Book of Abstracts

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VICE LAB

Pécsi Tudományegyetem
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EXP2026

Exploring Trends in Cognitive Science

PROGRAM AND ABSTRACTS

Organized by
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and the ViCE Lab
University of Pécs, Faculty of Humanities
and Social Sciences
Institute of Psychology

CONFERENCE PROGRAM

Day 0. - February 4.

17:00-19:30 Online preconference workshop
Bence Pálfi (Goldsmiths, University of London): The Bayes factor: An intuitive tool for hypothesis testing that increases the credibility of research

Day 1. - February 5.

10:30-11:00 Arrival and registration

11:00-12:15 Opening and Keynote talk
Eva Landová (Charles University): Evaluation of the emotions evoked by ancestral and modern threats: Are the fears of snakes and spiders influenced in the same way by our evolutionary past?

12:15-13:15 Lunch break

13:15-14:45 Talk session I. – Applied cognitive sciences
András Matuz (University of Pécs): The effects of spaceflight on motor cognition and psychophysiological responses
Zsolt Palatinus (University of Szeged): The perception of carrying and caring in the context of self-driving technologies
Tamás Ruppert (University of Pannonia): Cognitive science in system engineering: the human-centric manufacturing approach

15:00-17:15 Poster presentations and Research group introduction (*Coffee and snacks*)

Day 2. - February 6.

9:00-9:30 Arrival and coffee

9:30-11:30 Talk session II. Affective science
Anita Deák (University of Pécs): Wired to Laugh: Neural mechanisms of humor as an emotion regulation strategy
Gyöngyi Kökönyei (Eötvös Loránd University): Processing emotional stimuli in context: fMRI evidence from the emotional shifting task
Natália Kocsel (Eötvös Loránd University): Beyond trait emotion regulation: a state-level examination of self-critical rumination and daily affect
Iveta Stolhoferová (Charles University): Did you notice the snake or the spider? Distraction effects of two of the most frightening animals

11:30-12:30 Lunch break
12:30-14:00 Talk session III. Developmental cognitive psychology
Vera Varga (University of Pannonia): The role of phonology in the development of print tuning in typical and atypical readers
Brigitta Tóth (HUN-REN): From birth to lifespan: early brain function as a window into development and intervention
Ágnes Lukács (Budapest University of Technology and Economics): Language and cognitive changes across lifespan

14:15-15:30 Keynote talk II. and conference closing
Eszter Somogyi (University of Portsmouth): The development of body know how and the role of early sensorimotor experience

Keynote Talk 1
Thursday, 5 February 2026, Room: B402

Evaluation of the emotions evoked by ancestral and modern threats: Are the fears of snakes and spiders influenced in the same way by our evolutionary past?

Eva Landová [1], Markéta Janovcová[1], Iveta Štolhoferová [1], Aleksandra Chomik [1] Jakub Polák [1], Silvie Rádlová[2], Daniel Frynta [1]

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Humans have evolved rapid emotional and physiological reactions to ancestral, life-threatening stimuli, such as snakes, heights, or spoiled food. These threats can evoke fear or disgust and are common triggers of specific phobias. However, humans also encounter modern threats—such as car accidents or airborne toxins—and it remains unclear whether these elicit comparable responses or rely on similar underlying mechanisms.

Our research investigates evolutionary influences on fear and disgust responses, focusing primarily on phobias of snakes and spiders. Using psychometric assessments, subjective ratings of visual and live stimuli, psychophysiological and behavioural measures, and fMRI, we examine how ancestral threats shape emotional processing and how these responses differ across individuals, including those with specific phobias. We also relate self-report data to objective measures of defensive responses.

A growing area of interest concerns airborne diseases, which constitute an evolutionarily novel threat of increasing global relevance. We explore whether humans respond adequately to cues of airborne pathogens, or whether limited evolutionary experience leads to weaker emotional or behavioural reactions.

Across methodologies and respondent groups, our findings suggest that ancestral threats elicit stronger disgust responses, whereas certain modern threats provoke more intense fear, potentially via differing neural pathways. Preliminary data indicate that changes in fear of snakes and spiders may depend on baseline fear levels. Together, these results highlight both the evolutionary shaping and the flexibility of the human defensive response system (GAČR 25-16279S).

Keywords: arachnophobia, ophidiophobia, evolution, fear and disgust, survival circuit, behavioural immune system

Keynote Talk 2
Friday, 6 February 2026, Room: B407

The development of body know how and the role of early sensorimotor experience.

Eszter Somogyi

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This talk explores the development of body knowledge in infants, with a focus on self-touch, tactile stimulation, and body schema in body mapping. Reaching to the body is an early form of embodied self-knowledge, requiring the integration of body-centred spatial coding and perceptuomotor processes. This skill is vital for adaptive behaviours, such as signalling pain or removing foreign stimuli. We examine how infants use self-touch to map their body layout and how tactile experiences prepare them for complex motor behaviours like reaching. The presentation also reviews current understanding of body schema development, including insights from brain imaging studies. Finally, we highlight how early experiences allow infants to interact with their bodies and environment in more sophisticated ways, contributing to broader theories of sensorimotor development and the role of tactile experiences in early cognitive growth.

Keywords: Body know-how, Body mapping, Embodied self-knowledge, Sensorimotor development

Pre-conference Workshop
Wednesday, 4 February 2026, MS Teams, online

The Bayes factor: An intuitive tool for hypothesis testing that increases the credibility of research

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The Bayes factor has been a key tool for hypothesis testing in psychological science for over 15 years, offering a more intuitive alternative to frequentist methods and addressing some of their limitations that have contributed to the credibility crisis in psychology. It allows researchers to quantify evidence for both the alternative and null hypotheses while remaining unaffected by stopping rules. In this workshop, we will discuss the theoretical and practical foundations of the Bayes factor, explore its advantages over frequentist approaches, and practice calculating it using real data and a simple online calculator.

Keywords: Bayes factor, workshop, hypothesis testing

Invited talk session 1. Applied Cognitive Sciences
Thursday, 5 February 2026, Room: B402

The effects of spaceflight on motor cognition and psychophysiological responses

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During spaceflight, multiple factors - including microgravity, cosmic radiation, and psychological stressors - affect human physiology and behaviour. Previous research has demonstrated substantial physiological changes such as fluid redistribution, muscle atrophy, bone loss, and structural brain alterations. However, findings regarding spaceflight-induced cognitive changes remain inconsistent. The aim of our study was to investigate the effects of spaceflight on attentional and motor functions and to examine associated neural mechanisms. One astronaut was assessed multiple times pre-flight, in-flight, and post-flight, while a back-up crew member was tested in parallel on Earth as a ground-based control. Cognitive and motor performance were evaluated using a Flanker task implemented in virtual reality that required visually guided movements. During task performance, eye-movements were recorded, and brain oxygenation was measured using functional near-infrared spectroscopy. Perceived workload, sleep and mood were also assessed. In addition, saliva and tear samples were collected to analyze immune responses and stress-related biomarkers. Results showed altered movement initiation and execution during spaceflight. Movement initiation was faster early in the mission but declined with prolonged time in microgravity. Movement execution became faster but less accurate, particularly during trials involving response conflict (i.e. incongruent trials). Eye-tracking revealed increased fixation instability. These findings suggest differential effects on movement planning and execution, likely driven by sensorimotor adaptation to microgravity. In addition, selective attention might also be impaired in space. Finally, the analysis of eye-tracking suggests a greater role of perceptual and visuomotor processing in space-induced changes in cognition.

Keywords: Spaceflight, microgravity, virtual reality, fNIRS, motor cognition

The perception of carrying and caring in the context of self-driving technologies

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In this presentation we summarize five years of research conducted by the Autonomous Vehicle Readiness Research Group at the University of Szeged on passenger experiences and perceived safety.

