Fri. Oct 17, 2025

Oral | Timing & Time Perception

Fri. Oct 17, 2025 1:00 PM - 2:30 PM JST | Fri. Oct 17, 2025 4:00 AM - 5:30 AM UTC Room 3(East B1)

[O1] Oral 1: Timing & Time Perception

Chair:Nedim Goktepe(INM- Leibniz Institute for New Materials)

1:00 PM - 1:15 PM JST | 4:00 AM - 4:15 AM UTC

[O1-01]

Affective modulation of temporal binding using linguistic stimuli

*Felipe Toro Hernández[1], Theresa Moraes Ramalho[2], André Mascioli Cravo[2], Peter M. E. Claessens[2] (1. Graduate Program in Neuroscience and Cognition, Federal University of ABC (UFABC), São Paulo, Brazil (Brazil), 2. Center for Mathematics, Computing and Cognition, Federal University of ABC (UFABC), São Paulo, Brazil (Brazil))

1:15 PM - 1:30 PM JST | 4:15 AM - 4:30 AM UTC

[O1-02]

Causality Judgments and temporal order in individuals with Schizophrenia: a new case of time re-ordering

*Anne Giersch[1,2], Brice Martin[4,3], Cristina Rusu[1,2], Hager Guendouze[1,2] (1. INSERM (France), 2. University of Strasbourg (France), 3. Hôpital du Vinatier, Lyon (France), 4. Centre Hospitalier Drôme Vivarais (France))

1:30 PM - 1:45 PM JST | 4:30 AM - 4:45 AM UTC

[O1-03]

The human propensity for regularity extraction requires us to reconsider how we construct randomly timed stimuli

*Jelle van der Werff[1], Tommaso Tufarelli[1], Laura Verga[1], Andrea Ravignani[1] (1. Sapienza University of Rome (Italy))

1:45 PM - 2:00 PM JST | 4:45 AM - 5:00 AM UTC

[O1-04]

Moments or Continuum? Testing the Temporal Resolution of Human Anticipation

*GEORGIOS MICHALAREAS[1,2,3], David Poeppel[4], Matthias Grabenhorst[3,2] (1. Cooperative Brain Imaging Center (CoBIC), Goethe University Frankfurt (Germany), 2. Max-Planck-Institute for Empirical Aesthetics, Frankfurt (Germany), 3. Ernst Strüngmann Institute for Neuroscience in Cooperation with Max Planck Society, Frankfurt (Germany), 4. New York University (United States of America))

2:00 PM - 2:15 PM JST | 5:00 AM - 5:15 AM UTC

[O1-05]

Spatial tool use modulates time perception in near and far space

*Amir Jahanian-Najafabadi[1], Argiro Vatakis[2], Christoph Kayser[1] (1. Department of Cognitive Neuroscience, Bielefeld University (Germany), 2. Department of Psychology, Panteion University of Social and Political Sciences (Greece))

2:15 PM - 2:30 PM JST | 5:15 AM - 5:30 AM UTC

[O1-06]

Generalizing temporal perception in humans: learning transfer across interval categorization and interval identification tasks

*German Mendoza[1], Hugo Rey Andrade-Hernandez[2], Hugo Merchant[1] (1. Instituto de Neurobiología, UNAM (Mexico), 2. Maestría en Ciencias (Neurobiología), UNAM. (Mexico))

Oral | Development, Clinical

Fri. Oct 17, 2025 3:30 PM - 5:00 PM JST | Fri. Oct 17, 2025 6:30 AM - 8:00 AM UTC Room 3(East B1)

[O2] Oral 2: Decelopment, Clinical

Chair:Rafael Román-Caballero(Universidad de Granada & McMaster University)

3:30 PM - 3:45 PM JST | 6:30 AM - 6:45 AM UTC

[O2-01]

“Past is Present, and Present is Past for Me": A case report of a 21-year-old female with autism spectrum disorder and enhanced episodic memory

