array. In the third task (cued change), a single pseudoletter of the array changed in half of trials, and the presence vs. absence of an attentional cue (cued / uncued) and target delay (17 / 100 / 183 / 277 ms) were also manipulated. The participants were asked to indicate if there was or not a change (change detection). Additionally, in change trials, they were asked to recognize the previous stimulus (change identification). The results showed no differences between the two groups in the IM duration, capacity, nor change detection. However, according to generalized linear model analysis, the correct identification of the changed pseudoletter was lower in the dyslexia group (32.1%) than in controls (39.4%). Therefore, the results from this study suggest that, while IM duration and capacity might be more preserved, adults with dyslexia could have deficits in the ability to visually discriminate among different graphemes in IM.

Explicit knowledge modulates reversal learning in value-modulated attentional capture

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Value-modulated attentional capture (VMAC) refers to attentional biases towards high reward-signaling cues, even when it is counterproductive for task goals. VMAC has been considered analogous to sign-tracking paradigms in non-human animals and is conceptualized as a rather automatic form of attentional capture driven by Pavlovian mechanisms, persistent under conditions such as Pavlovian extinction. In Experiment 1, we investigated VMAC persistence when previous cue-reward contingencies are reversed in an extensive test phase compared to other studies. As in previous studies, participants received explicit instructions about reversal and trial-by-trial feedback, where we observed that the previously acquired VMAC effect disappeared at the onset of the reversal phase, even before feedback was significantly experienced, and progressively reversed to align with the new contingencies. This abrupt change suggests a potential modulatory role related to participants' explicit knowledge. To test this possibility, we conducted two pre-registered experiments to disentangle the roles of instructions and feedback on this effect. In Experiment 2a, we implemented a reversal phase under nominal extinction, where participants were told that they would still gain points, but no direct feedback was provided. Preliminary data showed that the VMAC effect immediately disappeared, and indicated a trend towards reversal throughout the phase. In Experiment 2b participants were not instructed about the reversed contingencies but received feedback on each trial. As hypothesized, preliminary data showed the persistence of the VMAC effect at the beginning of the phase, in contrast to our other experiments, and the subsequent reversal of the VMAC effect throughout the reversal phase. Nevertheless, an awareness test showed that participants generally became aware of our manipulation. Overall, our three experiments suggest that both explicit knowledge and feedback may be necessary for VMAC reversal learning.

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Surgical masks and female own-gender bias: implications for lineup accuracy

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The COVID-19 pandemic has triggered the widespread wearing of surgical masks. Therefore, nowadays the perpetrator of a crime could wear a surgical mask during the commission of a crime, although the witness will probably have to try to identify it in an unmasked lineup. For this reason, it is relevant to examine how the difference in retrieval conditions (masked vs. unmasked lineup) could affect eyewitness accuracy. In addition, several studies have shown that there is a female gender bias in lineup identification. That is, females exhibit higher accuracy in identifying female faces compared to male faces. To examine these issues, in the present study, 128 female participants watched one mock crime video in which the perpetrator wore a surgical mask. There were two versions of the mock crime: one with a female-target and one with a male-target. Both versions of the stimulus event depicted the same type of crime, with the target's face being visible for the identical amount of time (20 seconds). After a 48-hour delay, participants faced a lineup where all members either wore surgical masks or not. Moreover, participants faced a lineup in which the perpetrator could be present (target-present lineup) or not (target-absent lineup). Therefore, in this experiment, a 2 (female-target vs. male-target) x 2 (lineup components wearing surgical masks vs. not wearing surgical masks) x 2 (target-present vs. target-absent) between-participants design was employed. Regression analyses were conducted to examine if the type of lineup (masked vs. unmasked lineup) and the gender of the target (female vs. male) could predict the identification accuracy. In the target-present lineup, participants who faced the lineup in which all members wore surgical masks obtained a significantly lower error rate (i.e., fewer false alarms and omissions) compared to participants who faced the unmasked lineup. Furthermore, participants who attempted to identify the male-target obtained a significantly higher false alarm rate compared to the participants who attempted to identify the female-target. In contrast, in the target-absent lineup none of the results obtained reached statistical significance. Regarding participants' post-lineup confidence ratings, in the target-present lineup, there was a significant correlation between post-lineup confidence ratings and hits. Likewise, in the target-absent lineup, a significant correlation between post-lineup confidence ratings and correct rejections was obtained. Nonetheless, both correlations were moderately low. The results obtained in the target-present lineup supports the encoding specificity principle, demonstrating that consistency between encoding and retrieval conditions enhances identification accuracy. Additionally, the findings corroborate the female own-gender bias, as participants showed higher false alarm rate in identifying the male-target compared to the female-target.

False recognition in the DRM paradigm: time-course of ERP response and behavioural correlates

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In the present study, we examined electrophysiological and behavioural correlates of true and false memories in the Deese/Roediger-McDermont (DRM) paradigm. Twenty-eight participants were presented with 28 DRM lists and their electrophysiological activity was recorded during a recognition test, where the instructions encouraged decisions based on recollection processes. Electrophysiological effects were examined by a mass univariate approach for analysing event-related potentials (ERP) in the temporal domain. Behaviourally, the DRM effect was observed, as false recognition of critical lures (new words semantically related to studied words) was higher than false alarms of new (unrelated) words. Neurally, an expected old/new effect was observed during the time-range of the late positive component (LPC) over left centro-parietal scalp electrodes. True recognition also evoked larger LPC amplitudes than false recognition over left centro-parietal and fronto-central scalp electrodes, but no differences in LPC were observed between critical lures and new words. In contrast, correct rejections of critical lures compared to new words were accompanied by higher activation of a sustained positive slow wave (SPSW) in right fronto-central electrodes beyond 1200 ms, revealing a key role of post-retrieval processes in recognition. Results are discussed in light of theoretical approaches to false memory in the DRM paradigm.

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Differential effects of resource levels in encoding on true and false memories in DRM paradigm

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In the present study, 223 participants are presented with six Deese/Roediger-McDermont (DRM) lists, three concrete lists and three abstract lists. One group of participants listened to the lists in full attention condition, while other four groups of participants listened to the lists while simultaneously completing a shadowing task in four different conditions from least to most cognitively demanding. The results showed differential effects of resource level in encoding on true and false memory. Recall and recognition of the studied words were higher in the full attention condition than in the divided attention conditions. However, resource level did not affect false memory (i.e., neither recall nor recognition of critical theme words). On the other hand, list type affected true and false memories but in the opposite direction, i.e., there were more correct recall and hits for concrete lists than for abstract lists, but there were more false recall and recognition of critical theme words in the abstract lists than in the concrete lists. Finally, “remember” (“R”) judgments were sensitive to list type, as more “R” judgments were assigned to recalled and recognized words belonging to concrete lists than to those belonging to abstract lists for both true and false memories. In addition, in the recognition task, more “R” judgments were assigned to hits in the full attention condition than in three of the four divided attention conditions. Results are discussed in light of theoretical approaches to false memory in the DRM paradigm.

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Thinking fast and right: individual differences in the strength of mathematical intuitions

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In some reasoning problems a fast and wrong response is generated instead of the logico-mathematical one. It was traditionally considered that intuitive type 1 reasoning provides this first response and that only after conscious deliberation (type 2) the right response can be generated. However, recent studies have shown that some people are sensitive to logical and mathematical principles from the start. The hybrid-dual process model proposes that type 1 can produce both the heuristic and logical responses; which one is finally elicited depends on their relative strength, which can be measured through conflict detection indicators. A determinant of the strength of the logical intuition is mindware, i.e., specific knowledge and skills acquired through experience. Individual differences in cognitive skills and thinking dispositions would be responsible of increasing this experience and the automatization of mindware. In order to test these hybrid-dual model postulates, 103 participants conducted a dual response task on conflicting base rate problems. Performance at neutral base rate problems was used as indicator of mindware, and numeracy, cognitive ability and need for cognition were assessed. For the first time math anxiety was also measured, given its association with math contents' avoidance. Last, we also asked participants to rate the confidence in their responses and compared neutral and conflicting responses as a measure of conflict detection. Most participants who answered correctly, did it from the start. Those that corrected their initial erroneous response had a best mindware measured at the second moment (t2) and a marginally larger need for cognition than those who maintained their wrong answer when they could reflect. The former were also less confident in their initial response and slower at t2. Regarding the comparison between those that answered correctly from the beginning and those that corrected their initial mistake, the former showed better mindware measured at t1 and higher cognitive ability. They were also more confident in their initial response and faster at the second one. As for math anxiety and numeracy, a marginal correlation with accuracy was observed at t2. Altogether, our results support the hybrid-dual model: correct answers are often generated by type 1 reasoning and mindware is key to the strength of such mathematical intuitions, although other cognitive skills seem to be relevant to attaining better mindware.

False recognition in the context of bilingualism: Assessing false memory with ad hoc categorical, associative and taxonomic lists

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False memories in the context of bilingualism have been studied using the DRM paradigm, an experimental procedure involving the presentation of lists of words semantically related to a critical, non-presented word, observing high levels of false recognition of that critical word in a subsequent memory test. However, exploration of false recognition in L1 and L2, comparing lists that present ad hoc categorical, associative, and taxonomic relationships, is non-existent. The present research explores false recognition in ad hoc categorical, associative, and taxonomic lists in Portuguese (L1) students with some level of proficiency in English (L2). The 160 participants studied 12 lists (4 ad hoc, 4 associative, and 4 taxonomic), half presented in Portuguese and half presented in English. In the subsequent recognition memory test, half of the studied words and their corresponding critical words were presented in the same language as the study phase. In contrast, the other half were presented in an alternate language. The remaining words came from distractor lists. Results showed an advantage for L2 on the recognition of the targets (hit rate), regardless of the type of list. Additionally, the hit rate was also higher when the study and test words were in the same language (Portuguese-Portuguese vs. English-English). Regarding false recognition, the results showed differences among the three types of lists, regardless of the study and test language, with associative lists generating the highest levels of false recognition, followed by taxonomic lists, and finally, ad hoc lists. The study allows for progress in important lines of research, such as those related to the nature of semantic representation or understanding memory distortions in different languages.

An Ace Under the Inferior Parietal Cortex to Preserve Verbal Repetition

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Introduction: Verbal repetition is a crucial linguistic function for language learning, language rehabilitation, and a key feature for aphasia diagnosis. Traditionally linked to the activity of the direct segment of the arcuate fasciculus [AF] connecting Wernicke's and Broca's areas, a recent study on primary progressive aphasia ([PPA]; Forkel et al. 2020) suggest repetition deficits are linked to damage in the left temporo- parietal cortex and the indirect AF segments connecting the inferior parietal cortex with Broca's and Wernicke's areas. The present study aims to determine if, in cases of sudden brain damage (i.e., post- stroke aphasia (PSA)), preserved repetition is associated with these regions or if the right hemisphere plays a more prominent role.

Methods: Surface-based morphometry (SBM), multivariate lesion symptom mapping (MLSM), and resting state functional magnetic resonance imaging (rs-fMRI) analyses were performed to investigate anatomical and functional correlates of preserved repetition in 31 patients with PSA (55.81 ± 11.48 yo, 10 women). Repetition performance was measured with the repetition subscale of the Western Aphasia Battery Revised (WAB-R), and all analyses were controlled by age, time-post stroke, sex and lesion volume.

Results: Anatomically, whole-brain SBM showed an association between preserved verbal repetition and cortical thickness in the left temporo-parietal cortex. Region-of-interest analysis confirmed these results. MLSM analyses revealed a correlation between repetition deficits and damage in the temporo-parietal area, left middle temporal gyrus, and postcentral gyrus. At the functional level, rs-fMRI analyses indicated that repetition performance correlated with the strength of functional connectivity between temporo- parietal areas on the one hand, and between fronto-parietal on the other, modelling the indirect pathway between Wernicke's and Broca's area via the inferior parietal lobe.

Conclusion: This study shows that preserved verbal repetition in PSA is supported by temporo-parietal areas and their synchronization with frontal and temporal cortices in the left hemisphere, aligning with PPA research. No evidence supports the right hemisphere's compensatory role. Further studies with larger samples are needed to explore this issue across lesion locations, potentially identifying patients who may benefit from greater right hemisphere involvement.

