Fri. Oct 17, 2025

Symposium | Mammalian Brain

Fri. Oct 17, 2025 9:00 AM - 10:30 AM JST | Fri. Oct 17, 2025 12:00 AM - 1:30 AM UTC Room 1(Mathematical Science Building)

[S1] Symposium 1 :Time and Rhythm in the Mammalian Brain

Chair:Sonja Kotz(Maastricht University), Teresa Raimondi (Sapienza University of Rome)

9:00 AM - 9:30 AM JST | 12:00 AM - 12:30 AM UTC

[S1-01]

Time and Rhythm in the Mammalian Brain

*Sonja A Kotz[1], Teresa Raimondi[2] (1. Maastricht University (Netherlands), 2. Sapienza University of Rome (Italy))

9:30 AM - 9:45 AM JST | 12:30 AM - 12:45 AM UTC

[S1-02]

Tick-Tock Across Species: Comparative timing in audition

*Sonja A Kotz[1] (1. Maastricht University (Netherlands))

9:45 AM - 10:00 AM JST | 12:45 AM - 1:00 AM UTC

[S1-03]

When reward is right, macaques can have rhythm

*Hugo Merchant[1], Ameyaltzin Castillo-Almazán[1], Pablo Márquez[1], Vani Rajendran[1] (1. Instituto de Neurobiologia, UNAM, campus Juriquilla (Mexico))

10:00 AM - 10:15 AM JST | 1:00 AM - 1:15 AM UTC

[S1-04]

Rhythmic synchronization ability of rats

*Reo Wada[1], Hiroki Koda[1] (1. The University of Tokyo (Japan))

10:15 AM - 10:30 AM JST | 1:15 AM - 1:30 AM UTC

[S1-05]

Emergence of rhythm during sequential tapping in chimpanzees and humans

*Yuko Hattori[1] (1. Kyoto University (Japan))

Symposium | Healthy and Pathological Aging

Fri. Oct 17, 2025 5:15 PM - 6:45 PM JST | Fri. Oct 17, 2025 8:15 AM - 9:45 AM UTC Room 3(East B1)

[S3] Symposium 3: Towards a comprehensive understanding of time processing changes in healthy and pathological aging

Chair:Thomas Hinault(INSERM)

5:15 PM - 5:30 PM JST | 8:15 AM - 8:30 AM UTC

[S3-01]

Towards a comprehensive understanding of time processing changes in healthy and pathological aging

*Thomas Thierry Hinault[1] (1. U1077 Inserm (France))

5:30 PM - 5:45 PM JST | 8:30 AM - 8:45 AM UTC

[S3-02]

Aging effects on the neural bases of temporal processing

*Thomas Thierry Hinault[1] (1. U1077 Inserm (France))

5:45 PM - 6:00 PM JST | 8:45 AM - 9:00 AM UTC

[S3-03]

Electrophysiological signature of explicit and implicit timing in young and older adults

*Giovanna Mioni[1], Fiorella del Popolo Cristaldi[1], Luigi Micillo[1], Nicola Cellini[1] (1. Department of General Psychology, University of Padova (Italy))

6:00 PM - 6:15 PM JST | 9:00 AM - 9:15 AM UTC

[S3-04]

Time processing in prodromal stages of Alzheimer’s Disease

*Alice Teghil[1] (1. Sapienza University of Rome (Italy))

6:15 PM - 6:30 PM JST | 9:15 AM - 9:30 AM UTC

[S3-05]

Temporal processing disturbances in the dementias – from mechanisms to management

*Muireann Irish[1] (1. The University of Sydney (Australia))

Symposium | Temporal Metacognition

Fri. Oct 17, 2025 9:00 AM - 10:30 AM JST | Fri. Oct 17, 2025 12:00 AM - 1:30 AM UTC Room 2(West B1)

[S2] Symposium 2: Watching the Clock Err: Different Levels of Explanation for Temporal Metacognition

Chair:Tutku Oztel(George Mason University)

9:00 AM - 9:30 AM JST | 12:00 AM - 12:30 AM UTC

[S2-01]

Watching the Clock Err: Different Levels of Explanation for Temporal Metacognition