*Ryuta Ochi[1,2], Shigeru Kitazawa[3], Mitsuru Kawamura[2] (1. Department of Psychology, Graduate School of Letters, CHUO University (Japan), 2. Division of Neurology, Department of Internal Medicine, School of Medicine, Showa Medical University (Japan), 3. Dynamic Brain Network Laboratory, Graduate School of Frontier Biosciences, The University of Osaka (Japan))

3:45 PM - 4:00 PM JST | 6:45 AM - 7:00 AM UTC

[O2-02]

Time attitudes and psychological distress: Exploring the interface between temporal representation and affect

*Thiago Bonifácio[1], André Mascioli Cravo[1] (1. Federal University of ABC (Brazil))

4:00 PM - 4:15 PM JST | 7:00 AM - 7:15 AM UTC

[O2-03]

Victims living in the now: A developmental glimpse on time perspectives through a criminological lense

*Sebastian L. Kübel[1,2,3] (1. University of Bern (Switzerland), 2. Max Planck Institute for the Study of Crime, Security and Law (Germany), 3. University of Leiden (Netherlands))

4:15 PM - 4:30 PM JST | 7:15 AM - 7:30 AM UTC

[O2-04]

Visual attention of infants in early interactions: Comparing early processing of music and language

*Rafael Román-Caballero[1,2], Maya Psaris[2], Betania Y. Georlette[3], Mohammadreza Edalati[3], Barbara Tillmann[4], Sahar Moghimi[3], Gabriel (Naiqi) Xiao[2], Laurel J. Trainor[2], Juan Lupiáñez[1] (1. Universidad de Granada (Spain), 2. McMaster University (Canada), 3. Université de Picardie (France), 4. Université de Bourgogne (France))

4:30 PM - 4:45 PM JST | 7:30 AM - 7:45 AM UTC

[O2-05]

Visual causality detection capabilities in individuals treated for prolonged early-onset blindness

*Marin Vogelsang[1], Lukas Vogelsang[1], Priti Gupta[2], Stutee Narang[2], Purva Sethi[2], Suma Ganesh[2], Pawan Sinha[1] (1. MIT (United States of America), 2. Dr Shroff’s Charity Eye Hospital (India))

4:45 PM - 5:00 PM JST | 7:45 AM - 8:00 AM UTC

[O2-06]

Performance of late-sighted children on the temporal order judgement task

*Lukas Vogelsang[1], Priti Gupta[2], Marin Vogelsang[1], Naviya Lall[2], Manvi Jain[2], Chetan Ralekar[1], Suma Ganesh[2], Pawan Sinha[1] (1. MIT (United States of America), 2. Dr Shroff’s Charity Eye Hospital (India))

Oral | Attention, Multisensory, Time Perception

Fri. Oct 17, 2025 3:30 PM - 5:00 PM JST | Fri. Oct 17, 2025 6:30 AM - 8:00 AM UTC Room 2(West B1)

[O3] Oral 3: Attention, Multisensory, Time Perception

Chair:Yuki Murai(National Institute of Information and Communications Technology)

3:30 PM - 3:45 PM JST | 6:30 AM - 6:45 AM UTC

[O3-01]

Discrete vs. continuous timer bars: How visual segmentation shapes the perception of time "running out"

*Jasmindeep Kaur[1], Jiaying Zhao[1], Joan Danielle Ongchoco[1] (1. The University of British Columbia (Canada))

3:45 PM - 4:00 PM JST | 6:45 AM - 7:00 AM UTC

[O3-02]

Neural Dynamics of Motor-Induced Attention during the Encoding and Retention of Temporal Intervals

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

4:00 PM - 4:15 PM JST | 7:00 AM - 7:15 AM UTC

[O3-03]

The priority accumulation framework – attention in time and space

*Mor Sasi[1], Daniel Toledano[1], Shlomit Yuval-Greenberg[1,2], Dominique Lamy[1,2] (1. Tel Aviv University (Israel), 2. Sagol school of neuroscience (Israel))

4:15 PM - 4:30 PM JST | 7:15 AM - 7:30 AM UTC

[O3-04]