Joint effects of dyslexia and fog on the recognition of words in traffic signs

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The aim of the present work was to examine the joint influence of two factors on the recognition of words in traffic signs: fog, which adds visual noise to these words, and dyslexia. This question has not been directly tested so far, but a study on the effects of a white-noise based stimulus degradation in a lexical decision task, using 9 to 13-year-old children, showed that compared to controls, participants with dyslexia were more affected in accuracy, but less in response time. This study also found that in controls, the stimulus degradation increased the response time in pseudowords more than in words. In our work, a sample of 40 adults participated in a lexical decision experiment using city names on traffic signs. The sign dynamically expanded during the trial to simulate the participant's approach to the sign. The experimental design included a between-participants factor, Group: 20 adults with dyslexia versus a control group of 20 adults matched in age, gender, years of schooling, and driving experience; and two within-participants factors, Lexicality: 40 real city names versus 40 city pseudo-names, and Fog: foggy versus clear stimuli. Correct responses (percentage) and response latency (milliseconds) were analyzed using, respectively, generalized and general linear models. The analysis of the correct response percentage showed a high accuracy, close to ceiling across all conditions, although slightly lower in the dyslexia group overall, as compared to the control group. As for the response latency, the three main effects were significant, showing slower responses in the dyslexia group, in pseudowords, and in foggy stimuli. Interestingly, the interaction of Fog x Group was significant, showing that the detrimental effect of fog on response latency was weaker in the dyslexia group than in controls. Finally, the interaction Fog x Lexicality was also significant, showing a negative effect of fog on response latency stronger in words than in pseudowords. The interaction of Group x Lexicality was not significant, nor the three-way interaction. This study suggests that, when the potential trade-off between accuracy and speed is absent, both dyslexia and visual noise (fog) would impair the visual recognition of words in traffic signs, but their joint net effect would actually be under additive. In addition, both adults with and without dyslexia would show an effect of fog in words larger than in pseudowords.

La influencia del sexo y el rol de género en la atención social: un estudio sobre su relación con habilidades sociales y orientación académica

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Diversos estudios han demostrado que estímulos como la mirada y las flechas producen efectos de orientación atencional cuantitativamente equivalentes. Sin embargo, utilizando diseños experimentales más específicos, es posible observar una disociación cualitativa entre la orientación atencional desencadenada por estos estímulos. Específicamente, se ha encontrado que, mientras las flechas extienden la atención hacia todo el entorno que están señalando, la mirada enfoca la atención solo en el punto específico que está siendo observado. No obstante, hasta la fecha, no se ha aclarado si esta disociación entre estos estímulos de naturaleza tan distinta puede relacionarse con diferencias individuales en rasgos personales, que suelen asociarse con mayores o menores habilidades sociales. Con el objetivo de indagar en esta cuestión, en el presente estudio se ha explorado si las diferencias cualitativas encontradas en la orientación atencional desencadenada por las flechas y la mirada difieren entre los participantes según su sexo, rol de género, habilidades sociales o formación académica. Los resultados han mostrado que, aunque es posible observar la asociación esperada entre ambos estímulos, esta misma no se ve relacionada con ninguno de los atributos personales de los participantes considerados en este estudio.

Nuestros hallazgos sugieren que las diferencias entre la orientación atencional desencadenada por las flechas y la mirada no están asociadas con diferencias individuales en la cognición social.

Spatial and drawing abilities in artists and non-artists

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Research on cognitive processes in the creation of visual art has gained renewed interest in recent years. Cognitive Archaeology, a field focusing on behavioral interpretations derived from archaeological evidence using psychological models, has been interested in exploring the cognitive abilities involved in visual art production, seeking to understand the aspects underlying the creation of Paleolithic art motifs. Previous research showed that artists perform better than non-artists in spatial and drawing tasks. However, drawing skills have typically been assessed using a single general question about drawing accuracy, which may overlook essential aspects of drawing ability. It would be more enriching to have an assessment method that includes separate accuracy ratings for different aspects of drawing ability. In this sense, our work aimed, first, to develop a refined method for assessing drawing accuracy, and second, to analyze the differences between artists and non-artists in spatial and drawing abilities.

In this study, 50 fine arts students (i.e., artists) and 50 psychology students with no artistic experience (i.e., non-artists) completed three spatial tasks: a Mental Rotation Test (MRT), a Spatial Visualization Test (PFT), and a Vividness Visual Imagery Questionnaire (VVIQ-RV). Additionally, participants completed the Hand Drawing Task. The refined method developed for the assessment of this task included questions on the proportion, scale, three-dimensionality, and completeness of the drawing, in addition to the traditional general question about the drawing accuracy. The drawings were evaluated by 12 judges using a 7-point Likert scale. Results indicated that, on the one hand, artists scored higher than non-artists in all aspects assessed in the drawings and on the MRT and PFT, with no significant differences on the VVIQ-RV. On the other hand, correlation analyses showed a significant correlation between MRT and PFT, both spatial ability tasks. Additionally, while both spatial ability scores correlated with three-dimensionality and proportion, only MRT correlated with scale, and only PFT correlated with drawing accuracy. These findings suggest that not all the spatial abilities have the same impact on specific aspects of drawing, with a direct relationship between mental rotation and the dimension of scale, and between spatial visualization and drawing accuracy. This research deepens our understanding of the processes involved in artistic production.

Exploring the effect of binge drinking pattern of consumption and physical activity on an attentional task

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The pattern of heavy alcohol consumption, known as binge drinking (BD), is a common practice among young people, involving excessive alcohol consumption in short periods of time. It is defined as the consumption of 6 or more UBEs in males and 4 or more UBEs in females within a 4-6 hour session, resulting in a certain level of intoxication within the past 30 days. This study aims to investigate the impact of BD on the cognitive performance of young individuals who also engage in physical exercise, using a negative semantic priming task, and to examine the potential neuroprotective effect of exercise. The cognitive inhibition capacity and selective attention were evaluated using the negative semantic priming task in a sample composed of participants with a BD pattern of consumption and participants without such pattern (NOBD), with both groups engaging in different levels of physical activity. The results did not reveal significant differences in the negative semantic priming effect between the BD and NOBD groups, nor was a differential pattern found in the effect of physical exercise on both groups. These results, along with the contradictory findings found in this study, highlight the need to continue investigating the relationship between binge drinking and cognition. Furthermore, these findings lay the foundation for future research that could contribute to a better understanding of the underlying mechanisms and establish solid conclusions regarding the impact of binge drinking on cognitive performance.

An Eye-tracking study on the Pragmatics of Negation

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The process of understanding has been widely demonstrated to be more complicated when sentences are presented as negative, “A robin is not a tree”, irrespective of the surrounding conditions. Two eye tracking experiments compared affirmative and negative sentences within an informative context, “Due to its high addiction, heroin is not very safe” and an uninformative one, “The heart functioning is not very superficial”. In Experiment 1, participants read sentences while the eyes were registered. The expected results were that the eye fixations on the target were longer for negated sentences than affirmative ones in the uninformative context. This difference was smaller in the informative context, supporting the theory that context facilitates negation. However, some authors are debating that predictability is responsible for such a phenomenon and in the present framework this would be true if participants looked at the correct target word before listening to it. These results are confirmed in Experiment 2 when participants listened to the sentences while two target words were shown on the screen, “Dangerous / Safe” or “Important / Superficial” while the eyes were registered. We will discuss our findings according to the main theories of comprehension.

Bilingualism and cross-language similarity modify the phase of alpha oscillations during naturalistic sentence reading

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The current study examines how native language (L1) orthographic features influence the acquisition of novel word-forms in a second language (L2) among Spanish-English and Chinese-English bilinguals. Utilizing a naturalistic reading paradigm, we recorded eye movements and electroencephalography (EEG) to explore the online dynamics of L2 word learning. Participants read English passages containing novel words, while their eye movements and EEG responses were monitored. Pre-target analysis focused on alpha oscillations and their correlation with later event-related potentials (ERPs). No group differences were found in the first exposure or in the correlation between pre-target spectrum and later N400.

However, significant differences emerged in alpha oscillations during the final exposure, indicating that alpha band activity is modulated by L1 background. For Spanish bilinguals, pre-target interval activities were correlated with later ERP components from 300 ms onwards, suggesting that they likely allocate attentional processing before target onset to ensure efficient processing of subsequent stimuli. This indicates that previewed information from the parafovea prepares the visual system in advance. In contrast, Chinese bilinguals tend to concentrate their attentional resources on the visual structure of the target form when it becomes available. These findings underscore the impact of L1 orthographic features on the neural mechanisms of L2 word acquisition. The research highlights the importance of considering orthographic characteristics in bilingual education and suggests tailored instructional strategies to optimize L2 word acquisition across different language backgrounds.

Effects of transcranial alternating current stimulation (tACS) over frontal-midline theta oscillations on decision-making and functional connectivity: a Bayesian approach

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Frontal theta oscillations are essential for reinforcement learning and cognitive control, especially in uncertain situations. Nevertheless, their role in risky reward-based decision-making under ambiguous conditions, such as those found in gambling scenarios, is not well understood. This study seeks to unravel the neural mechanisms behind decision-making by examining brain activity during two resting-state periods and performance on the Iowa Gambling Task (IGT) using an fNIRS approach. The research design includes a single-session, single-blind, sham-controlled, mixed methodology, with frontolateral tACS stimulation as the experimental intervention.

We recruited forty-four participants for the study. Each participant underwent an 8-minute recording of resting-state functional connectivity, followed by a stimulation period that continued until the task concluded. Participants received 8 minutes of stimulation prior to the task and were assigned sequentially to either the active or sham condition, ensuring balanced group sizes while controlling for sex and age.

After the stimulation, participants performed the IGT.

To analyze the data, we employed a reinforcement learning model to extract parameters such as learning rate, inverse temperature, loss aversion, outcome sensitivity. Using a probabilistic approach, we developed a Bayesian Logistic Regression Model to identify parameters associated with the learning process and accuracy. Our results revealed differences in IGT performance between the groups. The active group demonstrated a higher punishment learning rate and lower outcome sensitivity compared to the sham group. However, no tACS effect was observed in the fNIRS measures. The discussion will focus on the intricate relationship between neurophysiological measures, reinforcement learning, and decision-making processes.

Lectures vs. Practice: Does Listening Alone Foster Critical Thinking?

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As educational talks and lectures across different formats become increasingly accessible and prevalent, evaluating their effectiveness in enhancing critical thinking is essential. Evidence from previous studies suggests that passive engagement in these activities does not substantially boost critical thinking skills. However, combining explicit instruction with practical exercises has proven to be more effective. This study aimed to compare these methodologies to determine whether an educational lecture alone improves critical thinking as effectively as when combined with practice. To this end, we conducted a 2-hour session for 143 psychology students, providing a comprehensive introduction to critical thinking. Participants were exposed to a pseudoscience video and a pseudoscientific article with methodological flaws. The active control group passively listened without engaging in any activities, while the experimental group performed practical exercises to identify methodological issues in both the video and the article (e.g., small sample sizes, absence of control groups). Additionally, a passive control group participated in an unrelated activity during the intervention. We hypothesized that the experimental group would exhibit the most significant improvement due to the practice component. To evaluate the effectiveness of the intervention, all students completed pretest and posttest assessments measuring their critical thinking skills. This study underscores the potential benefits of even a brief intervention for enhancing critical thinking, highlighting the crucial role of practice for psychology students. Such interventions provide valuable insights into the true impact of educational talks and lectures in the information age.