*Tutku Oztel[1] (1. George Mason University (United States of America))

9:30 AM - 9:45 AM JST | 12:30 AM - 12:45 AM UTC

[S2-02]

Cognitive Architecture Through Methodological Lenses: Understanding Temporal Error Monitoring

*Tutku Oztel[1] (1. George Mason University (United States of America))

9:45 AM - 10:00 AM JST | 12:45 AM - 1:00 AM UTC

[S2-03]

“Catching yourself trip” on timing errors

*Fuat Balci[1] (1. University of Manitoba (Canada))

10:00 AM - 10:15 AM JST | 1:00 AM - 1:15 AM UTC

[S2-04]

Exploring the Domain-Generality of Temporal Metacognition: From introspective reaction time to confidence in explicit timing

*Nathalie Pavailler[1] (1. CEA/DRF/Inst. Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; Université Paris-Saclay, Gif/Yvette, 91191 France (France))

Symposium | Temporal Experience

Fri. Oct 17, 2025 5:15 PM - 6:45 PM JST | Fri. Oct 17, 2025 8:15 AM - 9:45 AM UTC Room 2(West B1)

[S4] Symposium 4: The Varieties of Temporal Experience: The Past, Present, and Future of Time Perception Research

Chair:Martin Wiener(George Mason University)

5:15 PM - 5:30 PM JST | 8:15 AM - 8:30 AM UTC

[S4-01]

The Varieties of Temporal Experience: The Past, Present, and Future of Time Perception Research

*Martin Wiener[1] (1. George Mason University (United States of America))

5:30 PM - 5:45 PM JST | 8:30 AM - 8:45 AM UTC

[S4-02]

Is Time Special?

*Martin Wiener[1] (1. George Mason University (United States of America))

5:45 PM - 6:00 PM JST | 8:45 AM - 9:00 AM UTC

[S4-03]

Of time and memory in cognitive neurosciences: how the observer flaws our understanding of time

*Virginie van Wassenhove[1] (1. CEA NeuroSpin; INSERM Unicog; Univ. Paris-Saclay (France))

6:00 PM - 6:15 PM JST | 9:00 AM - 9:15 AM UTC

[S4-04]

Temporality and the brain: the long and winding emergence of time in cognitive neuroscience

*Ayelet N Landau[1,2] (1. Hebrew University of Jerusalem (Israel), 2. University College London (UK))

6:15 PM - 6:30 PM JST | 9:15 AM - 9:30 AM UTC

[S4-05]

Measuring the neural clocks: fifteen years of timing neurophysiology

*Hugo Merchant[1], Germán Mendoza[1], Oswaldo Pérez[1] (1. Instituto de Neurobiologia, UNAM, campus Juriquilla (Mexico))

Symposium | Mammalian Brain

Fri. Oct 17, 2025 9:00 AM - 10:30 AM JST | Fri. Oct 17, 2025 12:00 AM - 1:30 AM UTC Room 1(Mathematical Science Building)

[S1] Symposium 1 :Time and Rhythm in the Mammalian Brain

Chair:Sonja Kotz(Maastricht University), Teresa Raimondi (Sapienza University of Rome)