Multisensory Integration and Delay Adaptation in Sensorimotor Timing

*Lingyue Chen[1], Loes C.J. van Dam[1], Zhuanghua Shi[2] (1. Technische Universität Darmstadt (Germany), 2. Ludwig-Maximilians-Universität München (Germany))

4:30 PM - 4:45 PM JST | 7:30 AM - 7:45 AM UTC

[O3-05]

Memory encoding for new information, not autobiographical memory load, predicts age-related acceleration in subjective time passage over the last decade

*Alice Teghil[1,2], Sebastian Wittmann[3], Adele Lifrieri[1], Sophia Saad[3], Maddalena Boccia[1,2], Marc Wittmann[3] (1. Department of Psychology, Sapienza University of Rome (Italy), 2. Cognitive and Motor Rehabilitation and Neuroimaging Unit, IRCCS Fondazione Santa Lucia, Rome (Italy), 3. Institute for Frontier Areas of Psychology and Mental Health, Freiburg (Germany))

4:45 PM - 5:00 PM JST | 7:45 AM - 8:00 AM UTC

[O3-06]

Interference between time and space in advanced age

*Cindy Jagorska[1], Isa Steinecker[1], Martin Riemer[1] (1. Technical University Berlin (Germany))

Oral | Timing & Time Perception

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[O1-02]

Causality Judgments and temporal order in individuals with Schizophrenia: a new case of time re-ordering

*Anne Giersch[1,2], Brice Martin[4,3], Cristina Rusu[1,2], Hager Guendouze[1,2] (1. INSERM (France), 2. University of Strasbourg (France), 3. Hôpital du Vinatier, Lyon (France), 4. Centre Hospitalier Drôme Vivarais (France))

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[O1-03]

The human propensity for regularity extraction requires us to reconsider how we construct randomly timed stimuli

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Moments or Continuum? Testing the Temporal Resolution of Human Anticipation

*GEORGIOS MICHALAREAS[1,2,3], David Poeppel[4], Matthias Grabenhorst[3,2] (1. Cooperative Brain Imaging Center (CoBIC), Goethe University Frankfurt (Germany), 2. Max-Planck-Institute for Empirical Aesthetics, Frankfurt (Germany), 3. Ernst Strüngmann Institute for Neuroscience in Cooperation with Max Planck Society, Frankfurt (Germany), 4. New York University (United States of America))

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[O1-05]

Spatial tool use modulates time perception in near and far space

*Amir Jahanian-Najafabadi[1], Argiro Vatakis[2], Christoph Kayser[1] (1. Department of Cognitive Neuroscience, Bielefeld University (Germany), 2. Department of Psychology, Panteion University of Social and Political Sciences (Greece))

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[O1-06]

Generalizing temporal perception in humans: learning transfer across interval categorization and interval identification tasks

*German Mendoza[1], Hugo Rey Andrade-Hernandez[2], Hugo Merchant[1] (1. Instituto de Neurobiología, UNAM (Mexico), 2. Maestría en Ciencias (Neurobiología), UNAM. (Mexico))

Oscillatory Entrainment in Non-Deterministic Continuous Environments, Independent of Bayesian Interval Learning: Computational and Behavioral Evidence

*Elmira Hosseini[1,2], Assaf Breska[1]