In this ongoing investigation we routinely compare self-reports with physiological and psychological data from passengers in both human-driven and autonomous vehicles in real-life scenarios. In addition to questionnaires, methods like portable EEG and eye/head tracking were used to assess passenger responses. During this time-span we collected data on more than 160 individuals using a range of self-driving technologies and experimental settings. In general, passengers reported more negative emotions and higher anxiety levels in self-driving mode. Eye and head tracking revealed an increase in visual scanning and reduced blinking in autonomous mode—signs of higher cognitive load and alertness.

While self-reports showed some functional acceptance of autonomous driving, physiological data pointed to a clear emotional preference for human drivers. The sense of safety depends not just on vehicle function but also on perceived carefulness of navigation. Considering these psychological factors is crucial for the broader acceptance of autonomous technologies.

Keywords: Self driving, transportation psychology, field of safe travel, eye tracking, EEG

Cognitive Science in System Engineering: The Human-Centric Manufacturing Approach

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The rapid transformation of manufacturing toward cyber-physical and AI-driven systems presents a fundamental challenge: integrating human cognition and system intelligence into a coherent, cooperative framework. This presentation explores the application of cognitive science principles within system engineering to advance human-centric manufacturing. Our approach situates the human not as a peripheral operator but as a dynamic cognitive agent whose perception, decision-making, and adaptability are integral to system performance.

Drawing on cognitive ergonomics, behavioral modeling, and data-driven workflow analysis, we propose an integrative framework for modeling and optimizing human–system collaboration. The framework combines digital twin technologies with cognitive models to simulate and predict human performance under varying task demands. Data from ergonomic sensors and manufacturing process analytics inform AI/ML models that capture human workload, situational awareness, and decision efficiency in real-time. These insights support

adaptive system design—allowing manufacturing systems to adjust to human states, rather than requiring humans to adapt to rigid automation.

Preliminary validation experiments demonstrate that cognitive modeling can identify bottlenecks in human performance, reduce task complexity, and enhance operator engagement and safety. By embedding cognitive science within system engineering, we argue for a paradigm shift toward "cognitive manufacturing systems"—ecosystems that learn from and with humans.

Invited talk session 2. Affective Science
Friday, 6 February 2026, Room: B407

Wired to Laugh: Neural mechanisms of humor as an emotion regulation strategy

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Humor seems to be an optimal strategy to cope with negative situations when confronted with negative stimuli. Experimental research confirmed that humorous reappraisal, that is viewing negative stimuli in a humorous way, can reduce negative emotions. The main objective of our study is to investigate the neural mechanisms of humorous reappraisal with functional magnetic resonance imaging (fMRI) technique. 63 young, healthy adults (30 men, 33 women) saw negative and neutral pictures with either humorous or neutral captions, and gave ratings on two affective dimensions, valence and arousal. The results show that negative pictures with humorous captions were rated more positive than negative pictures with neutral captions. We also found elevated brain activation in the inferior frontal gyrus (IFG), in the temporo-parietal junction (TPJ), and in the insula in response to negative pictures with humorous captions. These brain regions are responsible for humor understanding and emotion regulation. While neutral pictures with humorous captions induced higher activation in brain regions responsible for visual and semantic information processing (e.g. occipital gyrus, temporal cortex) compared to neutral pictures with neutral captions. These results indicate that humor can down-regulate the negative emotions but does not necessarily change the intensity of the emotional experience. The attempt to reappraise a stimulus in a humorous way requires focusing on the to-be-reappraised stimulus, and the interconnectivity among brain regions integrates the cognitive and affective components of humor to elicit positive emotional responses.

Keywords: humorous reappraisal, cognitive emotion regulation, inferior frontal gyrus, temporo-parietal junction, emotion regulation network

Processing Emotional Stimuli in Context: fMRI Evidence from the Emotional Shifting Task

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Background: Processing of emotional stimuli is highly dependent on contextual information. According to the reasoning model, emotions are not directly discernible but are inferred through identifying the causal explanations that best account for the co-occurrence of events, emotional experiences, and expressions. Consequently, embedding emotional stimuli in context may alter both emotional and neural response, providing an opportunity to investigate implicit reappraisal processes and, more broadly, emotional flexibility.

Method: Functional MRI data were analyzed from 53 healthy participants (31 females; mean age = 25.23 ± 5.09 years). Participants completed the newly developed Emotional Shifting Task, which consists of picture pairs. In each pair, the first one is a decontextualized image depicting emotions using primarily facial and postural expressions from the second contextualized image. This design enables multiple contrasts: (1) context versus no-context, (2) automatic shifts from positive to negative valence or vice versa, (3) congruent versus incongruent images. Additionally, as individuals differ in both subjective and biological responses to emotional stimuli, the association between the neural responses with trait or state individual differences can be examined.

Results: Results indicated that contextualized images engaged several brain regions associated with the perception, attention, and processing of emotional stimuli. After excluding the general effect of context using an exclusive mask for the context versus no-context mask, automatic shifts from positive to negative valence elicited increased activation in the thalamus, caudate, medial frontal gyrus and lateral orbitofrontal cortex. Incongruent images, relative to congruent ones, recruited the Theory of Mind System to a greater extent. Furthermore, pre-scan cortisol levels and trait rumination were related to the neural processing of these complex emotional stimuli.

Conclusions: Our results demonstrate that contextual information, acting as an anticipatory pre-stimulus factor, can automatically modulate subjective experience and biological responses to emotional stimuli.

Keywords: Context; Emotional processing; Shifting; Implicit reappraisal; Emotional flexibility.

Beyond trait emotion regulation: a state-level examination of self-critical rumination and daily affect

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Background: Emotion regulation (ER) is a dynamic and context-dependent process, yet much of the literature rely on trait-level questionnaires that overlook the moment-to-moment mechanisms through which emotions unfold in daily life. One factor proposed to constrain ER flexibility is rumination—particularly self-critical thought patterns—which may impede the ability to adapt emotional responses to situational demands. However, little is known about whether the *content* of self-critical thinking or the *process* of ruminating is more proximally linked to momentary affective experiences. Furthermore, it remains unclear whether resting heart rate variability (HRV) shapes these state-level associations.

Method: Sixty-four young adults (12 men; *M*age = 21.17, *SD* = 1.65) completed a laboratory session assessing resting HRV (RMSSD) and trait self-critical rumination, followed by a nine-day experience sampling protocol (6 prompts/day) capturing momentary affect and self-critical/ruminative thoughts.

Results: Multilevel analyses showed that both momentary self-critical thoughts and momentary rumination predicted higher NA and lower PA at the within-person level, whereas trait tendencies lost significance when state predictors were included. Resting HRV moderated only the association between self-critical thoughts and affect: higher HRV attenuated increases in NA and decreases in PA during episodes of heightened self-critical thinking. In contrast, HRV did not moderate the effects of momentary rumination, and no significant three-way interactions emerged.

Conclusions: Our results suggest that although both self-critical thinking and ruminative processing undermine momentary affective well-being, they do so through partly distinct mechanisms. Self-critical thought content, rather than the ruminative process itself, appears more susceptible to physiological regulatory capacity, as only this pathway was buffered by higher HRV. Thus, both processes matter for everyday affect, but HRV may be more relevant when the inner dialogue becomes self-critical.