Differential cross-modal affective priming in first and second language: behavioral and electrophysiological evidence

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Previous research suggests that bilinguals process emotional language differently in their first (L1) and second language (L2). However, the evidence available is still inconclusive, and the underlying cognitive mechanisms of such differences remain elusive. We addressed this question through a cross-modal affective priming paradigm in L1 and L2, in which the effects of affective auditory stimulation (music) on the processing of written emotional words would reflect differences in the permeability of emotional processing in both languages. A group of 32 bilinguals (L1 Spanish – L2 English) performed an emotional categorization task consisting of two language blocks, the order of which was counterbalanced across participants. Each block contained 48 target words (in L1 or their L2 translations), 24 with positive and 24 with negative valence, randomly presented in both congruent and incongruent conditions with respect to the valence of the prime stimulus (musical excerpt), previously presented for 1000 ms (SOA = 200 ms). Positive and negative targets were matched in arousal, lexical frequency, length and imageability within languages as well as in valence between languages. During the task, participants were required to categorize targets as pleasant or unpleasant words and their reaction times and errors were recorded, along with their brain activity measured using an EEG with 64 channels. Preliminary results obtained in a series of ANOVAs revealed differences between L1 and L2, with larger TRs and lower accuracy for L2 than L1 words. Importantly, differential L1-L2 congruency effects were also observed in both behavioral and ERP data. Specifically, an interaction of congruency by language emerged in the accuracy analysis, with a higher percentage of errors for L2 words presented in incongruent than in congruent condition, difference not observed in L1. This was accompanied by a significant congruency by valence by language interaction in the ERP data; positive L2 words presented in the incongruent condition exhibited a larger N400 negativity than those in the congruent condition, whereas no N400 congruency effect was observed for L2 negative words or the L1 conditions. The greater permeability and influence of the emotional cross-modal incongruency in L2, coupled with the absence of congruency effects in L1, points to a greater automaticity of affective language processing in L1, which likely compensate for the congruency effect.

Individual differences in the causality bias under disfluent conditions: Raven's progressive matrices negatively correlate with the illusion of causality when the information is hard-to-read

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Previous studies have shown that fluency affects judgment and processing style. Furthermore, this effect has been tested under conditions that typically lead people to make systematic errors in their decisions, showing that disfluent manipulations such as presenting the information in a hard-to-read font may reduce the impact of cognitive biases. However, this debiasing effect is sometimes elusive and difficult to replicate, raising questions about the potential differences between studies (and, therefore, underlying variables) that may be modulating the impact of processing (dis)fluency.

One of the cognitive biases in which the effect of fluency has been studied is the illusion of causality. This causality bias occurs when people judge that a causal relationship exists between a potential cause and an effect that are actually unrelated. The aim of the present research was to replicate the reduction of the illusion of causality under disfluent conditions and explore different variables that could have led to mixed results in the literature. One hundred and fifty-five participants performed a standard causal learning task in which the potential cause and the (highly frequent) effect were presented as independent events in either an easy-to-read or hard-to-read font. Furthermore, after judging the causal relationship between the potential cause and the effect, participants completed the Actively open-minded thinking (AOT) test and Raven's progressive matrices.

Overall, the results showed a stronger overestimation of causality in the easy-to-read font group, replicating the debiasing effects of disfluency observed in previous studies. Additionally, a negative correlation was observed between the AOT and the causality judgments derived from the dogmatism and fact resistance subscales. Interestingly, a negative correlation between the score in the Raven's matrices and the illusion of causality was also observed, but only when the information was presented in a hard-to-read font. Our results provide further evidence of the debiasing effect of disfluency, pointing at individual differences as the possible source of variability in results. Specifically, it appears that individuals require sufficient cognitive resources to be more accurate in their judgments and decisions when the task is disfluent. Although this hypothesis is merely speculative, future research should consider these individual differences as a potential source of modulation of the effect (e.g., university students as the experimental sample).

Handwriting processing in children with attention-deficit/ hyperactivity disorder with/ without dyslexia

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Writing is defined as a complex process consisting of a series of sub-processes involving cognitive, linguistic, perceptual and motor skills (Afonso et al., 2019). Given its complexity, writing difficulties are common in neurodevelopmental disorders such as dyslexia or attention-deficit/hyperactivity disorder (ADHD). In this regard, several studies have investigated the characteristics of the written compositions of children with ADHD and dyslexia. However, so far, the comorbidity between both of them has not been analyzed (Puyjarinet et al., 2023). Likewise, it has not been analyzed whether there are differences between the different ADHD profiles (Puyjarinet et al., 2023).

The aim of the present study was to analyze the characteristics of the written compositions of children with ADHD and/or dyslexia (TDAH-DD) in comparison with that of a chronological age-matched group (CON). Similarly, the writing tendencies of the different profiles of the TDAH-DD group were examined. To achieve this objective, the performance of children aged 7;6 to 12;10 years ($n = 62$) was evaluated in the name writing task, alphabet task, word dictation task and sentence generation task. The Wacom Intous 5 digitizer tablet and Ductus software were used for data collection and analysis.

The results revealed higher reaction times, total duration and number of errors in the TDAH-DD group versus the CON group in word dictation. In the sentence generation task, the TDAH-DD group wrote fewer words and sentences versus CON, while the sentences were shorter and the number of errors higher.

Similarly, analysis of the different TDAH-DD profiles revealed a higher speed of the hyperactive ADHD with dyslexia group versus the other subgroups. The inattentive ADHD with dyslexia group obtained the longest total duration in word dictation. Spelling errors were more common in the combined ADHD without dyslexia group versus the hyperactive ADHD without dyslexia group.

The results highlight the need for a detailed diagnosis based on the idiosyncratic characteristics of each case without forgetting possible comorbidities. If a thorough evaluation is not carried out, it will not be possible to intervene in order to avoid the negative effects they may have on the subject's overall development.

Learning of linguistic rules with more or less attention involves distinct brain networks and different neural encoding

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The process of language acquisition involves understanding the inherent rules within words and phrases (e.g., "These cupcakes are unbelievable"). Monitoring statistical relationships among non-adjacent dependencies is crucial in this context. The focus of attention on these elements significantly affects how these rules are retained, as previous research has shown (Lopez-Barroso et al., 2016; Orpella et al., 2020). This study aims to explore how the encoding of dependencies is affected by attention and whether different neural networks are engaged in learning when attention is directed to elements of the dependency versus when learning occurs automatically, without focused attention. Two groups of participants listened to an artificial language that contained non-adjacent dependencies while neural modulations were recorded with functional MRI (N=36) or EEG (N=21). In both experiments, to direct attention, participants had to detect the presence of a target in each sentence but were not told about the rule dependencies. The language consisted of three-word sentences, presented in alternating blocks with a rule and blocks with no dependency rule. In the Rule block, the artificial language featured sequences following a structured A1-X-C1 and A2-X-C2 (e.g., moga male kudo), where "A1" predicted "C1" and "A2" predicted "C2". In the No-Rule block, the same words were organized into sequences with no rules, following an X-X-C1 or X-X-X structure. Participants responded yes/no for target presence and reaction times were recorded. Implicit learning was assessed through the target detection task involving "C1," predictable in the Rule block but not in the No-Rule block. Since the target "C1" was part of only one of the two rules, the Rule containing the target received goal-directed attention (Rule-target condition) while the non-target sentences (Rule Non-target condition) did not. Behavioral results showed faster responses in Rule blocks than in No-Rule blocks and quicker responses to Targets than No-targets cues. Univariate functional MRI analysis revealed a main effect of Rule presence, with greater activation in the left inferior parietal lobe and left middle and superior frontal gyrus in the Rule compared to No-Rule blocks. Attended rules (target) induced greater activation at the caudate nucleus compared to non-target Rules, while non-target Rules showed greater activation in the left middle and superior frontal gyrus compared to target Rules. EEG analysis of the first word of the sentence, which predicted the dependency in the rule conditions, showed an increased positivity (P2 component) in the frontal and central cortical regions compared to first words with no predictive value (No Rule). Additionally, when rules were attended (Rule-target), differences compared to non-target Rules were primarily associated with a modulation of the N1 and P2 components in the central and frontal cortical electrodes. These findings suggest an overlapping frontoparietal system, despite differences in attention recruitment, with distinct frontal and subcortical regions modulated by attention.

The neural markers of mild cognitive impairment in breast cancer patients: a multimodal approach to detection, predict, and monitor

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Cancer-related cognitive impairment (CRCI) manifests with symptoms such as cognitive fatigue, impaired attention, and memory deficits. This phenomenon is common but poorly understood. Our study focuses on breast cancer patients, given their high survival rate, high prevalence and younger age at diagnosis, which often occurs during their working years. Key research questions of this study include which electrophysiological changes are associated with CRCI or cancer treatment in general, what protective factors exist, and the relationship between subjective (self-reported) and objective cognitive impairment. We conducted a longitudinal study with 51 women diagnosed with breast cancer, assessed over two sessions spaced six months apart. Group 1 (G1; N=15, mean age=50.07) was tested after diagnosis but before treatment, while Group 2 (G2; N=36, mean age 51.19) was tested at the end of treatment. An age-, gender and level of education-matched control group (N=28, mean age=49.00) was also included. We collected a multimodal dataset including clinical information, subjective scales on cognitive abilities, and neuropsychological tests. Participants also underwent EEG sessions during an attention network test (ANT) and 5-minute eyes-closed and eyes-open resting-state EEG. At T1, G2 reported worse quality of life, lower cognitive ability, and higher physical and cognitive fatigue compared to controls and G1, indicating CRCI. G1's reports were similar to controls, suggesting treatment significantly impacts the subjective experience of CRCI. Cognitive impairment assessed with the MOCA battery showed significant decline in cognitive abilities in both experimental groups compared to controls, with 50% of G1, 31% of G2, and 11% of controls scoring below 26 (indicating mild cognitive impairment). The ANT revealed that G2 performed worse than controls at T1 (end of treatment), but their performance was not significantly different from control six months later. G1's performance was not significantly different from controls at either T1 or T2. Resting-state EEG analyses, including individual alpha frequency, alpha power, and power spectrum slope and offset, showed no significant changes between groups or over time. Our findings confirm that cancer treatment significantly impacts cognitive function and quality of life, with G2 showing the most impairment immediately following treatment. The subjective experience of cognitive deficits appears closely linked to treatment phases. Despite the null results in resting-state EEG, the study highlights the complexity of CRCI and the need for larger sample sizes to detect subtle electrophysiological changes. Investigating protective factors and improving our understanding of CRCI could lead to better interventions and support for cancer survivors.

Investigating Metacontrol and Mind-Wandering: Evidence from a High-Definition tDCS Study

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Individuals' cognitive control during tasks varies along a persistence-flexibility spectrum. Conversely, mind-wandering, the spontaneous (or voluntary) shift of attention from tasks to unrelated thoughts, often occurs during cognitive activities. The link between these meta-control styles (persistence-flexibility) and mind-wandering propensity is under-researched. Recent tDCS studies have highlighted a causal connection between the DLPFC and both mind-wandering and metacognitive styles. This research aims to explore the temporal dynamics of mind-wandering and metacognitive strategies by modulating the left DLPFC activity using HD-tDCS during a Global-Local task that includes thought probes. Results showed notable shifts in persistence-flexibility and mind-wandering over time. However, DLPFC stimulation via tDCS primarily influenced meta-control states rather than mind-wandering propensity. The anodal stimulation did have a major impact on showing a global-local preferential bias, boosting participants' focus. By separating the analyses between intentional and unintentional mind-wandering, we observed that the global precedence effect (global minus local conditions) correlated positively with intentional mind-wandering and negatively with unintentional mind-wandering, establishing a new dissociation between both forms of mind-wandering triggering not previously reported in the literature. The implications of these findings will be discussed further.

Temporal Dynamics in Gender Stereotype Representation and Its Influence on Face Perception

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Perception is the result of a continuous interaction between the processing of external sensory information and our prior knowledge about what is most likely to happen in a given context, studied under the umbrella of perceptual expectations. Previous research suggests that expectations based on gender stereotypes modulate activity in brain areas linked to face perception, as measured with functional magnetic resonance imaging. Nevertheless, the temporal dynamics with which the representation of gender expectations impact the perception of faces remains unknown. The main goal of this study was to examine the spatiotemporal patterns with which different types of behavioral data and neural activity reflect gender-based expectations during face perception. To that end we collected, in different sessions, electroencephalography (EEG) and mouse movements data while participants perceived and categorized faces. We employed two similar gender and emotion categorization tasks of a series of faces which could be congruent (angry male, happy female) or incongruent (happy male and angry female) with gender stereotypes. Analyses of the mouse trajectories revealed a congruency effect, reflected on a higher degree of curvature and more complex trajectory patterns in incongruent conditions. Representational Similarity Analysis (RSA) of mouse movements indicated that the spatiotemporal patterns of trajectories were modulated by stereotypes at medium to late stages of processing. Preliminary Multivariate Pattern Analysis (MVPA) of EEG data revealed that patterns of neural activity code gender expectations at intermediate stages of face processing. In contrast, preliminary analyses of Evoked-Related-Potentials (ERPs) identified amplitude differences between congruent and incongruent faces, in the early components P100 and N170. Taken together, our preliminary analyses suggest that social stereotypes influence the perception of faces at different stages, starting from early in time, supporting extant models of predictive coding.