Time and rhythm, the structured recurrence of events in time, orchestrate multiple functions in animal and human life, from oscillations in physiology, to gait patterning and social interaction. Despite their central role, the biological roots and evolution of time and rhythmicity remain only partially understood. This symposium will illuminate time and rhythm's multifaceted nature through an integrative, comparative framework, bridging proximate mechanisms and evolutionary explanations.
A central premise is that time and rhythm are not unitary phenomena but units of dissociable behavioral and neural modules. A comparative approach can dissect time and rhythm into components and trace their presence across taxa. Identifying homologies and analogies in temporal and rhythmic behavior allows reconstruction of their phylogenetic history and evolutionary significance.
However, isolated top-down (neurobiological) and bottom-up approaches have limitations. Top-down approaches identify brain modules enabling time and rhythm but are often ecologically limited and invasive. Bottom-up approaches detail observable output and ecological relevance but are a "black box" regarding proximate evolutionary causes, challenging phylogenetic tracing.
This symposium advocates for an integrative approach synthesizing both perspectives. Non-human animal models can reveal proximate neural and physiological mechanisms and ultimate causes (e.g., ecological pressures, communication, social dynamics) shaping the evolution of time and rhythm. Rodents and primates offer insights into convergent and divergent temporal and rhythmic behavior via phylogenetic and ethological proximity, respectively.
With this symposium, we pursue the following key objectives:
1. Fostering Interdisciplinary Dialogue: To bring together leading researchers from diverse fields including cognitive neuroscience, neurophysiology, comparative psychology, and ethology in a dialogue between mechanistic and evolutionary viewpoints.
2. Reviewing Current Advances: To provide a comprehensive overview of the most recent and innovative advances in experimental paradigms that link observed behavior to underlying brain activity across a wide range of species.
3. Catalyzing Future Research: To identify and catalyze promising new research directions and methodologies by highlighting both the conserved and unique aspects of timing and rhythmicity across different species.
4. Constructing a Comprehensive Framework: To collaboratively construct a more comprehensive and biologically grounded framework for understanding time and rhythm by recognizing their inherent architecture, remarkable evolutionary plasticity in response to diverse selective pressures, and fundamental role in coordinating the lives of animals, including humans.

9:00 AM - 9:30 AM JST | 12:00 AM - 12:30 AM UTC

[S1-01]

Time and Rhythm in the Mammalian Brain

*Sonja A Kotz[1], Teresa Raimondi[2] (1. Maastricht University (Netherlands), 2. Sapienza University of Rome (Italy))

9:30 AM - 9:45 AM JST | 12:30 AM - 12:45 AM UTC

[S1-02]

Tick-Tock Across Species: Comparative timing in audition

*Sonja A Kotz[1] (1. Maastricht University (Netherlands))

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[S1-03]

When reward is right, macaques can have rhythm

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[S1-04]

Rhythmic synchronization ability of rats

*Reo Wada[1], Hiroki Koda[1] (1. The University of Tokyo (Japan))

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[S1-05]

Emergence of rhythm during sequential tapping in chimpanzees and humans

*Yuko Hattori[1] (1. Kyoto University (Japan))

Time and Rhythm in the Mammalian Brain

*Sonja A Kotz[1], Teresa Raimondi[2]

1. Maastricht University, 2. Sapienza University of Rome

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Keywords: Time, Rhythm, Synchronization, Oscillation, Evolution

Tick-Tock Across Species: Comparative timing in audition

*Sonja A Kotz[1]

1. Maastricht University

Exploring basic timing and subjective rhythms comparatively is crucial for understanding the neural mechanisms underlying auditory processing and cognition. Our studies reveal that even at a fundamental level (auditory thalamus, MGB), the processing of temporal regularity aligns in rats and humans, highlighting the MGB' s importance in adaptive auditory filtering of spectrotemporal signal quality. Furthermore, comparative research between macaques and humans demonstrates shared neural oscillations for tracking, anticipating, and attending to temporal regularities, suggesting a conserved evolutionary basis for this ability. Investigating these basic timing mechanisms and their potential link to subjective rhythmic experiences therefore can illuminate the evolution of complex cognitive functions related to temporal processing across species.

Keywords: evolution

When reward is right, macaques can have rhythm

*Hugo Merchant[1], Ameyaltzin Castillo-Almazán[1], Pablo Márquez[1], Vani Rajendran[1]

1. Instituto de Neurobiologia, UNAM, campus Juriquilla

A large set of new behavioral and electrophysiological studies support the notion that monkeys are not only able to perceive and synchronize to an isochronous metronome but also to more complex inputs. EEG studies in the Rhesus monkey have shown that macaques produce evoked potentials linked to subjectively accented 1:2 and 1:3 rhythms from auditory metronomes. In addition, monkeys trained on tapping tasks can flexibly and predictively produce periodic intervals in synchrony with auditory and visual metronomes, can continue tapping without sensory cues, and can even consistently tap to the subjective beat of music excerpts.
Hence, macaques extract a rhythm from a continuous stream of sensory events, generate an internal rhythmic signal that predicts future beat events, and produce anticipatory motor commands such that movements slightly anticipate the next rhythm. Crucially, reward is a fundamental element so that monkeys can properly drive their predictive abilities within these tasks.