Keywords: state rumination, self-critical, resting heart rate variability, experience sampling method, negative affect, positive affect

Did you notice the snake or the spider? Distraction effects of two of the most frightening animals

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Previous research has shown that emotional stimuli can sway our attention or even divert it from a relevant task. Although such effects have been demonstrated for various types of emotional stimuli, including disgust-evoking, erotic, and frightening images, the latter category is the focus of the present study. In an eye-tracking experiment, participants were asked to find a square among 19 circles. Alongside this symbol matrix, a photo of an animal—a snake, a spider, a scorpion, or a crab—was displayed. We measured attentional responses via gaze patterns and behavioural responses via a button press once the target was detected. During recruitment, we targeted individuals with higher-than-normative fear of either snakes or spiders, assessed using standardised questionnaires. To date, we have collected data from 48 participants with high fear of snakes, 24 with high fear of spiders, and 46 controls. The aim of this study is to compare the distraction effects of snakes and spiders in participants with both low and high fear of these animals. Preliminary analyses indicate a substantial distraction effect of fear-relevant animals, which increases with the intensity of subjective fear. Perhaps surprisingly, spiders seem to distract people with high spider fear slightly more than snakes distract people with high snake fear. This difference may reflect the combined influence of fear and disgust elicited by spiders, compared with fear alone in the case of snakes.

Keywords: arachnophobia, attention, eye-tracking, fear, gaze, ophiophobia

Invited talk session 3. Developmental Cognitive Psychology
Friday, 6 February 2026, Room: B407

The role of phonology in the development of print tuning in typical and atypical readers

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Reading is a uniquely human skill that relies on the adaptation of pre-existing visual and auditory systems for efficient word recognition. During literacy acquisition, these systems become increasingly specialized and coordinated. While most children achieve fluent reading through instruction, around 5–10% struggle with developmental reading disorder, which is characterized by phonological processing deficits and often accompanied by orthographic impairments. These findings raise a central question: to what extent does phonology shape the development of print tuning?

To address this, two ERP studies examined the emergence and modulation of the N1 print-tuning effect, the neural marker of visual print sensitivity in Hungarian children. First, we investigated whether development of print tuning is driven by orthographic-phonological mapping in typically developing novice readers. To this end, we tested first- and third-grade children using pairs of pseudowords and Armenian letter strings in an implicit reading task. Robust left-lateralized print tuning was already present in first grade and remained stable by third grade, suggesting that coarse orthographic representations develop rapidly. Enhanced N1 responses during audiovisual presentation indicated sensitivity to letter–speech sound coupling, although fine-grained grapheme–phoneme integration was not yet automatic. integration.

Second, we test whether phonological deficits impair the development of print tuning. Thus, we compared third- to fifth-grade typically developing children and children with reading disorder using the same paradigm. Both groups exhibited strong N1 print-tuning effects, with larger amplitudes for Hungarian pseudowords relative to Armenian strings. Poor readers showed preserved coarse print tuning, suggesting intact orthographic processing at this early processing stage despite phonological difficulties.

Together, these findings demonstrate that phonology supports but does not drive the development of visual print tuning. Coarse orthographic specialization emerges early and remains robust even in children with reading difficulties, whereas fine-grained orthographic–phonological mapping follows a more protracted developmental course.

Keywords: print tuning, N1, reading disorder, audiovisual integration, reading development

From Birth to Lifespan: Early Brain Function as a Window into Development and Intervention

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Conditions during pregnancy and birth can profoundly shape brain development and influence cognitive, social, and motor outcomes across the lifespan. Neonatal brain function can now be assessed with high sensitivity and precision using non-invasive electrophysiological methods, offering unprecedented access to the earliest stages of human neural processing. In this talk, I will present evidence from studies linking perinatal factors—such as oxygen deprivation at birth—to later developmental trajectories. I will introduce our ongoing BIO-PREPA project, which investigates perinatal asphyxia (PA) through a unique combination of biochemical markers, such as lactate levels, and neonatal EEG measures of spontaneous and stimulus-driven brain activity. These early indicators are then linked to developmental outcomes at 18 months, thereby enhancing early diagnosis and informing timely interventions. Placing these findings in a broader context, I will discuss how brain plasticity changes from birth through critical and sensitive periods, and how recent advances in neuroscience suggest that reopening sensitive periods in later life may become a realistic goal. This perspective bridges neonatal research and lifespan health, highlighting opportunities for intervention from the very first days of life to older adulthood.

Keywords: perinatal asphyxia, EEG, biomarkers, development, brain plasticity

Language and cognitive changes across the lifespan

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Understanding how language functions evolve across the human lifespan requires attention not only to linguistic knowledge, but also to the underlying learning and cognitive mechanisms that support it. While language acquisition in childhood is known to rely on statistical learning (the ability to extract patterns and regularities from input) relatively little is known about how this capacity contributes to language processing later in life, and how it interacts with general cognitive resources such as working memory, attention control, and processing speed.
This talk will present findings from a large-scale developmental study of 608 Hungarian speakers between 14 to 92 years examining changes in language abilities, statistical learning and language-related cognitive abilities. Participants completed verbal statistical learning tasks designed to reflect mechanisms of vocabulary and grammar acquisition, alongside a battery of linguistic and cognitive measures. By comparing performance across age groups, the study

sheds light on how learning capacities vary across the lifespan, and how these changes relate to broader shifts in cognitive function.

The results point to a developmental trajectory in language and statistical learning that parallels known patterns in executive function and processing efficiency: all improve through adolescence and early adulthood and decline in later life. The talk will also explore the theoretical implications of these findings for models of language learning and language processing. The results support developmental models that view language as supported by multiple, interacting learning and control systems that may shift in weight and efficiency across the lifespan. They also provide empirical evidence that SL's impact on language is not isolated, but closely linked to broader cognitive architecture.

Language, statistical learning, cognitive resources, lifespan development

Negative emotions evoked by animals: small ones for children, but also for adults

Markéta Janovcová, Šárka Peterková, Helena Vaňková, Kristýna Sedláčková, Daniel Frynta, Eva Landová

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Humans' relationship with animals has been widely studied in terms of positive perceptions, but research also explores negative emotions. In the case of animals, the most important emotions are fear and disgust, which protect humans from acute danger and possible infection. The aim of this project was to find out which animals evoke the most fear and which are considered the most disgusting. Two sets of images were prepared to evaluate negative emotions, one representing animals that are dangerous or frightening, and the other containing disgusting-looking animals and various parasites. Each set contained 34 color photographs of animals standardized in size on a white background. A total of 344 children aged 3-17 (197 girls, 147 boys) and participated in the experiment. The children agreed sufficiently on the final ranking of the animals (Kendal's W for fear 0.269 and for disgust 0.561). When compared to adults, a very close correlation was found in the average ranking of animals in all age groups (Spearman's $r= 0.905$-0.966; $p<0.0001$) for disgust; for fear, the correlation was not as close ($r= 0.677$-0.900; $p<0.0001$), but still sufficient. The greatest differences in fear rakings were found for small animals, such as centipedes, crabs, scorpions, and stag beetles, which children fear more than adults. A more detailed cluster analysis of individual age groups divided children into preschoolers (3-5 years), younger schoolchildren (6-9 years), and older schoolchildren (10-17 years), with adults as another group (for fear). Two groups were identified for disgust: younger children (3-7 years) and older children (8-17 years), including adults. The results show that the perception of fear of animals changes during human ontogenesis, with younger children being more afraid of smaller animals. No significant differences were found between children and adults in terms of disgust.