Investigating Cognitive Domain Interactions: Linguistic and Numerical Processing of "Increase" and "Decrease" concepts

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The aim of this study was to investigate the relationship between cognitive domains in the processing of linguistic and numerical information, specifically through the semantic concepts of “increase” and “decrease”. We designed a two-stage paradigm. In the first stage, participants were presented with sequences of geometric figures representing an increasing or decreasing change in size magnitude. They were asked to identify whether the geometric figures followed a sequence of increasing or decreasing magnitude, or no specific sequence. In the second stage, the concepts of increase and decrease were implemented through arithmetic operations: one-digit additions (e.g., $6 + 3 = 9$) and subtractions (e.g., $7 - 2 = 4$) followed by a possible result. Participants were asked to determine whether the proposed result was or not correct. We expected to find a congruency effect: facilitation in solving additions when preceded by increasing sequences, and better performance in solving subtractions when preceded by decreasing sequences. Additionally, we expected to observe this effect inversely: facilitation in recognizing increasing sequences preceded by additions, and decreasing sequences preceded by subtractions. Contrary to our expectations, no facilitation effects were found either from changes in magnitude sequences to arithmetic operations, or inversely from operations to changes in magnitude sequences. These findings suggest an absence of cross-domain semantic processing between linguistic and mathematical contexts for “increase” and “decrease” concepts.

Contextual cueing and working memory: Studying the dependence of task difficulty on the expression of the effect

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In visual search tasks, targets that are displayed in already presented arrangements are more easily detected. This effect is known as "Contextual Cueing", and is understood as an instance of implicit learning, which would be independent of the availability of working memory resources. Evidence for this comes from some studies where the expression of the effect is not impaired by the addition of a secondary demanding working memory task. However, some studies have questioned these results, finding an impairment of the acquisition or expression of the effect after implementing other working memory tasks. The aim of the present study is to investigate whether this inconsistency in the literature can be explained by the fact that the tasks used have not been sufficiently demanding. To this end, a secondary visual spatial working memory task was used which adapted its difficulty according to the performance of the participants. This manipulation allowed us to ensure that the task was sufficiently demanding for all participants. A disruption of the Contextual Cueing will be interpreted as evidence that this learning is working memory dependent, and thus not automatic.

The use of the differential outcomes procedure for improving attentional control

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The Differential Outcomes Procedure (DOP), originating from animal behaviour research, is a useful method for improving learning and memory in both non-clinical populations and those with cognitive deficits. The DOP involves administering a specific outcome after each correct stimulus-response pairing, being more effective than non-differential reinforcement (NOP). Most research on the DOP supports a two-memory system that differentiates the effects of the DOP between prospective and retrospective memory. Furthermore, recent event-related potential (ERP) studies have found that the use of NOP is linked to the NSW ERP working-memory component, while the PSW feedback-related component appeared under DOP conditions. Additionally, N100, a component that is reportedly linked to attention, was larger for participants in NOP conditions and P300 was larger for DOP participants, suggesting easier discrimination. However, there is still a scarcity of research concerning the attentional effects of the DOP. Therefore, the purpose of this study is to measure the effectiveness of the DOP and prospective information on attentional processes, specifically on attentional selection and control by employing two widely used tasks: the Simon and Letter Flanker tasks. University students completed the tasks (n = 85 total). An ANOVA was conducted on reaction-time data for each of the tasks. The results showed that there was a general effect of congruence, but no effect of reinforcement or interaction between reinforcement (DOP or NOP) and congruence (congruent, incongruent, or neutral) in the Simon task.

Similarly, in the Flanker task, there was a general effect of congruence, but no effect of reinforcement or an interaction. These results suggest that the DOP might not be a useful procedure to improve attentional processes, although further research using different tasks or establishing a priori specific reward-stimulus associations is needed.

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Background music effects on sustained attention and working memory

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Many people listen to music while performing tasks that require concentration, (e.g., reading or studying) arguing that it improves their performance. This has led to number of studies aimed to understand the real effects of music on cognition (Ho et al., 2007). Although some studies suggest that music benefits cognitive performance (Xu & Sum, 2022), the underlying mechanisms remain unclear. For example, literature shows that listening to music evokes emotional responses (e.g., arousal regulation), which can be an explanatory factor of the impact of music on cognition (Nguyen & Grahn, 2017). However, it is uncertain whether listening to music affects attention directly, enhances memory through improved attention, or the role emotional responses to music play in that interaction. This study aims to determine whether the emotional response elicited by background music affects performance in attention and working memory tasks. To do so, a sample of 40 university students performed the Psychomotor Vigilance Task (PVT) and the Sustained Attention to Response task (SART) for sustained attention and vigilance; and the N-back and backward digit span tasks for working memory (WM) updating and capacity. We split our sample into two groups: half performed all tasks while listening to background classical music while the other half did it in silence. To evaluate the emotional impact of background music, participants fulfilled the self-assessment manikin test (SAM) for valence and arousal before and after performing the tasks. Our results did not show any significant group differences in the performance of any of the attentional or WM tasks. Thus, we could conclude that background music does not affect those cognitive process. However, music did not elicit any changes in participants' valence or arousal either. Therefore, it appears that our music selection failed at inducing the emotional responses necessary to modulate cognitive performance. That is, since there were no changes in emotional responses, no changes in cognitive performance were observed either. Future studies should explore strategies to effectively evoke emotional responses to music, as these may be crucial in harnessing the potential benefits of music on cognitive performance.

Exploring the Circadian Influence of Cognitive Processes that Do and Do Not Require Cognitive Control: Evidence from the Self-Prioritization Effect (SPE)

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The self-prioritization effect (SPE) reflects the trend to direct the attentional focus to stimuli that are linked to oneself in a given set of cues. In the same way, those perceived as being more unrelated would be processed in the background (Arnell et al., 1999; Shapiro et al., 1997; Sui et al., 2009; Sui & Han, 2007). One of the explanations underlying this effect has been related to the development of automatic-based responses in the presence of self-related cues. At the same time, more foreign stimuli would trigger control-based responses, which may take far longer to develop fully. Considering this approach, we use the task of Sui et al., (2012), which assesses the SPE by linking oneself, a friend, and a stranger to three distinct geometric shapes. Once the geometric shape and the specific label are presented, the participant must respond to whether the association is correct, based on the prior training. Our main goal in this work is to examine whether either type of stimulus processing tackled in this perceptual-matching task is substantially influenced by the chronotype of the participants and the time of day in which they perform it. In turn, chronotype describes the preference we hold for performing our daily activities at one time of the day or another. In this case, we evaluated extreme morning- and evening- types at two times of the day that both coincide and deviate from their preferences, respectively (i.e., 8 AM and 8:30 PM). In total, 40 participants were evaluated (32 women, Mage = 21.14; SDage = 5.45). Our results, contrary to our hypotheses expecting a significant influence of time of day on processes that require control vs. those that are automatic, showed a dissociation that was as unexpected as it was intriguing: only evening-types were affected by time of day in the performance of the perceptual matching task, and, in addition, in the processing of self-related stimuli (i.e., those requiring automatic-response strategies). Thus, in the condition you, data reflected a main synchrony effect irrespective of the bin, that is, regardless of the response speed $F(1,19) = 5.75$; $p = .02$; $\eta^2 = 0.23$. The synchrony effect remained statistically significant only in the first bin of the condition friend $F(4,76) = 4.37$; $p = .003$; $\eta^2 = 0.19$, and was not statistically significant in any case in the stranger condition $F(1,19) = 1.99$; $p = .17$; $\eta^2 = 0.09$. This pattern reveals interesting findings that are in line with previous literature that describes the evening-type chronotype as much less flexible and able to adapt to the adverse circumstances of being outside its optimal time (for an example see Adan et al., 2012; Correa et al., 2014). Moreover, our results also contradict the previous assertion that automatic processes are invulnerable to the time-of-day effect, pointing to other factors that are important to consider when addressing the distinction between automatic and controlled processing, such as the brain region on which these processes depend. In this sense, although we did not directly address brain structures involved in stimulus processing, we draw on the distinction of brain areas that have been previously linked to both self-related stimuli and other-related cues to understand our results. In this line, our data pattern would support to a greater extent the involvement of the ventromedial prefrontal cortex (VMPFC) in the Self-Attention Network (SAN) closely linked to circadian rhythms, than that of the dorsolateral prefrontal cortex (DLPFC), in line with other previous studies (for an example see Liang et al., 2022).

Streams of conscious visual experience: a functionnectome study

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Consciousness is a unique and complex form of experience encompassing our perceptions, thoughts, and emotions. However, a comprehensive understanding of the neural mechanisms underlying conscious experience remains elusive. Functional magnetic resonance imaging studies have allowed researchers to investigate the functional involvement of brain areas in visual conscious experience, while the role of anatomical connections has been primarily explored through studies with brain lesion patients. In this study, we used the Functionnectome, a new method that integrates structural connectivity data within functional analysis to explore this issue. The Functionnectome takes the activity from the grey matter and combines them based on how these areas are connected through white matter fibers. We analysed three fMRI datasets where participants performed a visual perceptual task with three different attentional manipulations. We employed a conjunction analysis to reveal the specific networks that underlie visual consciousness, independently from attention. Results underscored the importance of the superior longitudinal fasciculus within the fronto-parietal network, aligning with findings from studies on patients with spatial neglect. Additionally, our data revealed the critical contribution of the occipito-temporo-parietal fibers and the splenium of the corpus callosum in connecting early visual information with the visual ventral stream and the fronto-parietal network. This integration may facilitate the formation of a unified conscious experience, particularly through verbalization. Central to these networks is the thalamus and its cortical projections through the internal capsule, posited as a conductor in synchronizing these interactive processes. This research offers a comprehensive understanding of visual consciousness, highlighting the complex network of neural connections that lead to awareness.

Dynamic neural codes of content and geometry during a novel instruction task

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In everyday life, humans constantly face and overcome novel challenges through instructed behavior. This complex skill is based on cognitive control mechanisms that organize and maintain the task-relevant information, ensuring readiness. Previous studies examining these control processes have shown sustained neural activity of task components prior to execution, but they often focus on repetitive, highly practiced tasks. To address this gap, we aimed to characterize the temporal dynamics during the preparation and implementation of novel tasks. In an electroencephalography (EEG) experiment, we employed a novel verbal instruction paradigm where three task components (overall integration vs. selection demands, the relevant –animate or inanimate– targets, and the feature –shape or color– to respond to) were orthogonally manipulated to create unique task combinations on every trial. Our main goals were to (1) determine whether the content of novel instructions could be decoded from the neural data, and assess their temporal profile along the trial, using Multivariate Pattern Analysis (MVPA), and (2) examine the underlying organizational geometry of control-related codes, investigating their degree of dimensionality, with Cross-Condition Generalization Performance (CCGP), and abstraction, using Shattering Dimensionality (SD). The MVPA results indicated that decoding the content of the three task components was possible during both preparation and implementation. However, we observed that the coding dynamics varied substantially across components, with more stable and generalizable codes for higher-level variables (Task Demand), and more transient activity patterns for lower-level variables (Target Category and Target Relevant Feature). Moreover, neural patterns exhibited high dimensionality and abstraction, consistent with previous accounts of control representations' geometry, balancing a trade-off between separability and generalization of information. Lastly, additional neural similarity analysis on a low-dimensional manifold revealed that the different Task Demands, integration and selection, were geometrically structured to favor generalization of information. Overall, our findings highlight the dynamic manner in which both the content and geometry of neural activity operate during novel tasks, with changes in dimensionality and abstraction adjusting to the different trial stages.