Keywords: rhythm, macaques

Rhythmic synchronization ability of rats

*Reo Wada[1], Hiroki Koda[1]

1. The University of Tokyo

Studying how animals perceive and respond to rhythm is important for understanding the evolutionary origins of musical abilities. Rhythmic synchronization, where animals coordinate their movements with a rhythmic stimulus, is one way to examine rhythmic cognition and is thought to be accompanied by vocal learning ability. Recent studies suggest possible rhythmic synchronization in rats, a non-vocal learning animal, but different tasks and limited findings make species comparisons difficult. Here, we employed an approach similar to that for other species and investigated whether rats also spontaneously synchronize their tapping with a rhythmic auditory stimulus. The results showed that rats responded synchronously to stimulus presentation in the fast-tempo condition. This finding suggests that non-vocal learning species, such as rats, can synchronize external rhythm only when the tempo of the rhythm is close to the tempo of their movement.

Keywords: Rhythmic synchronization, rats

Emergence of rhythm during sequential tapping in chimpanzees and humans

*Yuko Hattori[1]

1. Kyoto University

Both humans and non-human animals are known to spontaneously generate motor rhythms when controlling temporally sequential movements, such as walking or speaking. However, most previous studies on motor-related rhythms have primarily focused on externally guided synchronization, leaving the properties of rhythms that emerge spontaneously during motor learning, especially in non-human animals, largely unexplored.
In this study, I examined the spontaneous generation of motor rhythms in chimpanzees and humans as they learned to perform sequential key-tapping tasks. By comparing the rhythmic characteristics between the two species, I aim to shed light on the evolutionary pathway of rhythm generation abilities during motor learning and explore uniquely human mechanisms underlying this capacity.

Keywords: chimpanzees, tapping

Symposium | Healthy and Pathological Aging

Fri. Oct 17, 2025 5:15 PM - 6:45 PM JST | Fri. Oct 17, 2025 8:15 AM - 9:45 AM UTC Room 3(East B1)

[S3] Symposium 3: Towards a comprehensive understanding of time processing changes in healthy and pathological aging

Chair:Thomas Hinault(INSERM)

Time processing, the ability to process and memorize temporal information, is essential for cognitive functioning and supports the seamless execution of many of life's daily tasks. While cognitive aging is typically associated with changes in attention and memory, mounting evidence indicates distinct alterations in time processing in older age. These changes in time processing are exacerbated in pathological aging, including neurodegenerative conditions such as Alzheimer's disease and semantic dementia.
Research exploring interindividual differences in time processing with advancing age, and their underlying neural substrates, are crucial to inform our understanding of trajectories of healthy aging, as well as to improve the early detection of neurodegenerative disorders. Moreover, understanding the cognitive mechanisms driving age-related changes in time processing has the potential to improve our capacity to intervene and support older individuals to live well. In turn, investigating healthy and pathological aging trajectories can inform current neurocognitive models of time processing.
To address these questions, this symposium brings together a panel of diverse speakers from three different countries who will discuss recent developments in the cognitive neuroscience of time processing. Our objective is to provide a comprehensive overview of the neurocognitive mechanisms underpinning altered time processing in healthy and pathological aging, and to promote multidisciplinary collaboration to inspire new directions for future research.

5:15 PM - 5:30 PM JST | 8:15 AM - 8:30 AM UTC

[S3-01]

Towards a comprehensive understanding of time processing changes in healthy and pathological aging

*Thomas Thierry Hinault[1] (1. U1077 Inserm (France))

5:30 PM - 5:45 PM JST | 8:30 AM - 8:45 AM UTC

[S3-02]

Aging effects on the neural bases of temporal processing

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[S3-03]

Electrophysiological signature of explicit and implicit timing in young and older adults

*Giovanna Mioni[1], Fiorella del Popolo Cristaldi[1], Luigi Micillo[1], Nicola Cellini[1] (1. Department of General Psychology, University of Padova (Italy))

6:00 PM - 6:15 PM JST | 9:00 AM - 9:15 AM UTC

[S3-04]