Keywords: emotions, fear, disgust, animals, children

Anxiety state changes and user experience in active and passive immersion

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Background: Virtual reality has been known for its positive effect on reducing anxiety. However, How the active vs passive and fully immersive vs partially immersive works is not enough assessed. This study aimed to assess the difference between those mechanisms.
Method: A pilot RCT (randomized controlled trial) was conducted to fifty-eight healthy individuals. They were randomly allocated to AFI-VR (Active Fully Immersive Virtual Reality, N=15), API-VR (Active Partially Immersive Virtual Reality, N=15), PFI-VR (Passive Fully Immersive Virtual Reality, N=14) and PPI-VR (Passive Partially Immersive Virtual Reality, N=14). Heart rate, breathing rate, STAI (State-Trait Anxiety Index), MPS (Multidimensional Presence Scale) and SUS (System Usability Scale) were measured.
Result: All group showed decrease in anxiety state, heart rate and breathing rate after minute 5. Nevertheless, statistically significant state anxiety changes were evident only in AFI-VR (p=0.02, F= 0.39) and PPI-VR (p=0.015, F=7.76). While PFI-VR (p=0.044, F4.96) and PPI-VR (p=0.011, F=8.74) were significant in heart rate changes, no significant changes were evident in breathing rate. High presence was found in AFI-VR and PFI-VR, while high usability was found in AFI-VR, PFI-VR and PPI-VR.
Discussion: The virtual reality might contribute to changes of anxiety state, heart rate and breathing rate. The harmony of immersion and interactivity levels might influence the user experience.

Keywords: anxiety, pulse rate, respirational rate, virtual reality

Learning in the 21st Century: Examining How TikTok-style Content Influences Memory Retention in Students

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The rise of short, visually intense video content (e.g., TikTok 'brain rot' videos) has radically reshaped media consumption habits, raising significant concerns about their effects on attention and memory. Students increasingly report concentration difficulties and attention deficit symptoms, complicating adaptation to traditional, lower-intensity educational methods. Previous investigation has already shown that frequent short-video viewing is negatively correlated with information recall accuracy.

We conducted two studies to investigate this effect in university students. In study 1 (N=87) participants were randomly assigned to one of three conditions: watching a traditional presentation in a classroom setting, a text-to-speech video with neutral background, as well as

the same content with fast-paced visuals in the background, after which they had to answer questions regarding the topic. The main finding of the pilot investigation was a negative correlation between daily short-video screen time and memory recall accuracy, suggesting that constant exposure to "brain rot" content impairs information retention. Contrary to expectations, presentation format alone and self-reported ADHD traits did not significantly influence recall performance.

To enhance ecological validity, Study 2 (N=54) utilized the traditional presentation format as well as a fast-paced short video presented via TikTok on the device of the participant. While data collection is still ongoing, preliminary results show enhanced short-term retention in the TikTok video condition for those who report watching this style of content more often, suggesting that traditional education might be able to utilize the shift in media consumption. Future goals include investigating longer-term retention of information.

Toward Cognitive-Driven Assistive Robotics: The Vision and Research Agenda of A²R Group

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A²R Group (Autonomous and Assistive Robotics) was founded in 2017 as an interdisciplinary research unit focused on integrating cognitive principles, artificial intelligence, and mechatronic design to develop robotic systems that enhance human autonomy, mobility, and rehabilitation. Our mission is to investigate how cognitive models and learning-based decision frameworks can be embedded into robotic architectures to support safe, adaptive, and context-aware behavior in real-world environments.

A²R's research agenda is structured around four key domains:

(1) **Cognitive and Social Interaction Models,** emphasizing human-intent understanding and adaptive interaction strategies;

(2) **Assistive and Rehabilitation Robotics,** including prosthetic technologies, sensor-driven motor support, and intelligent rehabilitation devices;

(3) **Autonomous Mobility and Navigation,** where we study robust perception, mapping, path planning, and real-time decision-making under uncertainty; and

(4) **AI-Driven Mechatronic Intelligence,** with a focus on reinforcement learning, dynamic control, and predictive modeling for complex robotic systems.

Additionally, part of work is the integration of reinforcement learning (RL) into mobility platforms and assistive devices, enabling robots to optimize navigation, interaction, and task execution through experience. We explore model-based and model-free RL approaches for autonomous navigation in crowded, dynamic, and partially observable environments, aligned with cognitive theories of learning, adaptation, and decision-making. Our studies on multi-agent coordination and swarm behaviors further highlight how distributed cognitive principles can enhance scalability and resilience in autonomous systems.

At EXP26, we aim to present the conceptual framework and emerging research directions of A²R Group, demonstrating how cognitive science perspectives inspire new methods for robotic perception, hierarchical planning, learning, and human-centered assistance. We invite discussion and collaboration across cognitive science, AI, engineering, and rehabilitation

domains, with the shared goal of advancing intelligent robotic systems capable of supporting human capabilities in meaningful, safe, and context-sensitive ways.

Keywords: cognitive robotics, assistive robotics, autonomous mobility and navigation, ai-driven mechatronic intelligence, multi-agent coordination

Adapting Work Instructions to Cognitive Profiles in Industrial Assembly

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Manual and hybrid assembly tasks will remain central in Industry 4.0 and Industry 5.0 environments, where workers still rely on written and graphical work instructions. These instructions are usually prepared from a technical viewpoint and often neglect human cognitive limits. As a result, they can overload working memory, slow down learning, and increase errors, especially when tasks are complex.

Here, we investigate how work instructions can be designed in a human-centred way, based on cognitive load theory, physiological sensing, and dynamic systems. The main objective is to develop and validate a framework that assesses and adapts work instructions to individual cognitive profiles.

Participants in an Industry 5.0 laboratory will learn new assembly tasks with different configurations of work instructions that vary in level of detail, visual complexity, abstraction, and temporal delivery. Before the task, their cognitive abilities, such as working memory, text comprehension, and visual processing, will be assessed. During learning, performance measures such as task time and errors, subjective workload ratings, and physiological signals, including electrodermal activity and heart rate variability, will be recorded.

The expected results are quantitative design rules for work instructions that are tailored to worker expertise and cognitive constraints, along with a prototype tool for operator-centered assessment and instruction generation. This work aims to shorten learning curves, reduce cognitive overload, and support human-centred manufacturing in complex assembly environments.

Keywords: Cognitive load, Work instructions, Dynamic instructions, Industry 5.0,

People's attitude towards gaming toxicity and its factors

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Video game toxicity is a widespread problem in today's virtual environment. The anonymity of the internet and the gigantic number of people who use it on a daily basis combined with the gaming industry's inability to manage hate speech in their games properly led to the normalization of everyday toxicity in video games.

This paper's aim is to investigate the role of people's empathy in tolerance towards gaming toxicity and to explore the influence of desensitization on perception and tolerance of toxicity occurring within video games. In order to support the hypotheses a questionnaire, measuring level of empathy, gaming habits and perception of in game toxicity, was made and sent out to social media platforms.

A total of 411 participants' answers were analyzed and the results showed that (1) people with higher levels of empathy are more intolerant of toxicity in video games, and that (2) the more time people are playing the more tolerant they will be towards in game toxicity.

Keywords: Toxicity, Gaming, Empathy

Mobile Multimodal Neuro-Psychophysiological Measurement Platform for Emotion- and Engagement-Focused Passenger Experience Research in Automated Vehicles

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The widespread acceptance of automated vehicles depends on a better understanding of passengers' emotional, cognitive and bodily responses in real traffic conditions. To address this, we developed a portable, multimodal measurement platform specifically designed for studies with passengers in automated vehicles. The system combines wearable eye tracking (Pupil Labs Core), 100 Hz RTK-enabled GPS ($\approx$3 cm accuracy), a 9-degree-of-freedom inertial measurement unit, a 240 fps global-shutter video camera, mobile EEG, and electrodermal activity (EDA) recording. All signals share a GNSS-based common time reference, allowing precise alignment of physiological and behavioural data streams on a single time axis.

We apply an emotion-focused user experience framework, assessing not only stress and arousal (EEG, EDA, pupillometry) but also the degree of "experiential engagement". A head-mounted camera records the passenger's visual scene; from the apparent motion of the environment we estimate head movement. This motion pattern is then compared to the vehicle's actual dynamics to determine whether the passenger anticipates upcoming manoeuvres (predictive postural adjustment) or mainly responds after the fact (corrective reaction). This provides an objective, high-temporal-resolution indicator of how far the passenger anticipates and correctly predicts the autonomous vehicle's motion.