1. Max-Planck Institute for Biological Cybernetics, 2. Tübingen University

Temporal prediction is essential for efficient interaction with our continuously changing environment, but previous research has focused on deterministic contexts such as isochronous rhythms, linking it to Oscillatory Entrainment (OE). However, real-world continuous streams typically lack deterministic temporal regularities (e.g. speech). Temporal prediction in uncertain environments was mostly studied for isolated intervals, supporting a Distributional Learning (DL) process. Whether and how OE or DL mechanisms drive temporal prediction in non-deterministic continuous streams remains unclear. To address this, we combined computational modeling of OE, using a simple harmonic coupled oscillator, and DL, using ideal Bayesian observer, with human behavioral experiments. Model simulations showed that in non-deterministic environments, the greater the temporal variability, the more the predictions and prediction certainties of the two models were differentiated. We designed continuous streams with low (25%) and high (50%) degrees of variability (mean rate = 1.25 Hz), for which the two models led to different predicted timepoints. In a speeded response task, we presented these streams to participants with the targets occurring at either of these predicted timepoints, an intermediate timepoint, or a late timepoint to account for hazard effects. We observed a general reduction in reaction times for later targets (hazard effect), and, critically, additional reduction in the 25% relative to 50% condition, but only for targets presented at the OE-predicted timepoint. This pattern was replicated in a second experiment in which the mean rate of the stream varied between trials (1 or 1.66 Hz), ruling out learning across trials. Overall, our findings highlight the inherent differences between the two mechanisms in handling uncertainty, and reveal the flexibility of OE in adapting to partial irregularities, and its independence from Bayesian DL.

Keywords: Temporal Prediciton, Oscillatory Entrainment, Bayesian Learning, Computational Modelling, Behavioral Study

Causality Judgments and temporal order in individuals with Schizophrenia: a new case of time re-ordering

*Anne Giersch[1,2], Brice Martin[4,3], Cristina Rusu[1,2], Hager Guendouze[1,2]

1. INSERM, 2. University of Strasbourg, 3. Hôpital du Vinatier, Lyon, 4. Centre Hospitalier Drôme Vivarais

Temporal order (TO) helps to establish causal relationships between events, but can also be reversed to match perceived causality. We explored whether mechanisms related with conscious causality-inference can induce TO reversal, by studying the relation between temporal order and causality in both neurotypicals and patients with schizophrenia (SZ). Those patients have difficulties to order events in time and often emit aberrant causality judgements. We adapted our task from the Michotte paradigm to impose distinct causality judgements.
The tasks all entailed the same trials, but different judgements. On each trial a square moved towards a second static square, which was displayed at various delays before or after the stop of the moving square (-512 ms to +512 ms). In one block participants judged to which amount the static square stopped the moving square. In another block participants judged whether the moving square caused the appearance of the static square. In a last temporal order judgement task participants pressed to the side of the first event: the stop of the moving square or the onset of the static square.
Patients with SZ (28 vs. 21 controls) were impaired at judging temporal order. In addition, neurotypicals, but not individuals with SZ, were biased to answer that the onset of the static square was the first event. Follow-up experiments in 54 neurotypicals showed this (large) bias to occur only after decisions about the static square stopping the moving one. Additional data showed the persistence of the bias after one week.

This study confirms a difficulty in temporal order processing in SZ. Most importantly, neurotypicals, but not patients with SZ, adjusted temporal order perception to causality. Given (1) the robustness of this effect, (2) the task-imposed causality (rather than causality emerging naturally), and (3) known impairments in schizophrenia, we suggest that an active re-organization of information in vision leads to temporal re-ordering.

Keywords: Temporal order judgement, causality, visual organization, schizophrenia

The human propensity for regularity extraction requires us to reconsider how we construct randomly timed stimuli

*Jelle van der Werff[1], Tommaso Tufarelli, Laura Verga, Andrea Ravignani[1]

1. Sapienza University of Rome

Rhythm as a concept is notoriously hard to define, yet all definitions seem to presuppose a categorical distinction between rhythm and its converse, temporal randomness. The two are commonly juxtaposed as separate conditions in experiments, where it is sometimes assumed that the conditions are maximally contrastive. However, different methods exist for creating temporal randomness, and so we asked: can humans distinguish between the resulting different types of randomness? And can we mathematically model how they do it?

In a finger-tapping experiment we tested humans' synchronization performance for two types of highly irregular sequences that differed only in the amount of autocorrelation between adjacent intervals. Autocorrelations are often—and sometimes unwittingly—introduced in random sequences as a result of the jittering (i.e. offsetting) of event onsets. To avoid this, one can randomly sample the intervals between event onsets, which does not result in correlated intervals.