Time processing in prodromal stages of Alzheimer's Disease

*Alice Teghil[1] (1. Sapienza University of Rome (Italy))

6:15 PM - 6:30 PM JST | 9:15 AM - 9:30 AM UTC

[S3-05]

Temporal processing disturbances in the dementias – from mechanisms to management

*Muireann Irish[1] (1. The University of Sydney (Australia))

Towards a comprehensive understanding of time processing changes in healthy and pathological aging

*Thomas Thierry Hinault[1]

1. U1077 Inserm

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Keywords: Cognitive Aging, Alzheimer’s disease, Mental time travel, Duration Processing, EEG

Aging effects on the neural bases of temporal processing

*Thomas Thierry Hinault[1]

1. U1077 Inserm

While behavioral studies have been conducted to specify age-related changes of time perception and the temporal structuration of memory content, the neural bases underlying these changes remain unknown. The TIMES project is currently investigating age-related changes in the neural mechanisms underlying temporal processing using simultaneous electroencephalography and functional magnetic resonance imaging (EEG-fMRI), in healthy young (20-35 years) and healthy older participants (60-75 years). In this talk, I will present preliminary results showing that individual levels of fronto-parietal theta-gamma synchrony are associated with the activity of the striatum and fronto-striatal functional connectivity couplings. These fronto-parietal theta-gamma couplings show a greater variability as a function of decreased striatal activity in older adults. By applying multiscale modelling to investigate network dynamics association with temporal processing, new insights can be obtained on both the evolution of the neural bases of temporal processing with advancing age and the heterogeneity of aging trajectories across individuals.

Keywords: aging

Electrophysiological signature of explicit and implicit timing in young and older adults

*Giovanna Mioni[1], Fiorella del Popolo Cristaldi[1], Luigi Micillo[1], Nicola Cellini[1]

1. Department of General Psychology, University of Padova

Age-related changes in temporal processing are widely reported, but it remains debated whether they result from a slowing of temporal processing or reduced cognitive functioning in older adults. This study examined electrophysiological signatures of explicit and implicit timing using EEG, focusing on CNV, N1/P2 amplitude, and beta band modulation. Young and older adults (N = 26) completed time bisection (explicit) and foreperiod (implicit) tasks. Results showed no significant CNV or N1/P2 differences between tasks in older adults. However, younger adults exhibited larger CNV amplitudes than older adults for supra-second intervals in the explicit task and for all intervals in the implicit task.
Additionally, younger participants showed greater beta desynchronization for all intervals in the implicit task. These findings suggest age-related differences in temporal processing, with younger adults displaying stronger neural engagement, particularly in implicit timing.

Keywords: aging, EEG

Time processing in prodromal stages of Alzheimer’ s Disease

*Alice Teghil[1]

1. Sapienza University of Rome

While impaired time processing is common in Alzheimer’ s Disease (AD), research on duration perception in early disease stages, such as Mild Cognitive Impairment (MCI), has yielded mixed results.
In this talk, I will present evidence that subtle alterations in duration processing may occur early in AD, as reduced performance in retrospective timing and temporal learning tasks already emerges in MCI. Differences in timing performance relative to healthy older adults are also found in Subjective Cognitive Decline (SCD), a preclinical phase of AD characterized by a self-perceived change in cognitive performance not revealed by neuropsychological tests. Recent results show that changes in duration processing in SCD are further modulated by the level of cognitive complaint, and are paralleled by time-dependent alterations in autobiographical memory. Findings shed light on factors underlying altered time perception in prodromal AD, and on the contribution of duration processing to episodic features of memory.

Keywords: Alzheimer’ s Disease

Temporal processing disturbances in the dementias –from mechanisms to management

*Muireann Irish[1]

1. The University of Sydney

Humans possess the remarkable capacity to navigate mentally through extended periods of subjective time. This capacity bestows immense flexibility in our thinking, enabling us to revisit events from the past via autobiographical memory, or to project oneself into the future via episodic foresight. There is now abundant evidence to indicate that these temporally extended voyages across past and future contexts are compromised in neurodegenerative disorders, reflecting the breakdown of large-scale brain networks implicated in memory, planning, and executive function. In this talk, I will provide an overview of mental time travel disturbances in frontotemporal dementia, semantic dementia, and Alzheimer’ s disease, paying particular attention to their respective underlying neurocognitive mechanisms. I will demonstrate how mental time travel disturbances likely represent a transdiagnostic feature of dementia, and how we can use this information to support many of the behavioural and functional impairments experienced by patients in their daily lives.