The multimodal data collected with this platform complement conventional questionnaires and interviews by offering objective, continuous markers of emotional state, cognitive load and postural adaptation. The poster will present the architecture of the measurement system, the synchronization procedure, and initial experimental results, illustrating the feasibility and added value of this approach for emotion- and experience-centred research on automated vehicles.

How experience with sign language affects abilities of motor and visual mental rotation

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Embodied cognition frameworks propose that perceptual and motor experiences shape higher-level cognitive processes. Sign language users routinely perceive linguistic information through complex visual–manual patterns and produce it through articulated hand movements, making them an ideal population for examining whether experience enhances imagery-related abilities. This study investigated whether signing experience is associated with improved performance in visual and motor imagery, operationalized through two mental rotation tasks.

25 hearing signers and 25 matched non-signers completed a visual (same/different) mental rotation task (vMRT), requiring judgments of whether two simultaneously presented hands could be mapped onto each other by rotating them, and a motor (left/right) mental rotation task (mMRT), requiring laterality judgments of single rotated hands. Reaction times for correct trials were analyzed using linear mixed-effects models with Group, Rotation Angle, and their interaction as predictors.

In the vMRT, signers responded significantly faster than non-signers when judging different hands, whereas no significant group difference was found for same-hand trials. In the mMRT, signers showed selectively faster responses to palms (but not backs of hands), with group differences varying across rotation angles, indicating a significant interaction.

These findings suggest a dissociation in signer advantages: in the visual domain, signers may exhibit facilitated encoding rather than manipulation of visual hand information, whereas in the motor domain, signing experience may enhance manipulation of motor representations. Given the modest sample size, future work with larger and more diverse groups is needed to determine the robustness of these modality-specific effects.

Resting-State Brain Network Dynamics in Midlife: Effects of Hormonal Changes

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Midlife is a critical yet understudied period in brain aging research, particularly regarding the influence of sex and hormonal changes. Women experience a rapid decline in ovarian hormones during the menopausal transition, which may impact neural function well before older age, raising questions about whether sex-specific differences in neural aging are detectable in early postmenopause. Hormone replacement therapy (HRT) can mitigate menopausal symptoms, yet its long-term effects on cognitive function and neural dynamics in humans remain insufficiently understood.

In this study, we investigated resting-state brain activity in three age-matched groups of middle-aged adults: 15 postmenopausal women without hormone therapy (HRT–; mean age = 53.5, SD = 2.76), 12 postmenopausal women receiving hormone therapy (HRT+; mean age = 52.8, SD = 3.13), and 12 men (M; mean age = 49.25, SD = 5.36). All women were within five years of their final menstrual period, targeting the early postmenopausal stage. We used resting-state EEG, and Spectral Power Density (SPD) and Multiscale Entropy (MSE) analyses assessed oscillatory activity and signal complexity.

Our results revealed no significant differences between HRT– and M groups in MSE or SPD. The HRT+ group showed higher MSE at medium time scales across all electrodes compared with both the HRT– and M groups, as well as increased short-scale MSE globally relative to HRT– women, and in parietal–occipital regions relative to men. SPD analyses indicated reduced delta power and increased frontal beta and gamma power in HRT+ women.

These findings suggest that no detectable sex differences are present at rest. However, HRT appears to enhance neural complexity and modulate oscillatory activity, potentially supporting more efficient brain function.

Keywords: menopause, hormone replacement therapy, EEG, multiscale entropy, spectral power density

Understanding Privileged Access and Second-Order Theory of Mind

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The present poster reports two experiments on attribution of privileged access to mental states in children. The main question of Experiment 1 is the following: When and how does the child acquire the attribution of privileged access to mental states? We tested children between 4-and 6 years of age (N=100). We used a modified version of Bartsch and Wellman's (1989) experiment. Our subjects witnessed the following scenario in the form of a puppet play: „Here is Ann. Ann is looking for her kitten. The kitten is hiding under the chair. But Ann is looking for it under the piano. Why? What do you think?" In our modification, after answering this question another identical puppet appeared and the children's task was to select Ann on the basis of the puppets' first person verbal reports. One could argue that our selection task described above is equivalent to a second-order theory of mind task because the child has to select Ann on the basis of her report concerning her first-order mental states. This was the reason for running a second experiment on the relationship between attribution of privileged access and second-order theory of mind. So, in the second experiment we replicated the Ann task and complemented it with a specific second-order theory of mind task by Perner and Howes (1992/1995). Our participants were between 4 and 6 years of age (N=127). The main result is that we did not find a significant correlation between the Ann (selection) task and the Self-Reflection Question. Our finding in Experiment 2 rules out an explicit second-order mental state attribution interpretation of our data (i.e. that the subject consciously reasons like "Ann says that she thought her kitten was under the piano"). We put our findings into the framework of procedural metacognition.

Keywords: privileged access, theory of mind, second-order mental state, procedural metacognition

Terra Cognita Reverse Navigation Tool

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With the development of smart phones an adaptive navigational support system was made widespreadly available that can be used instantly, with flexible views of the route. This is possibly changing the cognitive strategies in navigation. Some people prefer to navigate based on the landmarks they locate from first person view, comparing these to one's own position,

which is called egocentric spatial thinking; while other people compare landmarks to each other, and develop a certain bird's eyes view, called allocentric spatial thinking (Ekstrom & Isham, 2017). The Reverse Navigation Tool of the Terra Cognita Toolset aims to explore the efficiency of the switch between egocentric and allocentric thinking through a task of locating a route in an unknown environment based on a video.

The Reverse Navigation Tool runs in a browser and requires a database server to store the input of the participants. The user interface consists of a first person view video of a route and a basic Google Maps based webmap platform on which participants can mark the hypothesized route. As it is a georeferenced interface rather than a more widespreadly used image file, it allows for collecting geodata - the exact coordinates of each point - and this provides more opportunity for data analysis. The sequence of latitudes and longitudes shows the general direction the participant labelled the route towards, and the difference of each point with the previous one can be compared with the actual route coordinates, which makes a mathematical analysis possible, instead of visualising the data for comparison.

During the pilot the toolset will be used combined with the Santa Barbara Sense of Direction Scale (Hegarty et al., 2002) and a background survey, which might provide more details on the variance of the results. After a successful pilot the script and the setup manual of the tool will be published. Following the pilot and validation of the tool it will be useful in measuring the success in switching between allocentric and egocentric thinking.

Hegarty, M. Richardson, A. E., Montello, D. R., Lovelace, K & Subbiah, I. (2002). Development of a Self-Report Measure of Environmental Spatial Ability. *Intelligence, 30*, 425-447.
Ekstrom, A. D., & Isham, E. A. (2017). Human spatial navigation: Representations across dimensions and Scales. *Current Opinion in Behavioral Sciences*, *17*, 84–89. https://doi.org/10.1016/j.cobeha.2017.06.005

Keywords: navigation, spatial thinking, web map development, cognitive cartography

The effects of Physical Activity on Attentional Mechanisms

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Attention is one of the most important cognitive abilities, which forms the basis for learning, self-regulation, and the successful completion of daily activities. Physical activity performed by children plays an important role in the development of motor skills and abilities, social relationships, emotional bonding, and in the development of cognitive abilities. During exercise, even in the case of the simplest activities, the student's entire physiological and psychological functional system, as well as their regulatory apparatus, is activated. The aim of my research is to examine the relationship between physical activity and the functioning of attentional systems among primary school   students. Our hypothesis is that students who engaged in physical activity during a physical education class prior to the measurement of attentional abilities will perform better on attentional tasks than those whose data collection was not preceded by any movement activity. Data collection is currently underway in a local primary school. The procedure entails separate occasions with 40 primary students aged 7-9. We are going to use during both occasions a standardized, paper-based attentional test, suitable for detecting short-term attentional charges. The first measurement (control) will be administered following a standard academic class. The second measurement

(Intervention) will take place immediately after a structured Physical Education session, which was specifically designed and coordinated with the PE teacher. We anticipate that the statistical analysis will reveal significant improvement in attentional performance among participants in the physical activity group compared to the control group. The ultimate goal of the research is to provide empirical validation for the beneficial effects of physical activity and to solidify of role of physical activity as a practical intervention for strengthening attention function.