The balance of goal-directed and habit systems: A look into individual differences

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Instrumental human behaviour is controlled by two complementary and interacting neurocognitive systems: goal-directed and habits. Given a specific context, when actions are consistently associated with a desired outcome, they usually become habitual behaviours. Those contextual cues present during the learning process can also trigger the habit, even when it is no longer rewarded. The amount of training (i.e., the number of occasions in which the action was followed by the reward in the past) and the motivational value of the outcome are two factors which influence habit acquisition. Nonetheless, most studies using the outcome devaluation procedure did not observe enhanced habit expression after overtraining. They commonly measure habit strength through perseverative responses, which continue to occur even after they are no longer rewarded. We proposed an alternative habit index: the switch cost for inhibiting habitual actions in favour of emitting behaviour aligned with current contingencies, assessed in terms of reaction time (RT). Previous research from our investigation group has found an increment in the RT to stimuli associated with devalued reward as compared to stimuli which maintained intact their reward, but only in the group who received three days of training. We aim to replicate these results using a within-subject design (i.e., all participants pass both the minimal training and overtraining conditions) and spread the overtraining to five consecutive days to check the habit strength under these conditions. We also administered some questionnaires to measure whether individual differences could influence the behavioural expression of habits. Regarding accuracy, we found a greater proportion of perseverative errors consistent with habits in the minimal group, compared to overtraining. Indeed, the TR switch cost was significantly higher for overtraining condition and stimuli associated with high-value outcomes. Questionnaire scores did not significantly correlate with this dependent variable. Contrary to what one would expect from a measure of habits, it seems that the more training participants received, the fewer mistakes they made in devalued trials. This result could be explained as a trade-off in which overtrained participants prioritize accuracy at the expense of needing much more time to respond. Therefore, the RT switch cost would emerge as a more reliable measure of habit strength.

A novel paradigm to study the interactions between selective attention and expectation during preparation

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Individuals prepare to handle various tasks by combining various sources of a-priory information. Recently, there has been growing interest in studying preparatory phenomena from a proactive perspective, emphasizing the central role of top-down processes. Two of these are selective attention, related to information relevance, and perceptual expectation, regarding information probability. These phenomena modulate stimulus perception and response selection, however it is less clear whether and how they interact during preparation contexts. To study this, we developed a cue-target paradigm that manipulated both the relevance and probability of information. A set of visual stimuli, faces and person's names, with homogeneous perceptual characteristics was selected for the task based on a prior study by Peñalver et al. (2023). Additionally, two auditory tones (with high and low pitch) were created. On every trial, cues created expectations about the most likely visual stimulus to appear (either a face or a name), and also instructed about the discrimination task to perform, either with the visual (sex/gender) or auditory (high/low pitch) stimuli. Electroencephalography data was recorded to contrast how the expectation-based preparation unfolded in attended and unattended contexts. Preliminary data analyses suggest the existence of a behavioral expectation effect (facilitation on valid trials) that is not affected by the attentional manipulation. On the other hand, initial Event-Related Potential analyses point to lower amplitudes for expected than unexpected stimuli in the P100 and N170 components, and larger amplitudes for attended than unattended ones. Overall, our manipulation seems successful in manipulating the relevance and probability of information and offer suggestive information of separate mechanisms. Further analyses, including multivariate approaches, will be needed to offer a more comprehensive picture of the interaction of relevance and probabilistic phenomena during preparatory and target processing stages.

Decoding neural codes of stimulus category in EEG: similarities and differences observed under different functional relevance priorities

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Faced with the daily challenge of constantly shifting intentions and plans, individuals must keep track of what matters depending on upcoming tasks. Prioritizing one piece of information over another, while maintaining both available, can be difficult and may involve encoding and maintenance schemes suited to avoid interference. Proposed schemes include keeping representations in 'active' and 'latent' states, with prioritization based on what is currently demanded by the task. The current study uses a working memory (WM) paradigm, in which novel stimulus-response (S-R) pairings are encoded and later cued in three conditions: a probe that appears right after the cue (current), with a certain delay (delayed), or with a delay interrupted by an irrelevant task (prospective). The aim is to investigate WM representations' format, contents, and time course depending on their relevance, and, further to explain whether they fall into different functional states. Behavioral results show slower reaction times and higher error rates for the prospective condition, suggesting that task demands modulate the state of representations to guide behavior. EEG decoding analyses reveal shared neural codes for stimulus categories during encoding and testing among and between the three working memory conditions. In the prospective condition, however, the stimulus category may be maintained in a way that protects it from interference. Overall, this points to different coding schemes in WM modulated by task demands.

Misconceptions and active denial might be critical for negation-induced forgetting

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A recent and somewhat striking finding is that producing negations (responding “no” to questions) leads to forgetting the denied information, at least compared to producing affirmations (responding “yes”). Recently, we have employed a new memory paradigm in which participants first learn novel world- knowledge information and then assert or deny its veracity, showing that this negation-induced forgetting occurs even when associative interference is fully controlled. This communication presents two new experiments that employ the same paradigm and aim to better characterize the processes underlying the influence of negation on memory. In the original study, participants engaged in a multi-step procedure: they began by assessing the familiarity and pleasantness of new information (e.g., “The pango is a soup”). Following this, they were informed of the veracity of the information, being told whether it was true (e.g., “The pango is indeed a soup”) or false (e.g., “The pango is not a soup”). They then had to assert or deny this information themselves by writing “yes” or “no”. Finally, after a brief distracting period, they were asked to complete a cued recall task (e.g., “Pango ”). This procedure was systematically altered in the new experiments. In one of them, the veracity of the information was presented at the outset, prior to evaluating familiarity and pleasantness; in the other, the phase where participants had to actively assert or deny the recently learned information was omitted. Negation did not affect cued recall rates in either experiment; however, the familiarity attributed to the new information did have a significant impact. These findings suggest that the influence of negation production on memory might require the active correction or rejection of previously learned information, linking it to its primary function in adult communication— denial.

Analysis of executive functions in a sample of the impulsive-compulsive spectrum through a virtual reality task: ICE CREM Nesplora

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Obsessive-compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD), archetypes of the impulsive-compulsive spectrum disorders, are characterised by deficits in executive functions: difficulties in creating action plans based on rules and instructions, adapting quickly and flexibly to change, or holding information in the mind and manipulating it. In the present study, we aimed to explore whether three of the executive functions (planning, working memory and flexibility) are impaired in a sample of 141 adults (56 with ADHD, 39 with OCD and 46 healthy controls) using an ecological and objective assessment. For this purpose, we have used the virtual reality task ICE CREAM Nesplora. Likewise, we obtained a record of resting-state functional connectivity between several regions of frontoparietal networks using functional near-infrared spectroscopy. We also examine their symptomatology (inattention, impulsivity-hyperactivity, anxiety, depression or obsessive-compulsive behavior) measured via self-reported clinical questionnaires. We found that the healthy control group performed significantly higher on the task than the clinical groups. These results were analyzed with Bayesian statistics to examine functional connectivity between frontoparietal regions or clinical variables as possible predictors of performance from a categorical (group) and dimensional perspective. Executive functions are skills essential for cognitive, social, and psychological development. So, it is necessary to study them widely to improve the target of interventions. This study suggested clinical implications from the results obtained.

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Mouse-Tracking as a Window into Rule-Based Reasoning

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In the domain of legal philosophy, a debate has emerged on the proper interpretation of laws, namely, whether they ought to be enforced by consulting their letter or, conversely, as both their literal formulation and their underlying spirit, when judging putative transgressions. A similar controversy has translated into cognitive psychology and neuroscience as either focusing on the role of moral concerns or, conversely, on the primacy of text (i.e., textualism) in people's enforcement of rules in general. Traditionally, the orthogonal manipulation of Text and Purpose of legal norms as either violated or complied with yielded two congruent conditions, with both of them transgressed or unbroken and, conversely, two incongruent ones, with only one of the two being infringed. Building on similar research, we designed a mouse-tracking experiment to uncover the spatio-temporal dynamics of text and purpose processing during judgments of rule violation. Specifically, 39 native Spanish speakers engaged in 96 trials of statutory interpretation, while their actual response, speed and the trajectory of their mouse on the screen were recorded. Results replicated evidence from previous studies, namely an effect of both factors on the given response (i.e., Yes vs. No), an interference effect on RT, and generally faster conviction than acquittal. Additionally, we observed the same interference effect on both the Maximum Absolute Deviation (MAD) and Area Under the Curve (AUC) indices, suggesting increased conflict for incongruent versus congruent trials. A top-down application of trajectory types suggested that the interference effect on measures of curvature may be driven primarily by discrete, rather than continuous, shifts along the response dimension that are more likely to occur during acquittal, than during conviction, decisions. Exploratory analyses focused on the use of Representational Similarity Analysis (RSA) to uncover the temporal unfolding of cognitive processes across congruent and incongruent trials. Overall, our results provide evidence of cognitive conflict during statutory interpretation, and yield novel insights into the emergence and resolution of interpretive conflict between a rule's textual and evaluative dimensions over time.

Is the reversed congruency effect observed with gaze due to its social nature? Analysis of non-social stimuli with similar asymmetrical contrast features of eye-gaze stimuli

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Eye-gaze plays a crucial role in social interactions and may engage different attentional orienting mechanisms compared to non-social cues. Using a spatial interference paradigm with arrows vs. eye-gaze, it has been observed that arrows result in faster reaction times in congruent than incongruent trials, exhibiting a standard congruency effect (SCE). In contrast, eye-gaze results in faster reaction times in incongruent than congruent trials, producing a reversed congruency effect (RCE). This reversion might be driven by the social significance of gaze processing. Additionally, using the conditional accuracy function (CAF), higher error rates for congruent than incongruent trials with social stimuli were observed within the fastest responses, with both trials types showing reduced accuracy in the first bins. To explore whether the dissociations observed in reaction times and CAF with gaze are due to the incongruent location of the salient sclera as opposed to the less salient pupils, we adapted non-social stimuli to have a similar contrast pattern to that of eye-gaze. We used two types of arrow targets: Eyes-like arrows (darker, less salient on the target arrowhead) and Anti-Eyes-like arrows (darker, less salient on the arrow tail). Our results revealed no reversion for either type of target, consistently showing the SCE independently of contrast features. Additionally, no dissociation was observed in the CAF; both Eyes-like and Anti-Eyes-like arrows showed similar patterns, consistent with traditional non-social stimuli in distributional analysis studies. This suggests that the social nature of the stimuli might underlie the reversions observed with reaction times and accuracy.

Reading in English as a Foreign language by Spanish-speaking children: second, fourth and sixth grades

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Reading development in English as a foreign language (EFL) presents challenges and is often influenced by the learner's L1. The challenges and potential interferences would arise if L1 is transparent (like Spanish), and FL is opaque (like English). In this study, we tried to explore English reading strategies among Spanish-speaking primary school students, from second to sixth grades. A total of 92 primary school children performed an English word reading-aloud task. Word frequency and word length (in letters, phonemes and syllables) were manipulated, while consistency and syllable type were controlled. Words were used in DMDX software, and the recordings were subsequently analyzed using CheckVocal to obtain reading accuracy and reading latencies. The results indicated that children in grades 4 and 6 were more likely to read correctly than in grade 2 (second: 53.65% accuracy; fourth: 77.66%; sixth: 79.06%). In addition, high-frequency words were more likely to be read correctly than low-frequency words. In addition, considering reading latencies, results indicated grade, English lexical frequency and word length effects. However, lexical frequency and length were grade-dependent, as we did not find differences between 4th and 6th grades in short words. Results suggest that Spanish-speaking children are more accurate and faster in the upper grades, especially for short words, indicating the formation of orthographic representations and lexical reading of these words. These data suggest a reading development similar to that of L1.