Keywords: Alzheimer’ s disease

Symposium | Temporal Metacognition

Fri. Oct 17, 2025 9:00 AM - 10:30 AM JST | Fri. Oct 17, 2025 12:00 AM - 1:30 AM UTC Room 2(West B1)

[S2] Symposium 2: Watching the Clock Err: Different Levels of Explanation for Temporal Metacognition

Chair:Tutku Oztel(George Mason University)

Recent studies have demonstrated that the scope of the metacognitive abilities can be expanded to time and other metric domains, reflected in a trial-by-trial match between timing errors and error monitoring components. This reveals a robust temporal error monitoring ability that can also be observed in numerosity and spatial forms. The symposium aims at providing an extensive discussion on different levels of explanation of temporal error monitoring by bringing together speakers that employ diverse methodologies in humans, rodents, and computational modeling. The first speaker will discuss how different methodological approaches can capture differential cognitive/phenomenological aspects of the metric error monitoring ability and shed light into our understanding of it at the cognitive level. The second speaker will discuss how this ability takes place at the computational level along with providing insights on its manifestation in mouse behavior. The last speaker will discuss how domain generality of temporal error monitoring can be investigated with motor action taking along with its physiological markers. While aiming at providing different methodological and theoretical approaches for the study of temporal error monitoring, this symposium series would be of particular interest for all researchers who aim to study time perception and magnitude representations at the consciousness level.

9:00 AM - 9:30 AM JST | 12:00 AM - 12:30 AM UTC

[S2-01]

Watching the Clock Err: Different Levels of Explanation for Temporal Metacognition

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[S2-02]

Cognitive Architecture Through Methodological Lenses: Understanding Temporal Error Monitoring

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“Catching yourself trip” on timing errors

*Fuat Balci[1] (1. University of Manitoba (Canada))

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[S2-04]

Exploring the Domain-Generality of Temporal Metacognition: From introspective reaction time to confidence in explicit timing

*Nathalie Pavailler[1] (1. CEA/DRF/Inst. Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; Université Paris-Saclay, Gif/Yvette, 91191 France (France))

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Keywords: Temporal Error Monitoring, Metacognition, Time Perception, Levels of Processing

Cognitive Architecture Through Methodological Lenses: Understanding Temporal Error Monitoring

*Tutku Oztel[1]

1. George Mason University

Recent research indicates that error monitoring abilities extend to the metric domains of time, space, and number. In this talk, I will discuss our current understanding of metric/temporal error monitoring (TEM) by elucidating how diverse methodologies shape it.
First, I will focus on explicit measures of assessing TEM, delineating online and offline measurement. I will first discuss the discovery of phenomenological dissociation of timing error magnitude and direction within online measures. I will then identify key factors for monitoring cumulative timing errors within offline measures. Next, I will elaborate on TEM's application to non-motor timing, discussing how non-motor temporal biases are represented on a hypothetical mental timeline in temporal order judgment and why contextual temporal biases are exempt from metacognitive monitoring. Finally, I will address implicit indications of TEM through Bayesian integration of social cues in numerosity estimation. I will conclude by discussing implications for future investigations of TEM.

Keywords: Temporal Error Monitoring

“Catching yourself trip” on timing errors

*Fuat Balci[1]

1. University of Manitoba

Recent evidence shows that humans and rats can monitor their timing errors, namely “temporal error monitoring”. In the first part of this talk, I will present new evidence corroborating these observations in two mice studies. First study shows monitoring of temporal control, forming a rudimentary temporal error monitoring. The second study demonstrates a refined magnitude-based error monitoring. Together, these results demonstrate the nested architecture of temporal awareness. Next, I will present two drift-diffusion models of temporal error monitoring. First model affords the etrospective detection of timing errors, whereas the second model reads out and anticipates timing errors. Notably, second model affords the translation of real-time error signals into improved timing without violating psychophysical features of timing behavior. Finally, the task representation dependency of the refinement element accounts for the widely reported reward-rate maximizing timing behavior. Ultimately, this talk signifies the maturing empirical and theoretical scenery in temporal error monitoring research.