Keywords: attention performance, cognitive performance, physical activity, primary school students, immediate effects

Fathers minding the baby – A comparative analysis of parental mentalization observed during mother-infant and father-infant interactions

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Infants learn forms of communication, to recognize emotions, to regulate their emotions, to attribute intentions and later mentalize others through early interactions with their parents. Mothers are assumed to be the primary caregivers and main partners in early interactions, while the role of fathers is often overlooked. That is why our research aims to identify the characteristics of the mentalization of fathers and mothers in dyadic play-interactions with their infants.

We hypothesize that mentalization will vary by gender, but the degree of parental involvement will interact with the effect of parental gender.

Families of infants between 12 and 22 months (N≈15) were invited to the observational laboratory of the University of Pécs or visited in their homes. In two consecutive settings, the father and the mother were instructed to play with the infant "as they usually do". The duration of the interactions was 10 minutes. Interactions were coded by the *Mind-Mindedness Coding Manual 2.2. version*. In addition, to control parental emotional state that may influence the interaction, we asked parents to fill out *The Patient Health Questionnaire* (PHQ), and to measure parental involvement parents filled out the *Comprehensive Early Childhood Parenting Questionnaire* (CECPAQ) and a list of self-made items about the parents' involvement in daily childcare tasks.

The data collection and data analytic process of the study is still in progress. The presentation aims to introduce the first results, which can give us a better understanding of the father's role in the early development of the infant, about which there is currently little literature available.

Keywords: mentalization, sensitivity, parent-infant interaction, comparative study

Assess the visual attention of the quality inspector operator

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Quality inspection remains one of the most human-dependent processes in manufacturing, requiring operators to detect predefined defects with precision and consistency visually. However, inspection performance is strongly influenced by individual attention patterns, search strategies, and fatigue. This study investigates how eye-tracking can be used to analyse and improve visual inspection processes and situational awareness by quantifying where, how long, and in what sequence operators examine product surfaces during a quality check.

Participant performed a structured visual inspection task while wearing eye-tracking glasses. Gaze data were collected to map attention hotspots, identify potentially overlooked regions, and characterise differences in inspection strategies across shift periods. This approach provides a fine-grained understanding of how visual attention is distributed during inspection and offers insights into factors that may influence consistency and defect-detection accuracy and situational awareness. The analysis highlights how eye-tracking can reveal blind spots in inspection coverage, detect inefficient scanning patterns, and support the evaluation of operator performance from an objective, data-driven perspective.

These insights demonstrate the potential of eye-tracking as a powerful tool for assessing and enhancing visual inspection processes. The proposed methodology can inform the development of targeted training interventions and future adaptive systems that guide operators toward more complete and systematic quality checks.

Keywords: Eye-tracking, Quality inspection, Situational awareness, Manufacturing

Linguistic markers in self-description of woman with bordeline personality disorder and depression – a qualitative study

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Borderline personality disorder (BPD) is characterized by identity diffusion and instability in self-representation, which are expected to surface in the linguistic encoding of self-descriptions. From a cognitive-linguistic perspective, narrative language offers a window into underlying mental representations, defense mechanisms, and self-related information processing.

 This qualitive study examined narrative and linguistic markers in the spontaneous self-descriptions of individuals with BPD and depression diagnosis compared to non-clinical controls. Data collection is ongoing; at the time of submission, the sample comprises women

with BPD and comorbid depression (n=8) and demographically matched women without psychiatric diagnoses (n=9), with further interviews currently being conducted to increase the number of participants. Semi-structured interviews were conducted using the Structured Interview of Personality Organization - Revised. Transcripts from women with BPD and demographically matched women without psychiatric diagnoses were analysed with the Hungarian Narrative Categorical Content Analysis program (NarrCat), a neural network–based Hungarian sentiment analyser, and manual linguistic coding. Frequencies were normalised for text length.

Participants with BPD produced self-narratives with significantly more negative sentiment at the sentence level, a higher rate of encoding errors (morphological/syntactic and contamination errors), and more intensification in negative emotional contexts, including negative emotive intensifiers. There were trend-level group differences indicating more explicit negation and a reduced use of psychological perspective (self-referential mental-state terms) in the BPD group. These patterns suggest a cognitively more negative, less integrated and less reflexive construal of the self in BPD, visible in fine-grained linguistic choices. Despite the small sample and comorbid depression, the findings highlight the promise of cognitive-linguistic markers for modelling narrative identity and self-representations in personality pathology, and for complementing clinical assessment in future, larger-scale studies. These tentative findings are consistent with previous literature, indicating specific characteristics of borderline personality organization through various linguistic and narrative markers.

Keywords: borderline personality disorder, linguistic markers, qualitive analysis, cognitive linguistics, self-representation

The role of social experiences in the development of attitudes towards artificial intelligence

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As artificial intelligence (AI) becomes a constantly growing aspect of our everyday life, so does our relationship with it advance. Most people interact with conversational artificial intelligence (CAI), such as ChatGPT, Microsoft Copilot, or Gemini. While a majority of individuals use them for productivity purposes there is a social relational aspect to it. These artificial agents provide pseudo-social relationships, which influence people's social interactions. Social anxiety and bullying are two closely linked phenomena, which both have an effect on social interactions. The current research focuses on individuals' attitudes and behaviors towards CAI in the context of social anxiety and previous experiences with bullying. The aim of the study is to find out the quality of relationship between behaviors in the past as a perpetrator and present negative behaviors towards CAI. My further raised hypotheses are if frequent usage of AI will show more positive behavior towards CAI, and if the relationship of social anxiety and bullying behavior towards CAI is influenced by bullying victimhood. The survey will be done through an online questionnaire.

The preliminary results indicate a moderately strong relationship between Bullying and CAI Bullying, furthermore an indirect effect with the mediator factor of victimhood between social anxiety and bullying CAI.

While much of this topic is undiscovered further psychological research is needed to understand the underlying phenomena in connection with CAI's social emotional aspects. The expected results of the research may help us better understand how social experiences influence people's relationship to artificial intelligence, and what role social interactions may play in understanding the human side of technilogical development.

Development and validation of a digital, gamified version of a dyscalculia assessment tool

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Developmental dyscalculia (DD) is a prevalent and persistent learning disability, affecting approximately 3–6 % of school-aged children. Affected children often struggle with number sense, basic arithmetic operations, time comprehension, spatial reasoning, and quantity estimation, which can hinder academic performance, limit educational attainment, and negatively impact long-term well-being.

Early detection of dyscalculia is critical because it enables timely intervention. Digital testing offers a promising direction: it enables standardized, objective, large-scale data collection, which can be used for nation-wide screening. Furthermore, children can be more motivated with gamified digital tests, which can lead to increased measurement efficiency.

The aim of our study was to develop and validate a digital, gamified version of a dyscalculia assessment tool, the Pedagogical Assessment of Dyscalculia (DPV; Dékány et al., 2020), a test developed for the preschool age group. The DPV is a widely used tool by the Hungarian Pedagogical Service, designed to measure the development of number sense, operational skills, and other cognitive functions, and to support dyscalculia screening by identifying partial skill weaknesses. Among others, the test evaluates spatial orientation, mechanical calculation, number memory, understanding of quantitative relations, and the manifestation of operational skills during task performance.