Subjects tapped closer to the sequence tempo for event-jittered (autocorrelated) sequences than for interval-sampled (uncorrelated) ones. They also tapped more regularly in response to them. However, they did not tap more accurately for either type. The subjects thus seemed to regularize their taps towards the sequence tempo, leveraging the autocorrelations to improve their tempo estimate.

We then modelled how tempo estimation of random sequences might work for both types of sequences. Using linear statistical estimators we were able to show that the statistical advantage that the autocorrelated intervals brings when estimating tempo occurs after only two or three intervals, and that this advantage stabilizes after that.

When designing experiments, we may need to more carefully consider how temporal randomness is constructed, as temporal randomness does not seem to be unitary entity. Rather, it is a fuzzy set created by artificial methodological choices.

Keywords: temporal randomness, rhythmicity, time perception

Moments or Continuum? Testing the Temporal Resolution of Human Anticipation

*GEORGIOS MICHALAREAS[1,2,3], David Poeppel[4], Matthias Grabenhorst[3,2]

1. Cooperative Brain Imaging Center (CoBIC), Goethe University Frankfurt, 2. Max-Planck-Institute for Empirical Aesthetics, Frankfurt, 3. Ernst Strüngmann Institute for Neuroscience in Cooperation with Max Planck Society, Frankfurt, 4. New York University

When we predict *when* something will occur, do we sweep a continuous timeline or focus on a handful of privileged instants? We addressed this question in a Set-Go paradigm that orthogonally manipulated two factors. First, we shaped the time-to-event (Go-time) probability over a 0.4–1.4s time interval so that it rose linearly, fell linearly, or remained flat. Second, we discretised this time interval into 3, 5, 9, or 15 Go-time sampling points, parameterising temporal granularity from coarse to fine.

Because humans rapidly internalise a probability-density function (PDF)[1] we expected all participants to learn the rising, falling, or flat probability trend. Against this backdrop, three rival hypotheses were tested by the different sampling resolutions.First, according to the **“selective-gain hypothesis”**, widely spaced Go-times—beyond the scalar noise of interval timing (≈10 % of the interval)[2]—allow the brain to spotlight individual time points, yielding faster responses there. In contrast, the **“chunking-cost hypothesis”** suggests that sparse Go-times lead to discrete attentional episodes[3]. Transitioning between these episodes adds cognitive load and slows down responses. Finally, the **“resolution-invariant hypothesis”** proposes that the brain relies solely on the continuous PDF, regardless of sampling resolution[3].

We tested the effect of temporal granularity in both visual and auditory modalities. The results showed that Reaction Times were highly similar across sampling conditions—arguing against selective-gain or chunking processes, in the case of a small number of sampling points. Temporal anticipation was primarily driven by the event probability distribution, highlighting the importance of the macroscale characteristics of event probabilities over their temporal microstructure.

References

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2. J. Gibbon, *Psychol. Rev.* **84**, 279–325 (1977).
3. E. G. Akyürek, *Neurosci. Biobehav. Rev.* **170**, 106041 (2025).
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Keywords: Temporal resolution, Anticipation, Event probability, Sampling, Interval timing

Spatial tool use modulates time perception in near and far space

*Amir Jahanian-Najafabadi[1], Argiro Vatakis[2], Christoph Kayser[1]

1. Department of Cognitive Neuroscience, Bielefeld University, 2. Department of Psychology, Panteion University of Social and Political Sciences