Keywords: Temporal Error Monitoring

Exploring the Domain-Generality of Temporal Metacognition: From introspective reaction time to confidence in explicit timing

*Nathalie Pavailler[1]

1. CEA/DRF/Inst. Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; Université Paris-Saclay, Gif/Yvette, 91191 France

Temporal metacognition refers to the ability to monitor and evaluate timing-related processes but whether this type of metacognition is domain-general or domain-specific is unknown. To address this question, I will present two different lines of work. In the first one, we investigated introspective reaction time (iRT) judgments and showed their reliance on multiple sources of information combining direct readouts of mental operations and inferential processes (Pavailler et al, 2025). iRT is postulated to be linked to a generic performance monitoring system, as reflected by the Error-Related Negativity recorded with EEG (Pavailler et al., in prep).
In a second line of work, we used metaperception and developed a confidence forced-choice paradigm (de Gardelle & Mamassian, 2014, 2016) contrasting temporal and visual bisection tasks. I will discuss how these two approaches contribute to a better understanding of whether temporal metacognition relies on specialized or shared cognitive and neural mechanisms.

Keywords: temporal metacognition

Symposium | Temporal Experience

Fri. Oct 17, 2025 5:15 PM - 6:45 PM JST | Fri. Oct 17, 2025 8:15 AM - 9:45 AM UTC Room 2(West B1)

[S4] Symposium 4: The Varieties of Temporal Experience: The Past, Present, and Future of Time Perception Research

Chair:Martin Wiener(George Mason University)

Time is experienced in myriad ways, between periods of high stability and instability, governing the ways in which we experience everyday moments, encode memories, make decisions, plan and organize our thoughts. The time perception researcher is thus faced with a challenge unlike other domains: whence to begin?
At the TRF2 meeting, we held a special event dedicated to the near-term goals of time perception research – the timing “moonshot”; in this symposium, we will bidirectionally extend this horizon to provide an overview of the past, the present, and the future of time perception research. That is, what does the history and emergence of timing research tell us about where it may be headed? What are the challenges, both common to other disciplines and unique to our own, in studying “time”? What answers have we achieved, with the advent of new technologies and recording techniques, and what remains unknown, or unknowable? Each of the four speakers will thus provide their own unique perspective on these questions. Unlike other symposia, the talks will be shorter in length and will be followed by a panel discussion among the speakers with a moderator and questions. The intended audience is early career scientists and students, with the goal being to help guide future inquiries and enable success, whether continuing in time perception research or exploring other domains.

5:15 PM - 5:30 PM JST | 8:15 AM - 8:30 AM UTC

[S4-01]

The Varieties of Temporal Experience: The Past, Present, and Future of Time Perception Research

*Martin Wiener[1] (1. George Mason University (United States of America))

5:30 PM - 5:45 PM JST | 8:30 AM - 8:45 AM UTC

[S4-02]

Is Time Special?

*Martin Wiener[1] (1. George Mason University (United States of America))

5:45 PM - 6:00 PM JST | 8:45 AM - 9:00 AM UTC

[S4-03]

Of time and memory in cognitive neurosciences: how the observer flaws our understanding of time

*Virginie van Wassenhove[1] (1. CEA NeuroSpin; INSERM Unicog; Univ. Paris-Saclay (France))

6:00 PM - 6:15 PM JST | 9:00 AM - 9:15 AM UTC

[S4-04]

Temporality and the brain: the long and winding emergence of time in cognitive neuroscience

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6:15 PM - 6:30 PM JST | 9:15 AM - 9:30 AM UTC

[S4-05]

Measuring the neural clocks: fifteen years of timing neurophysiology

*Hugo Merchant[1], Germán Mendoza[1], Oswaldo Pérez[1] (1. Instituto de Neurobiologia, UNAM, campus Juriquilla (Mexico))

The Varieties of Temporal Experience: The Past, Present, and Future of Time Perception Research