Hierarchical Detection of Auditory Irregularities in Early Infancy: An Event Related Study

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The ability to learn regular patterns and detect irregularities in auditory sequences emerges in early life. In event-related potential protocols, neural activity changes (i.e., a parietal mismatch negativity, MNN, followed by a positive frontal effect) can be observed linked to the presentation of deviant events from early age. However, these responses seem to appear in simple tasks involving local deviants in auditory sequences, whereas in more complex tasks that require the integration of information overtime it is not present. However, few studies have addressed this question. To investigate it, we used the auditory global- local task and recorded brain activity (EEG) in 1-month-old infants (current $n = 15$). The local-global task consisted of two blocks of 210 trials (including four sequentially presented tones), in which the last tone could be regular (r) or irregular/deviant (i). In one block, we presented a sequence of four regular sounds (rrrr) as the most frequent one (75%) and, in the remaining sequences, an irregular sound appeared at the end (rrri). In the other block, we presented a frequent sequence with an irregular ending sound (rrri) and regular sequences as the infrequent (rrrR). We then compared the neural activity of deviant sounds (rrri/rrri) to that of all regular sounds (rrr/rrrR) to measure the local effect, whereas we compared the neural activity of infrequent sequences (rrri/rrrR) to that of frequent sequences (rrrr/rrri) to evaluate the global effect. Our preliminary analysis revealed local effects in both parietal and frontal electrodes. Event- related amplitude in the parietal electrodes was more negative from 200-400ms for sequences that presented an irregular sound. Also, these sequences presented larger positive amplitude in frontal electrodes from 600-800ms. For the global effect (frequent vs. infrequent sequences), we found a negative deflection over parietal electrodes ranging between 400-1000ms and a frontal effect around 600ms. Therefore, we replicated the MNN and frontal activity in deviant sounds (local effect) and also showed differences in global and more complex conditions. However, despite infants having the capacity to detect global and local irregularities. These results signal infant's capacity to unveil regularities on the surrounding world and react accordingly when those are broken, which is probably an early milestone of the emergence of flexible behavior.

Impact of Sleep Duration on Lexicalization: Paradoxical Effects on Implicit Memory

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Dual-process hypothesis suggests slow-wave sleep (SWS) aids declarative memory consolidation, while REM sleep supports non-declarative learning. Previous research shows sleep significantly affects word learning and consolidation, but results are inconsistent regarding its benefit for automatic and controlled access to newly acquired word forms. This study explores sleep duration's differential effects on both access types. A group of 66 university students performed a naming task in which to-be-learned novel (pseudowords) and familiar words were repeated through six blocks. Immediately after learning and 24h later they completed implicit (a lexical decision task with orthographic neighbors of the learned pseudowords and unrelated pseudowords) and explicit paradigms (recognition task) to measure novel word's access. Based on their reported sleep patterns for the previous night, participants were divided into two experimental groups: more sleep ($n = 40$; $M = 8:22$ hours; $SD = 37$ minutes) or less sleep ($n = 26$; $M = 6:44$ hours; $SD = 55$ minutes). Learning was evaluated by decrease in reaction times (RTs) through naming using an automated procedure validated on an external sample (absolute difference = 38.29 ms; $R^2 = 0.87$). We tested RTs differences by day and group, with participant intercepts as a random factor. In the naming task, RTs reduced between the first and second ($p < .0001$) and between the second and third blocks ($p < .0001$), indexing learning. No significant differences were found in naming or recognition (explicit) tasks between groups. In the lexical decision (implicit) task, an interference effect was revealed (greater RTs for neighbors than unrelated pseudowords), but only on the second day and in the less sleep group (interaction word type * group * day: $F = 5.3025$; $p = 0.0232$; post hoc neighbor (Day 2, less sleep, $M = 813$ ms, $SD = 193$ ms) vs. unrelated (Day 2, less sleep, $M = 789$ ms, $SD = 221$ ms): $p = 0.0304$). Hence shorter sleep duration, presumably reducing REM sleep, paradoxically showed enhanced interference for neighbor pseudowords, an index that trained pseudowords were lexicalized and inhibited their processing. These effects were absent in longer sleep periods, suggesting a memory trace-cleaning effect with longer REM periods. Given REM sleep's role in synaptic reorganization and that selective REM suppression has shown paradoxical learning improvements, further exploration of REM sleep's effects on implicit word learning is warranted.

An analysis of the unconscious processing of hierarchical patterns through Bayesian and General Recognition Theory models

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Research in consciousness has been determined by a lack of conceptual clarity and confusion between types of data and measures, which impacts the effects found making it not unusual to find contradictory effects for the same phenomenon. Therefore, it is essential to develop methodologies that address these problems, and experimental designs that allow to collect necessary data to apply them. Within this area, visual perception and, particularly, perceptual grouping, has been put in the spotlight, questioning whether local forms group into global forms in the absence of awareness, with diverse effects being found. To study these grouping effects in the absence of awareness, this study evaluates whether a masked stimulus is unconsciously processed, combining different designs of a masked priming paradigm and both objective and subjective measures of awareness collected in separate blocks (offline measures) or trial-by-trial (online measures). To examine whether primes are processed unconsciously or not, two novel methods are applied: a correction to Greenwald's regression using a Bayesian generative model, and Sensitivity versus Awareness curves, based on general recognition theory. Both methods avoid post-hoc selection of subjects and trials and account for various methodological problems like the regression to the mean which can lead to a misinterpretation of the results. Our results indicate a certain dependence between perceptual processing and awareness level. Interestingly, the use of different paradigms to assess unconscious processing and their consequent theoretical assumptions can lead to somewhat divergent results.

Exploring taboo words among young Spanish speakers

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Taboo words constitute a subgroup of words with a significant emotional component that activates brain regions such as the amygdala and the thalamocortical pathway. Traditionally, the emotional content of language has been explored through the valence-arousal dichotomy, but other variables like social context and individual differences, are also influential in their acquisition and use. Emotional word processing differs markedly from neutral or non-emotional words, a phenomenon that extends to taboo words. Research has predominantly focused on English-speaking populations, with databases available in Dutch and American English, leaving a notable gap in Spanish-language research. This study aimed to explore the perception of taboo words among young Spanish speakers in order to create a database. The research involved 183 young adults. We selected and categorized 235 words that are considered taboo, profane, or offensive into six distinct groups: sexual concepts, swear words, eschatological terms, insults, death and illness-related terms, and behaviors. Participants rated each word on a scale from 1 to 7 (1: Not at all taboo, 7: Extremely taboo). The study also collected extensive personal data on demographics, personality traits, education, and contextual usage of swear words. Analyses of participants' individual characteristics, linguistic variables, categorical word, and a cross-linguistic comparison with a Dutch population were conducted. No significant differences were found in individual characteristics. In the word analysis, only a correlation was observed between lexical frequency and taboo ratings, suggesting that higher frequency words were perceived as less taboo. In the categorical analysis, sexual content and insults emerged as the most taboo categories. The cross-linguistic comparison revealed a positive correlation in taboo ratings between Spanish and Dutch participants, with Dutch participants rating categories as more taboo than their Spanish counterparts.

This pioneering research in Spanish confirms the effects of word category and lexical frequency, supporting previous findings. This database provides a valuable tool for future research in this field and removes language barriers, enabling more Spanish-speaking researchers to access this information. The results highlight the influence of social context on the use and perception of taboo language, suggesting cultural similarities in the assessment of offensive language.

How do adults attribute responsibility in bullying situations?

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In this study, we evaluated how witnesses of school bullying situations attribute responsibility to the actors of an aggression, and whether Lagnado et al.'s (2013) model can explain it. The model suggests that responsibility attribution depends on two factors: a prospective factor called criticality and retrospective one termed pivotality. We asked adult participants read 12 childhood harassment stories involving two aggressors (character A and character B). They were asked to provide prospective and retrospective judgments of responsibility for each character on each story. In prospective judgments, they were required to estimate the relevance of each aggressor, considering whether they had the necessary means to carry out the aggression in the future (criticality factor). In retrospective judgments, participants were asked to estimate the degree of responsibility of each character (A and B) once the aggression had occurred, considering if they ultimately participated in the aggression or not (pivotality factor). Adults' responsibility judgments were influenced by the importance of an individual's contribution to the aggressive act and their actual participation in it. These results are consistent with the model. However, we found some discrepancies between the model and the data. We discuss these discrepancies in terms of their theoretical and practical implications.

An open-source approach for closed loop cognitive studies

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The study of cognition and perception involves establishing meaningful correlations and causal relationships with the environment; a black box approach entered by strictly controlled inputs that generate a measurable output. Here, we present MILPS (Multisensory Information Labeled Processing System): an open-source project that, on the one hand, enables performing perceptual experiments with an inexpensive setup; on the other hand, it will offer a novel Input Inference Label Approach that frees the experimenter from a traditional black box approach. Under the active inference framework, the dynamics of the Bayesian brain and the external world are understood as action perception loops that self-evidence by prediction error minimization. MILPS will offer an improvement to the classical approach to directly infer perception through the action that a subject is performing, adding less constraints to input control, in such a way that we can observe these adaptive systems, these action-perception loops, in the most ecological way tagging actions as events used by the subject to minimize prediction error. Finally, MILBPS offers an open-source repository for perceptual experiments that synchronize data acquisition and data analysis from eye tracking, Emotibit and EEG recordings. Further work will enable the addition of gesture-tracking data and other devices. We have already replicated studies to validate our set up and we will continue moving forward for further improvements.

Effects of a multi-modal auditory environment on language acquisition

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Past research shows novel word learning is facilitated when accompanied by elements which enrich their semantic representation (García-Gámez & Macizo, 2019; Kaplan-Rakowski & Loranc-Paszylk, 2019; Li & Deng, 2023). In particular, multi-modal contexts can be useful in creating a stronger memory trace during learning. We investigated whether informative environmental sounds (e.g., the sound of a door opening), though non-linguistic in nature, can facilitate learning of foreign language (FL) words that match the sound (e.g., door). N = 36 Spanish-speaking natives learned 42 Spanish-FL word pairs presented auditorily and sequentially. Each stimuli sequence was accompanied by one of three sound conditions: a congruent sound that matched the word pairs' denotation, a tone, or, silence. Participants were exposed to each item a total of 10 times and their learning progress was measured throughout by translation tasks at two different time points (after 5 exposures and after 10 exposures). After completing the learning, they were tested through a picture naming task (naming pictures in the FL) and a recognition task (discriminating a series of FL words as learned or new). Reaction times and accuracy measurements were considered for these tasks. Our hypothesis is that learning during the condition paired with a congruent sound would be more beneficial for learning as compared with the tone and the silent condition. As a secondary objective, we wished to know how the number of languages spoken by participants would affect their ability to learn vocabulary in a new FL. Data collection is underway although preliminary results show differences in the sound conditions on the learning process as revealed by the translation tasks. Results will be discussed in the context of language learning models.

Role of cerebellum in cognitive flexibility, inhibitory control and working memory: a transcranial direct current stimulation (tDCS) double-blinded and sham-controlled study

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Historically, the cerebellum has been primarily linked to motor functions, particularly in terms of coordinating, refining, and regulating movements, thereby enhancing the smoothness and efficiency of everyday motor activities. However, recent research has expanded our understanding of the cerebellum's role, highlighting its involvement in cognitive processes and complex human behaviors, including executive functions. Transcranial direct current stimulation (tDCS) is a non-invasive neuromodulation tool used to explore the functions of specific brain regions by either exciting or inhibiting them. Recent findings suggest that anodal tDCS applied to the right cerebellum can modulate executive functions. This study aimed to investigate the cerebellum's role in three core executive functions by applying anodal tDCS to the right cerebellum on 33 healthy participants. During the stimulation, participants performed the Go/No-go task, the Probabilistic Reversal Learning task, and the n-back task, to assess inhibitory control, cognitive flexibility, and working memory, respectively. The stimulation protocol was a 30-minute session at 1.5 mA using 5x5 electrodes. The study employed a within-subject, double-blind, sham-controlled design with each participant undergoing both active and sham tDCS sessions in a counterbalanced order.

The results revealed that active tDCS led to significant differences in executive function performance compared to sham stimulation. These findings are detailed and discussed in the current work. The outcomes support further investigation into the cerebellum's role in executive functions, particularly in larger and clinical populations, to deepen our understanding of this brain region's contribution to higher-order behaviors.