We conducted a validation study (N=58; age range: 5.3-7.1 years) comparing pre-school children's performance on the digital version compared to the original paper-and-pencil version in a within-subject design, counterbalanced for the order of the two tests.

Findings will be discussed regarding whether they support the validity of the digital adaptation and its suitability for large-scale, early detection of dyscalculia.

Differential Associations of Mobile Device Use and Offline Activities with Children's Socio-Cognitive Skills

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Children's increasing exposure to mobile devices raises concerns regarding socio-cognitive development. This study investigated how online and offline activities performed alone or with family, on weekdays and weekends, are associated with socio-cognitive skills in early school-age children. A cross-sectional online study was conducted with 6–8-year-old children (N = 73, M = 7.4 years) and their parents. Parents reported children's online and offline activities separately for weekdays and weekends, distinguishing solitary and joint use. Children completed socio- cognitive tasks: Sally–Anne/Ice Cream Test (second-order false belief), Faux Pas Test (detection of social norm violations), Real and Apparent Emotion Test, and Facial Emotion Recognition Test. Binomial and ordinal GzLMs were applied with the socio-cognitive test scores as dependent variables. Covariates included age, sex, home type, parental education, and age of first screen exposure. Weekday and weekend screen time were consistently associated with poorer socio-cognitive performance. On weekdays, higher screen exposure predicted lower Emotion Recognition Test scores (p = 0.031), indicating reduced emotion understanding. Weekend screen time showed a similar pattern: children with less screen time performed better on the Faux Pas Test (p = 0.035) and the Sally–Anne Test (p = 0.014), highlighting the negative impact of screen use, especially solitary touch-screen device use (Faux Pas Test (p = 0.039). Even online family activities were linked to lower performance (Sally-Anne/Ice Cream Test, p = 0.014). Offline family-based activities were linked to better socio-cognitive outcomes such as emotion recognition (p = 0.017). Conversely, offline solitary activities on weekends were related to higher emotion recognition (p = 0.021) but on weekdays to poorer Faux Pas performance (p = 0.028). These results emphasize that real-life interactions support socio-cognitive development, whereas solitary offline activities have ambiguous effects. Online activities – whether solitary or social – hinder socio-cognitive development, probably through limiting opportunities for meaningful social interactions.

Keywords: socio-cognitive development; screen time; emotion recognition; online and offline activities; early school-age children

Faulty Instructions, Real Signals: Capturing Confusion in Action

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Confusion arises when incoming information contradicts an individual's expectations, creating cognitive disequilibrium and an accompanying affective response. In real work environments, such conflicts often occur when unclear or faulty instructions disrupt task performance. The long-term aim of this research is to support workers by developing systems that can detect these moments of confusion and offer timely guidance. As a foundational step, this study focuses on gathering multimodal data (both psychological and physiological) to better understand how confusion manifests.

Participants assembled and disassembled puzzle patterns following visual instructions. A faulty instruction was intentionally introduced near the end of the task, creating an impossible final placement and eliciting a clear confusion episode. This design allowed us to elicit and clearly time-stamp confusion episodes for later analysis. Physiological data were recorded using an 8-channel wearable EEG system (Unicorn Hybrid Black), chosen for its relevance to real-world, industry-compatible scenarios. Planned preprocessing and analyses include band-power extraction, Fourier transforms, time–frequency decomposition, and phase-locking metrics. Subjective experience was assessed through an extensive post-task questionnaire battery, including the Dundee Stress State Questionnaire (DSSQ), and custom scales adapted from validated instruments to measure cognitive conflict dimensions (anomaly detection, anxiety, interest, cognitive reappraisal), frustration, performance self-esteem, and cognitive load. Participants also rated their perceived confusion, error detection, and motivational shifts.

By integrating subjective and EEG-based indicators, this study aims to identify characteristic signatures of confusion and related emotional responses. These findings will support the development of real-time, sensor-based methods to detect confusion in practical settings where workers may benefit from adaptive guidance.

Keywords: Confusion, Work instructions, Industry 5.0, Manufacturing, Operator 4.0

Research Group Introductions
Thursday, 5 February 2026, Room: B407

Research group presentation: Language Acquisition Research Group, BME Department of Cognitive Science

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Abstract: Why do some people learn languages easily while others struggle? Our research aims to disentangle this question by studying the cognitive foundations of individual differences in both first language ability and second language learning. Although it is often assumed that acquiring one's native language is effortless while learning a foreign language is challenging and cognitively demanding, recent work suggests that these two processes may rely on much more similar mechanisms than previously believed. This perspective opens the door to rethinking what "language aptitude" really is and how it shapes our linguistic experiences throughout life.

Starting in 2026 January, our NKKP project investigates how adults differ in their language skills and what cognitive abilities support these differences. As the first part of the project, we map first language proficiency and cognitive profiles of adults using a wide range of tasks. We build detailed measures of Hungarian first language proficiency that are sensitive to individual differences in the adult typical population. We also assess a broad set of cognitive abilities that previous research has linked to learning and processing language. By combining these measures, we aim to understand how cognitive strengths and weaknesses shape the way people understand and use their mother tongue.

The second major part of our work focuses on second language learning. Here we use two complementary approaches: (1) controlled learning of an artificial miniature language in the lab, which allows us to observe the building blocks of language learning under highly controlled conditions, and (2) real-world second language learning in university classrooms, where we can track how beginners progress during a semester. We test what cognitive abilities matter for second language learning and how one's first language proficiency influences success in both the lab-based and ecologically valid, real-world arrangements.

Taken together, our research aims to show that first language acquisition and second language learning are not isolated processes, but parallel pathways influenced by a shared set of cognitive skills. By doing so, the project challenges traditional assumptions and provides a more integrated picture of how people learn, process, and use language. The findings may have important implications for education, for example, helping teachers tailor instruction to learners' cognitive profiles or informing the development of tools that better identify individual strengths and weaknesses in language learning.

Our team of psychologists, linguists and language educators combines expertise in experimental psychology, psychometrics and linguistics. We aim to contribute to shaping how language aptitude and the role of cognitive individual differences is understood, and contribute to more effective, evidence-based approaches to language learning.

Cognitive, Motivational and Environmental Determinants of Sport Persistence: An Interdisciplinary Research Programme

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Established in 2023, the Sport Persistence Research Group is an interdisciplinary research unit integrating knowledge from psychology, educational sciences, sport sciences and engineering. Its central aim is to investigate and develop innovative interventions that support sport persistence (behavioural commitment of the athlete) as well as the related psychological and cognitive processes and the maintenance of athletic performance. Our primary focus is to explore which biological, psychological, cognitive and social factors determine athletes' long-term commitment to sport, how the persistence required to sustain sporting activity develops during adolescence and young adulthood, and which environmental factors (family, school, coach, peers) facilitate or hinder this process. The scientific foundation of our research lies in Bronfenbrenner's ecological model and its sport-specific adaptation by Bauman and colleagues, both of which interpret human development across multiple systemic levels, allowing for a multidimensional understanding of sport persistence. The research group's profile is further characterised by using mixed methodologies and the incorporation of technological solutions (particularly human–robot interaction (HRI) and soft computing methods) into sport psychological research. The multidisciplinary background of our team members (psychology, engineering, sport sciences) ensures that the phenomenon of sport persistence can be examined at a systematic level and through multiple methodological perspectives.

Our research to date has had the overarching aim of conducting an interdisciplinary, exploratory and comparative examination of sport persistence. We started with theoretical groundwork: we reviewed key sport psychological and general motivational theories, including Achievement Goal Theory, the Theory of Planned Behaviour, the Expectancy–Value Theory and the Sport Commitment Model, and, building on these model, worked to clarify what is meant by sport persistence and how it can be reliably measured. As part of this effort, we developed a complex sport persistence index that goes beyond the previous, purely dichotomous approach (participates in sport/does not participate), and which proved to be a valid measurement tool in a large-sample analysis.