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Time is experienced in myriad ways, between periods of high stability and instability, governing the ways in which we experience everyday moments, encode memories, make decisions, plan and organize our thoughts. The time perception researcher is thus faced with a challenge unlike other domains: whence to begin?
At the TRF2 meeting, we held a special event dedicated to the near-term goals of time perception research –the timing “moonshot”; in this symposium, we will bidirectionally extend this horizon to provide an overview of the past, the present, and the future of time perception research. That is, what does the history and emergence of timing research tell us about where it may be headed? What are the challenges, both common to other disciplines and unique to our own, in studying “time”? What answers have we achieved, with the advent of new technologies and recording techniques, and what remains unknown, or unknowable? Each of the four speakers will thus provide their own unique perspective on these questions. Unlike other symposia, the talks will be shorter in length and will be followed by a panel discussion among the speakers with a moderator and questions. The intended audience is early career scientists and students, with the goal being to help guide future inquiries and enable success, whether continuing in time perception research or exploring other domains.

Keywords: Time Perception, Cognitive Neuroscience, History of Timing, Philosophy of Timing

Is Time Special?

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Is “time” special? The answer to this question may seem obvious to a group of timing researchers at a timing conference, but the importance of a thing can be obscured by its closeness. In this talk, I will provide a reasoned argument for why the study of time is, in fact, special and why researchers can and should focus their attention to how the brain processes and perceives intervals of time. The title of the talk also reflects the internal conflict that many researchers studying time must face: since time is such an omnipresent feature of consciousness, of what use is there in studying it at all? Are we really studying “time”, or are we using temporal behavior to study other phenomena? This talk will lay out that argument and then proceed to counter it with the alternative view that time is, in fact, special.

Keywords: time

Of time and memory in cognitive neurosciences: how the observer flaws our understanding of time

*Virginie van Wassenhove[1]

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We segment time into past, present, and future, and scale temporal phenomenologies to “now”, a lifetime or universal times. This operationalization provides a practical approach to the study of temporal cognition, but it also suggests that neural systems process information differently when it is available in the present than when it is not. In cognitive neuroscience, this operationalization also divides the study of time into timing research, which focuses on online time perception (the integration of past experiences and prior knowledge to inform expectations and future predictions) and memory research, centered on the reconstruction of past events and foresight or imagination. Interestingly, both approaches require a temporal coordinate system or reference frame for time to enable the flexible mapping of information. Yet neither domain directly tackles the issue. The physical realization of a mental time axis in the brain currently eludes existing frameworks.

Keywords: time perception

Temporality and the brain: the long and winding emergence of time in cognitive neuroscience

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Understanding how our sensory systems generate coherent experiences of the world has been an outstanding quest for centuries. Throughout history, philosophers, biologists, psychologists, and –in the past few decades - cognitive neuroscientists have sought answers to how our brain generates thinking and feeling, behavior, and consciousness. Among the most fundamental aspects of conscious experience is the perception of time. In this talk I will discuss a bias that has characterized this quest: a spatial approach to understanding the neural mechanisms of cognition. I will critically assess this emphasis, offer a historical account, and point to its tacit assumptions and limitations. I will highlight key moments when opportunities to incorporate temporal principles were overlooked. Drawing on recent examples, I will discuss the potential of integrating the temporal domain into our understanding of the brain. Finally, I will show how a temporal prism can illuminate the study of mechanisms of time perception.

Keywords: cognitive neuroscience

Measuring the neural clocks: fifteen years of timing neurophysiology

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During the last fifteen-years many laboratories across the globe have recorded the neural activity of different brain areas during timing tasks, including perceptual or motor paradigms that require processing single intervals or rhythmic sequences. A handful of time-varying signals in the discharge rate of neurons have been identified as potential neural clocks. Here, we show how the neural populations of cells in the medial premotor areas and the putamen encode different timing features during a set of timing tasks, strongly suggesting that neural sequences and state space neural trajectories are the substrate of timing and that these signals are interacting dynamically with other sensory and motor execution neural responses of the timing tasks. We are also discussing how this interval timing information needs to be integrated with the incoming neural signals of primary sensory areas to generate efficient loops, especially in rhythmic tasks.

Keywords: neural correlates