Designing a Task to Measure the Impact of Spatial Layouts on Categorization Learning

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Space plays a pivotal role in human cognitive processing, acting as a crucial dimension for organizing information. This also applies to perception and memory, affecting how information is processed and retained. Existing research has mainly described how spatial representations, such as the loci method, aid explicit memorization. However, a computational explanation of how space aligns information to scaffold cognitive processing remains missing. We present the initial design of an experimental task to measure the interrelation of space with memory and categorization learning. The experiment involves two sequential tasks, both employing object images with latent features from the NOUN database. In the first task, participants learn associations between objects and one of four spatial locations in a 2x2 grid (NW, NE, SW, SE). Participants use a computer mouse to drag and drop objects into their correct quadrants, receiving feedback to learn the associations. Following this, participants perform a binary classification of the same objects into two categories. Participants perform two repetitions of these tasks (order counterbalanced), differing in a key design manipulation. In the 1D condition, object categorization aligns with a single spatial dimension (left-right or up-down, counterbalanced across participants). In the 2D condition, categorization involves a two-dimensional spatial layout (diagonal arrangement, up-left and down-right or up-right and down-left). Each condition includes multiple blocks with rest screens to prevent fatigue. Feedback is provided after each trial and block, with performance measured through accuracy and response times. We anticipate significant differences in learning and performance between the 1D and 2D conditions. We predict that participants will find it easier to learn and recall paired associations in the 1D condition (congruent), showing higher accuracy and faster response times compared to the 2D condition (incongruent). To further investigate these predictions, we plan to develop computational models that simulate the learning processes observed in the experiment, including Convolutional Neural Networks, Recurrent Neural Networks, and Deep Q-Networks. These models will be adapted to help us understand the underlying brain mechanisms of spatial learning and categorization.

The Effects of Proactive Interference in Working Memory Over Time

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Proactive interference (PI) is the deleterious effect of information that was once relevant, but is no longer relevant, on current working memory (WM) processing. The ability to overcome PI has been previously found to partially predict WM capacity. The current study aimed to shed light on the ability to overcome PI in visual WM, and for how long the disruptive effects of item-specific PI last over time. To carry out these objectives, forty-five participants aged between 19 and 44 years completed a computerised, online version of the n-back task that consisted of images of faces with neutral expressions. The n-back task contained lure trials, which were designed to produce item-specific PI. These lure trials were either presented recently in time relative to the current trial (3- and 4-back; proximal lures) or further back in time (5- and 6- back; distal lures). The results showed that both types of lure trial produced PI in participants, as demonstrated by lower accuracy and longer reaction times (RT) for these trials compared to trials designed to not produce PI. Furthermore, analyses showed that although both types of lure produced similar costs in RTs, proximal lures caused greater disruption in terms of accuracy compared to distal lures. This suggests that although participants were more successful at inhibiting the PI caused by distal lures compared to proximal lures, as evidence by improvements in accuracy, the costs associated with overcoming PI caused by distal lures was still evident in RT to the same extent as with proximal lures. The results are discussed in light of their implications for theories regarding how we control the contents of visual WM.

Smart Starts: Cognitive Differences Predict Prior Knowledge Involvement in Language Learning

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Unlike children acquiring their first language (L1), L2/Ln learners can draw on existing grammatical knowledge to ease the task, at least for those properties where the grammars align. This means that, in addition to statistical learning, there might be a substantial role for individual differences in cognitive processes necessary to identify, recruit and deploy this prior knowledge—e.g., procedural memory, working memory (WM), inhibitory control. In this study, we measured these individual differences through an SRT task, a digit-span, and a Stroop task, at the onset of a longitudinal artificial language (AL) learning paradigm. Grammatical and lexical similarity between the ALs and previous languages (Norwegian-English or Spanish-English) were systematically manipulated. Behavioral measures of sensitivity to grammatical violations in the AL were collected after each training session (3 total). Results suggest that the ability to capitalize on prior knowledge is significantly modulated by individual differences in procedural memory, WM and inhibitory control.

Influence of Emotional States and Cognitive Flexibility on Inhibitory Control Performance

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This study explores the influence of positive and negative emotions on performance in a cognitive task designed to assess inhibitory control, as well as the potential moderating role of cognitive flexibility. A total of 81 university students, aged 18 to 30 years (54 women), participated in the study and performed an antisaccade task. The task involved detecting a target (either Q or O) that could appear in the attended visual field, as indicated by a peripheral cue appeared (prosaccade block), or in the visual field opposite to that indicated by the peripheral cue (antisaccade block). Consequently, in some trials, the subjects were required to inhibit the automatic response of attending to the cue's location. The main novelty of this study was the addition of images with different emotional valences (positive, negative, neutral) presented before each block of trials. This was done in order to induce an emotional state in participants and examine its effect on task performance. Additionally, the Changes test was used to assess cognitive flexibility (high, low).

The results showed that both positive and negative emotional conditions improved performance in the antisaccade task relative to the neutral condition. The positive condition led to faster reaction times.

Furthermore, individuals with high cognitive flexibility demonstrated more accurate and quicker latency. The men showed a higher percentage of correct responses and were faster than women in the attentional task.

This study provides evidence on the importance of emotions and cognitive flexibility in tasks requiring inhibitory control. It highlights that positive emotions can facilitate better performance in contexts demanding high levels of attention and rapid response. The enhanced accuracy and velocity observed in individuals with high cognitive flexibility indicate that this capacity is a pivotal factor in the execution of intricate cognitive operations.

How Children with Reading Problems Represent Temporal Information. A pilot study

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This study investigates whether children with reading difficulties ($N = 9$; \bar{X} age = 9.6) access and use a mental timeline to represent images denoting specific chronological times (e.g., a picture of an old car), compared to children without such difficulties ($N = 10$; \bar{X} age = 9.9). Previous research with children has shown that the left-past and right-future response pattern (commonly observed in some Western cultures) typically emerges around the age of 14. Given that children with reading problems often have spatial orientation difficulties, the aim of this study is to determine if these challenges influence their performance on tasks involving a mental timeline. In accordance with previous studies and observations in healthy adults, it is expected that children without reading difficulties will exhibit a more typical performance pattern, responding faster to the left-past and right-future scheme than to the left-future and right-past scheme, even when they are not aware of the temporal stimuli. However, it is anticipated that different results will be observed in children reading difficulties. Due to their spatial orientation difficulties, it is possible that they may not show a clear response pattern favouring either temporal scheme. The absence of a discernible response pattern in this latter group would suggest a potential difficulty in the spatial representation of temporal information. Preliminary results from this study indicate an inversion of the expected pattern, with both groups, with and without reading difficulties, responding faster to the old with their right hand and to the new with their left hand. This hypothesis remains open to further investigation, as multiple factors could influence the results. The study highlights the need for additional research to better understand the spatial-temporal processing challenges faced by children with reading problem, such as dyslexia.

Subcortical contributions to the origin of individual differences in learning the specific sounds of a second language

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People differ in their ability to master second language (L2) specific sounds. Previous research has shown that such individual differences appear even when people have the same linguistic background and are driven by speech-specific mechanisms in both early (Díaz et al., 2008) and late (Díaz et al., 2012; 2016) bilinguals. Studies systematically reported smaller mismatch negativity (MMN) responses for speech sounds in L2 poor perceivers. However, the role of subcortical brain structures in such individual variability has not yet been investigated. The aim of this study is to determine to what extent perceptual differences are already present at lower levels of the auditory pathway than those cortical processes captured by the MMN. We assessed the MMN and the frequency-following response (FFR) in two groups of participants that differed in their ability to discriminate the German speech contrast /u:/-/y:/ (unknown to all of them). The MMN is a brain potential primarily originating from cortical areas, whereas the FFR is a brain response reflecting mostly neural activity in the subcortical auditory pathway. Thus, these two brain responses allow us to assess cortical and subcortical contributions to individual differences in L2 phoneme learning. For the MMN, participants were tested on both native phonemes and non-linguistic auditory stimuli matched in complexity to the native phonemes. For the FFR, they were presented with the native /da/ and the non-native /oa/ syllables. Preliminary analysis revealed that the two groups of participants differed in their MMN and FFR responses to speech sounds. Good perceivers of the unknown German speech contrast showed larger MMN and FFR responses than poor perceivers, meaning that, besides differences in discriminating the novel German contrast, they also differently perceived native phonemes, for which it is commonly assumed we are all excellent at. Our preliminary results indicate that individual variability in perceiving speech sounds may be influenced not only by experience-based brain plasticity, but also by an intrinsic individual component related to how subcortical brain structures automatically process sound.

Context-dependent allocation of attentional control in anxiety and uncontrollability: The role of flexible learning

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Volatile and unpredictable environments often evoke experiences of anxiety and uncontrollability. Previous research showed that both, high anxiety trait and perceived lack of control, can have a negative impact on the efficiency of attentional control. In this research we examined a novel hypothesis, that anxiety and uncontrollability can affect implicit learning processes related to the allocation of attentional control. We assumed that people who experience anxiety or uncontrollability will show lower levels of attentional control because the implicit learning process from contextual cues is altered. In Experiment 1 we examined how dispositional differences in anxiety are related to implicit learning from the task context indexed by the context specific congruency effect (CSPC). Participants high (vs low) in anxiety trait did not show differences in the CSPC effect in the learning phase. However, once an association was acquired, anxious participants showed difficulties to modify it based on contextual information in the re-learning phase. In Study 2 we examined the effect of uncontrollability on subsequent implicit learning from contextual cues. We observed a lack of CSPC effect for the participants previously exposed to uncontrollability in the learning and the re-learning phase. We discuss the implications of these findings for theorizing about the effects of anxiety and lack of control on flexible learning about how to allocate (more or less) attentional control according to implicit learning from contextual cues.

Unravelling the syntactic processing of missing objects in Spanish-Catalan bilinguals

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This study investigates whether bilingual speakers of Spanish and Catalan process the missing object abstractly in the syntax with both grammatical and ungrammatical constructions. Previous research with monolinguals has evidenced a syntactic-represented account (Cai et al., 2015) suggesting that speakers construct a syntactic representation even when the object is not phonologically expressed. Nevertheless, little is known with respect to bilingual speakers. Spanish-Catalan bilinguals were considered a good fit to explore this phenomenon, due to the differential linguistic constructions of the two languages when it comes to the indefinite object-drop. Specifically, whereas Spanish allows for omissions when the object can be retrieved by the context, Catalan employs the partitive clitic “en” whenever the object is not overtly expressed and, thus, does not permit such syntactic constructions (Campos, 1986; Clements, 2006). This study aims to test Spanish-Catalan bilinguals to answer the following research questions: (i) Do Spanish-Catalan bilingual speakers process the missing object syntactically? (ii) If so, are missing objects processed in both syntactic systems of the bilingual regardless of the linguistic allowance of the non-object-drop language (Catalan)? (iii) Is the priming effect modulated by the linguistic dominance of the bilingual speakers? One-hundred Spanish-Catalan bilingual speakers with different Ages of Onset of Acquisition (AoA) and different language dominance profiles will be recruited for the study. A structural priming task was designed both in Spanish and Catalan to test whether the syntactic structure of a sentence can prime the structure of a subsequent sentence in missing-argument vs. full-form clitic constructions. Additionally, in the Spanish version of the task, an ungrammatical syntactic condition with the “en” partitive has been included, whereas in the Catalan version an ungrammatical condition with the Spanish mirror situation was included: the omission of the clitic “en”. Spanish-Catalan bilinguals will perform the task in both languages. We predict that depending on the linguistic dominance participants would be subjected to differential priming effects. Specifically, we propose that Catalan dominants would experience a higher priming effect for the ungrammatical condition in the Spanish task, whereas they would experience a lower effect for the ungrammatical condition in the Catalan task. Catalan dominant speakers would also show a lower priming effect for object-dropped grammatical conditions in the Spanish task. A mirror-like situation is expected for Spanish dominants. This study is particularly relevant as it specifically targets the cross-linguistic transfer in the syntax of bilingual speakers with both grammatical and ungrammatical constructions, representing a novel approach to the current psycholinguistics scenario.