In addition, within a qualitative research framework, we conducted semi-structured interviews with secondary school and university athletes, based on Bronfenbrenner's ecological model and with particular attention to the individual drives and the relevance of the key actors of the microsystem: family, peers and coaches. The analysis showed that families provide exceptionally diverse and stable support, contributing both to athletes' emotional security and to their logistical background. Peers were found to exert a strong influence on perseverance through their motivational and social comparison functions, while coaches played a crucial role in sustaining an athletic career through the quality of their feedback, personal attention and supportive attitudes.

Building on the qualitative findings, we carried out a large-scale quantitative study in which we examined the individual, social and environmental factors determining the maintenance of sport

persistence within a representative sample. Our results confirmed that, among competitive athletes, sport orientation, grit, resilience and perceptions of success exert particularly strong effects on persistence, whereas among recreational athletes environmental and social factors play a more dominant role. The quantitative data also allowed us to identify distinct athlete profiles that are clearly differentiated by their levels of sport persistence and motivational patterns.

Drawing on the identified factors, we have started developing and testing a sport persistence training programme, which is currently being evaluated in a randomised controlled trial (RCT). The programme aims to enhance athletes' motivation, emotional regulation and persistence, with particular emphasis on variables such as grit, future orientation, rumination and sport-related anxiety. The training is available in both hybrid and online formats, making it widely accessible. We plan to disseminate the results not only in academic forums but also within professional communities, such as coaches and sports clubs, during the year 2026.

One of the most innovative aspects of our research group is the integration of robotics and artificial intelligence-based tools into sport psychological investigations. In the near future, a key focus will be an empirical research series involving the Pepper humanoid robot, examining the effects of robot-assisted situations on athletes' performance, persistence and cognitive functioning. This research direction is novel even at an international level, as the application of robot psychology within sport science is currently only emerging.

A further important new direction of the group concerns the examination of cognitive functions in relation to sport persistence. One of our developing fields is the investigation of the significance of attentional processes and executive functions in sport persistence, based on the premise that athletic persistence is not solely a motivational phenomenon, but one closely linked to executive functioning, such as inhibition, cognitive flexibility, planning and sustained attention. Tasks administered by the Pepper robot (such as the d2 test, the Pieron test, Nuts & Bolts or problem-solving tasks) provide opportunities to measure these functions, while the experimental–control design enables us to explore how athletes' attentional performance changes in robot-assisted situations. Additionally, we place strong emphasis on assessing the role of anxiety management, emotional states and stress responses in sport persistence. Robot-assisted experiments allow us to examine how the robot's tone of voice, instructions and feedback shape athletes' emotional reactions, what changes occur in cognitive–affective functioning, and how physiological and behavioural indicators can be linked with cognitive performance. The structured load management enabled by robot-assisted tasks also makes it possible to precisely control cognitive load, track fluctuations in performance and motivation, and investigate how HRI may support optimal cognitive load levels. Our aim is to create a robot-assisted training programme that can effectively complement the work of sport psychologists and coaches in preparing athletes mentally and maintaining their long-term commitment.

Keywords: sport persistence, sport motivation, applied psychology, socioecological models, persistence training, executive functioning, attitudes toward AI and robots

Neurocognitive Mechanisms of Urban Experience: How the Built Environment Shapes Perception, Emotion and Well-Being

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The aim of the Environmental & Cognitive Neuroscience in Architecture Lab (ECNA Lab), grounded in a spirit of multidisciplinarity, is to integrate architecture, urban studies, psychology and cognitive neuroscience to investigate how the built environment influences human perception, cognition, emotions and well-being. The scientific exploration of residents', users' and visitors' experiences is relevant not only for research rooted in the humanities, but also for engineering and architecture, as one of the fundamental tasks of architecture is to improve environmental quality and support human functioning.

The focus of the research builds on Kevin Lynch's foundational ideas, particularly the notion of "harmonious structural conception as a communication system", which asserts that the legibility of a city - whether understood through its structural patterns from above or the visual experience of its urban "landscape" - significantly shapes how inhabitants perceive and live their environment. According to Lynch's classical approach, a city should be interpreted as its residents perceive it, based on three essential criteria: identity, meaning the recognisability of the city as a distinct entity; structure, referring to the clarity and organisation of its formal and spatial components; and meaning, that is, the extent to which this structure becomes endowed with significance for the observer. The physical elements of a city (paths, streets, pavements and channels; boundaries and transitional zones; neighbourhoods and districts; nodes and strategic points; as well as landmarks, characteristic buildings and visual cues) all constitute factors that fundamentally influence spatial processing, navigation and emotional responses in the human brain.

The main focus of the group is to discover the neurocognitive and psychological mechanisms through which urban spaces and buildings exert their effects: how the brain processes architectural forms, lighting conditions, proportions and materiality; what neural and emotional responses different types of urban environments evoke; and how urban well-being, a sense of safety or place attachment emerge at a neurocognitive level. The laboratory's research programme investigates questions situated at the intersection of modern urban planning, sustainable architecture, public health and cognitive sciences, thereby contributing to the development of a more human-centred, effective and mentally supportive built environment.

The research group intends to pursue the following research directions:

1. **The impact of the built environment on cognitive and emotional processes:** Urban spaces and buildings create stimulus-rich environments that exert substantial influence on attentional functions, spatial perception and stress responses. From the perspective of spatial perception and form recognition, the group examines how spatial articulation, the presence or absence of sightlines, and architectural proportional systems influence people's distance estimation, orientation and cognitive load. Special attention is given to how physiological stress indicators (such as heart rate variability and skin conductance) change in crowded, disorganised, low-aesthetic-quality or excessively noisy environments. The

aim is to identify architectural characteristics that may reduce or, conversely, exacerbate stress.

2. **Neural processing of urban spaces:** Using modern neuroimaging and mobile neuromonitoring tools (e.g., EEG, fNIRS), the group investigates how the brain represents urban environments. In relation to navigation and orientation, the research examines which neural patterns are associated with route planning, the formation of mental maps and difficulties in orientation. The investigations also aim to identify architectural features that promote a sense of predictability, control or social presence. Further research explores how excessive visual stimuli, advertising surfaces or disordered spatial structures burden the cognitive system, and how these factors affect performance, attention and emotional state.

3. **Neuroarchitecture – the relationship between architecture and brain function**: This research line focuses on the neuroaesthetic examination of architectural forms. Regarding materiality, lighting, rhythm and proportions, the group explores how the brain processes the textures of natural and artificial materials, changing light conditions and the rhythms of geometric structures. A key goal is to determine which architectural decisions evoke calmness, inspiration or overload, and how these responses can be measured using objective biomarkers.

4. **Urban well-being:** Exploring the relationship between mental health and the urban environment has become a topic of global significance. The laboratory investigates the environmental–architectural factors linked to depression, anxiety, social isolation and burnout. Concerning the role of green spaces, existing research suggests that the presence of natural elements has demonstrable stress-reducing and attention-restorative effects. The aim is to understand which physiological and neural markers describe these effects, and how they can be integrated into urban planning practice.

The research group aims to produce scientific publications through multidisciplinary collaboration involving the Faculty of Engineering and Faculty of Humanities at the University of Debrecen, and to expand this network with domestic and international partners. Another key objective is the training of young researchers, achieved through the active involvement and supervision of PhD students. In the longer term, the group intends to submit large-scale national and international grant applications, which will enable the development of sustainable research infrastructure and enhance international scientific visibility.

Keywords: built environment, neural processing, neuroarchitecture, spatial perception, urban well-being