Effect of bilingualism experience on attentional spatial orienting skills in beginner readers

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It has been proposed that being consistently exposed to complex bilingual environments reduces the specialisation of structural brain organisation for language, through higher interhemispheric cooperation. Accordingly, Lallier et al. (2024) showed that exposure to bilingual contexts in childhood modifies the spatial attentional allocation to speech, towards a balanced and more efficient orientation across ears. The present research addresses the question as to whether such effect of bilingual exposure on attentional spatial orientation could be found for nonverbal tasks. For that purpose, we tested forty 6-year-old Spanish-Basque bilingual children varying in their early dual-language (or bilingual) contexts exposure over the previous two years, quantified through self-reported measures (range: 0-100%). In one visual and one auditory attentional Posner tasks (Posner, 1980), participants had to localise as quickly as possible a target preceded by a spatially congruent or incongruent cue. We expected children with more dual-language exposure to show signs of more balanced spatial attentional orienting skills across modalities. Localisation time and accuracy were analysed as a function of target side and congruency controlling for non-verbal IQ and Spanish proficiency, and bilingual exposure was entered as a continuous covariate of interest in the models. In the auditory modality, bilingual exposure was found to influence spatial attentional orienting, with higher levels of dual-language exposure relating to stronger detrimental effects of incongruent cues on localisation time of targets presented in the right ear compared to the left ear. On the opposite, higher levels of single-language contexts exposure were associated with greater negative incongruency effects for targets presented in the left compared to the right ear. In the visual modality, bilingual exposure influenced target detection accuracy as a function of target side, reflecting that children more exposed to single-language contexts localised the target overall better when presented in the right side whereas children more exposed to dual-language contexts showed this benefit for left side targets. We interpret these results in line with the presence of modulations of the reliance on motor and attentional biases for target spatial localisation by the long-term exposure to complex dual-language contexts. We propose that such exposure might reduce the dominant hand motor biases to benefit processing in the left hemispace, reflecting a stronger and more efficient reliance on the dominant right hemisphere in attentional tasks. Therefore, 6-7 y.o. bilingual children exposed predominantly to dual-language contexts might already use “adult-like” spatial attentional orienting strategies (Marzecová et al., 2013) indicating a more mature attentional system less vulnerable to noise (e.g. motor biases).

Semantic and arithmetic additions: a study of cross-domain cognitive processing

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Starting from the idea that the meaning of words could derive from the joint activation of semantic features (McRae & Jones, 2013), this study aimed to investigate the possible existence of common semantic processing when people process linguistic (e.g., read sentences) and numerical information (e.g., solve additions). Specifically, we evaluated whether this joint activation could be understood as a semantic addition, similar to the addition problems (addition of symbolic elements such as the numbers that constitute the operands of the arithmetic addition). For this purpose, we considered phrases denoting the composition (or not) of an element as a result of two constituent elements (linguistic information) and addition operations (numerical information). A paradigm composed of blocks of two stages was designed. In the first stage, we used true (e.g., with flour and water is made bread), or false sentences (e.g., with flour and sponge is made bread) containing the idea of elements composition. Participants decided whether a sentence was or not correct. In the second stage, an addition appeared with a possible result (e.g., $5 + 4 = 7$), and participants indicated whether the proposed result was or not correct. We expected to find facilitation effects from linguistic to numerical information (when participants performed correct additions preceded by true sentences compared to false sentences). Furthermore, we expected to observe this effect inversely, that is, the effectiveness of the linguistic task determined by the correct compared to the incorrect addition. Results showed facilitation from sentences to additions (correct additions were solved faster when preceded by true vs. false sentences) but not from additions to sentences, suggesting that the interpretation of an element in a sentence as a semantic addition of its constituent elements is not confirmed at all.

Testing the causal role of the motor system in language comprehension: A preregistered, multilab, TMS study

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A central claim of the embodied cognition framework is that motor brain areas play a causal role in language comprehension. Yet, available evidence is inconclusive. We will test this idea in a large-scale registered report involving multiple laboratories, which will secure high power to detect an effect.

Participants will complete a concreteness judgment task involving hand-action verbs (e.g., “to grab”), verbs related to bodily effectors other than the hands (e.g., “to kick”), and non-action abstract verbs (e.g., “to dream”). Before the task, we will apply inhibitory transcranial magnetic stimulation (TMS) to the hand primary motor cortex (M1) or the vertex (as a control region). According to embodiment predictions, we should observe slower reaction times for hand verbs (compared to the other categories of verbs) after the stimulation of the hand M1 (but not in the vertex condition). We will also record pre-post TMS motor- evoked potentials (MEPs) as a manipulation check for correct M1 inhibition. Given that registered reports need to be peer-reviewed before collecting and analyzing the data, the talk will focus on presenting the overall design of the study, pilot studies, and simulation-based power analyses to estimate the required sample size.

Is there value in value-driven distraction? A meta-analysis of studies on individual differences

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Neutral salient stimuli capture attention. Moreover, when they are associated with the prospect of reward, they lead to greater attentional capture, regardless of task goals or the intrinsic properties of the stimuli. Value-driven distraction has been viewed as a form of "human attentional sign-tracking," the tendency to direct responses to a stimulus that has acquired motivational properties through Pavlovian learning. Although value-driven distraction shares characteristics with automatic processes, its conceptualization as a form of attentional sign-tracking relies heavily on studies of individual differences. Indeed, many studies have found value-driven distraction to be related to psychopathological conditions, impulsivity, or even real-life outcomes. Although such findings support the construct validity of value-driven distraction, individual differences research in experimental psychology is facing a major crisis. Experimental tasks well suited for capturing group-level effects may lack the psychometric properties desirable for correlational research. In the present paper, we test the robustness of results from correlational studies measuring value-driven distraction using z-curve meta-analysis. This technique allows us to test for the presence and severity of publication bias in the literature using the observed distribution of p-values. We found strong evidence of publication bias and low power in the literature. Although this finding is not conclusive against the absence of real effects, it casts doubt on the overall robustness of the literature. We recommend that researchers investigating individual differences in reward-driven distraction follow good research practices, such as pre-registering hypotheses and statistical tests prior to data collection, and always perform a power analysis that takes into account possible statistical artifacts, such as low reliability or range restriction.

Keywords: attention, learning, value, individual differences, reliability, z-curve analysis.

The Vienna Art Interest and Art Knowledge Questionnaire and the Aesthetic Fluency Scale translated into Spanish: an analysis of their factor solution and psychometric properties

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Since the 19th-century philosopher and physicist Gustav Fechner introduced empirical methods to study aesthetic appreciation, the understanding of what drives a satisfactory aesthetic experience has significantly evolved. Initially, research focused on how formal features influenced preferences (Nadal & Vartanian, 2019). However, both behavioural and neuroscientific studies have unveiled that aesthetic experiences are not solely determined by the properties of the object being evaluated. Instead, they result from the interplay of bottom-up and top-down cognitive processes involving sensory-motor, emotion-valuation and knowledge-meaning neural systems (Vartanian & Chatterjee, 2022). For instance, when admiring an artwork not only do its colours or composition contribute to our response, but also our knowledge and interest in the visual arts, as the most relevant theories in this field acknowledge (Vartanian & Chatterjee, 2022). Studies with English and German-speaking populations usually include questionnaires with robust psychometric properties to control for these variables. In recent years, the Vienna Art Interest and Art Knowledge Questionnaire (VAIAK; Specker et al., 2018), comprising both a subjective appraisal of art interest and an objective assessment of art knowledge, has gained prominence in such studies. Despite measuring art knowledge subjectively, the Aesthetic Fluency Scale (AFS; Smith & Smith, 2006) has also been widely used due to its brevity, ease of administration and accessibility for blind and partially sighted participants. Recently, it has been updated to an equally short but more robust version (Cotter et al., 2023). Here, we will present the psychometric properties of the three questionnaires (the VAIAK and both the original and the updated versions of the AFS) and their factor solution in a sample of over 370 laypeople and art experts. In addition, we will discuss whether more validation efforts are needed to ensure that these questionnaires are suitable for use in aesthetic experience studies with Spanish participants.

Eye-tracking during reading at high and low sampling rates

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Eye-movement research has revolutionized our understanding of reading, but the use of eye-tracking techniques is still limited to only a few countries in the world. Publication statistics from the last 25 years show that most publications on eye-movements during reading have authors based in Western countries. We argue that eye-tracking is the ideal technique for reading and language research in countries with limited resources, and that it is crucially important to not just study a small subset of languages, but that more needs to be done to make eye-tracking technology accessible for researchers in those countries. This includes evaluating to what extent cognitive processes during reading can be measured with less expensive eye-tracking devices. One such way may be to use devices with a lower sampling rate, which may be much less expensive than high-sampling rate eye-trackers. We present findings from a study with 32 participants (university students, mean age 22.3) that recorded readers' eye movements during reading at different sampling rates (250 Hz, 500 Hz, 1000 Hz, and 2000 Hz as well as simulated sampling rates of 125 Hz, 50 Hz, and 31.25 Hz). Our results show that it is possible to measure the classic effect of a target word frequency manipulation on fixation time measures such as first fixation duration, gaze duration, and total viewing time, reflecting ongoing processing during reading, even at sampling rates of 250 Hz and less. In particular, the effect of frequency on gaze duration and total viewing time was clearly evident even at 31.25 Hz, suggesting that, in principle, even devices with very low sampling rates can be used to study reading.

Handwriting vs. Keyboarding: Performance Disparities in Spanish Adults with Dyslexia

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Developmental dyslexia, a specific learning difficulty, is characterized by pronounced difficulties in reading and writing. Regarding writing, individuals with dyslexia often struggle with spelling retrieval, especially when faced with inconsistent or lengthy stimuli. These difficulties can affect motor execution in handwriting and reducing text productivity and quality due to high cognitive demands. Digital tools are now commonplace, and it is crucial to evaluate their advantages over traditional writing, especially for people with dyslexia. These tools offer benefits such as spell checking or text prediction, which can reduce cognitive load. However, unfamiliarity with digital tools may pose challenges, and it remains unclear if they benefit everyone equally or if specific writing difficulties affect their effectiveness.

Our study evaluates whether keyboarding offers advantages over traditional handwriting for Spanish adults with dyslexia. We hypothesize that control individuals will perform better in keyboarding tasks, showing increased writing speed, fewer errors, and reduced need for corrections, all supported by digital tools. Conversely, we hypothesize that individuals with dyslexia will not demonstrate significant differences in performance between handwriting and keyboarding. We posit that due to the insufficient integration of digital tools into daily instruction for individuals with dyslexia, these tools will not provide a substantial benefit, making handwriting a more accessible option than keyboarding.

The research involved 40 young adults, half of whom had dyslexia, performing two writing tasks -sentence dictation and written composition on a given topic- in both handwriting and keyboarding modalities. Spelling errors, total word count, writing speed, text quality, among others measures, were collected to assess the impact of spelling difficulties in both writing modes. Performance metrics were captured using smartpens for handwriting and Inputlog software for keyboarding. At present, final results are pending as data analysis is ongoing. Preliminary findings, however, seem to support our proposed hypotheses. We anticipate that the results will offer valuable insights into the distinct challenges and advantages of both handwriting and keyboarding for individuals with dyslexia. This knowledge could inform the development of customized educational strategies and the integration of digital tools to accommodate diverse writing needs. Further research is warranted to explore the specific demands of handwriting and typing for individuals with dyslexia across different age groups, including children, adolescents, and adults.

Eyes on the road: applying human visual patterns to autonomous vehicle technology

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Autonomous driving aims to revolutionize the way we conceptualize transportation; however, the implementation of sensor technologies has not yet fully replicated the complexity of human perception. This study addresses this gap by directly comparing human eye movement patterns with the telemetry of autonomous vehicles, aiming to integrate human perceptual efficiency into autonomous systems to optimize their functionality and safety. Starting from a theoretical framework suggesting that human perception and attention are highly adaptive and contextually relevant, our research proposes an approach that could reduce data redundancy in autonomous vehicles by focusing on critical information similar to how a human driver would. In an effort to capture the essence of human driving and its applicability to autonomous vehicle technology, participants from diverse demographics were recruited for a real-world driving experiment in an urban area. Each participant drove an electric vehicle over a 5 km route, during which telemetry data such as steering wheel and pedal positions were collected. Simultaneously, subjects wore eye-tracking glasses that recorded both their ocular movements and the images of the external environment. Additionally, an activity tracker was used to monitor heart rate, aiming to determine the influence of emotional and physical states on attentional patterns. The data collected enabled a detailed analysis of drivers' visual fixation points and attentional patterns, which were correlated with the vehicle telemetry to identify specific behaviors in various driving contexts, including stimulus visualization, processing time before decision-making, and the speed of executing actions such as accelerating or braking. This interdisciplinary approach, which merged cognitive psychology with automotive engineering, not only sees to establish behavioral patterns that can be emulated by autonomous systems to optimize decision-making and vehicular efficiency but also proposes a new way to understand and enhance autonomous driving technology. By integrating models of human attention and perception into the design of autonomous systems, the study suggests a pathway to develop vehicles that process data efficiently and interact with their environment in a more intuitive and adaptive manner, closely aligning with human cognitive capabilities.

Collaborators



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