In our recent research, we found that time estimation is mildly influenced by spatial distance and tool-use training in both young and older adults, using a visual time reproduction task. These findings supported the notion that time perception is linked to spatial processing and sensorimotor interactions within and beyond the peripersonal space, with effects that appear to be age-dependent. In the present study, we aimed to replicate and extend these findings by investigating whether spatial influences on time perception are task-specific and sensitive to stimulus duration. Twenty young adults performed two temporal judgment tasks (time reproduction, time bisection) before and after tool-use training. During training, participants used a mechanical grabber to grasp and move 100 objects located at a distance of 120 cm toward their body. Time stimuli, consisting of eight durations (2100–2900 ms), were presented at three distances from the body: 60 cm, 120 cm, and 240 cm. In the reproduction task, participants reproduced the durations; in the bisection task, they judged whether durations were shorter or longer than a learned standard. The results revealed consistent underestimation of intervals presented at 60 cm (near space), indicated by a reduced proportion of “long” responses compared to the 120 cm and 240 cm (far space) conditions. This suggests a distance-dependent modulation of perceived time, with time appearing to be perceived as shorter in near space. Notably, tool-use training shifted these baseline biases, indicating that sensorimotor experience can influence temporal judgments across space. These findings reinforce the idea that time perception is not purely internal but is shaped by the spatial context of sensory events and by our capacity to interact with objects in space, suggesting the plasticity of time perception in response to action and space around us.

Keywords: time perception, spatial distance, tool-use training, peripersonal space, action-perception coupling

Generalizing temporal perception in humans: learning transfer across interval categorization and interval identification tasks

*German Mendoza[1], Hugo Rey Andrade-Hernandez[2], Hugo Merchant[1]

1. Instituto de Neurobiología, UNAM, 2. Maestría en Ciencias (Neurobiología), UNAM.

Perceiving the elapse of time in the sub-second to second range is an essential ability of humans and other animal species, yet its neural bases are not well known. Some experimental paradigms have been designed to understand this cognitive function, including interval categorization and identification. The former requires assigning the intervals of a test set to short- or long-duration categories. The latter requires differentiating all the intervals based on their different durations. An intuitive idea is that the brain uses the same neural mechanism to measure time elapsed to solve both tasks. Nevertheless, some neurophysiological observations, including ours, suggest this is not the case. To analyze this possibility, we designed a learning transfer paradigm. One group of participants was intensively trained in identifying each of eight different intervals. Then, it was tested by categorizing the same intervals as short or long before and after the training. Another group was intensively trained in categorizing the intervals and was tested in identifying them before and after the training. We found that participants showed statistical trends and significant changes in performance, reaction time, accuracy, and sensitivity to certain intervals depending on the trained task. The asymmetrical effects suggested differences in the neural mechanisms recruited to categorize and identify intervals. Based on these observations and previous neurophysiological findings in humans and non-human primates, we propose neural mechanisms for interval categorization and identification.

Keywords: timing, categorization, identification, learning transfer, human psychophysics

Oral | Development, Clinical

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[O2] Oral 2: Decelopment, Clinical

Chair:Rafael Román-Caballero(Universidad de Granada & McMaster University)

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*Ryuta Ochi[1,2], Shigeru Kitazawa[3], Mitsuru Kawamura[2] (1. Department of Psychology, Graduate School of Letters, CHUO University (Japan), 2. Division of Neurology, Department of Internal Medicine, School of Medicine, Showa Medical University (Japan), 3. Dynamic Brain Network Laboratory, Graduate School of Frontier Biosciences, The University of Osaka (Japan))

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[O2-02]

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“Past is Present, and Present is Past for Me": A case report of a 21-year-old female with autism spectrum disorder and enhanced episodic memory

*Ryuta Ochi[1,2], Shigeru Kitazawa[3], Mitsuru Kawamura[2]

1. Department of Psychology, Graduate School of Letters, CHUO University, 2. Division of Neurology, Department of Internal Medicine, School of Medicine, Showa Medical University, 3. Dynamic Brain Network Laboratory, Graduate School of Frontier Biosciences, The University of Osaka

Introduction:
Some individuals with Autism Spectrum Disorder (ASD) experience sudden recall of past events, known as the “time-slip phenomenon." This phenomenon has been reported in individuals with ASD who show preserved intellectual function and exceptional memory abilities (Sugiyama 1994, 2016). Here, we report the case of a 21-year-old female with ASD and enhanced episodic memory who exhibited a unique perception of time passage.
Case Information:
The patient was a 21-year-old right-handed university student. She had a history of eating disorders since age 16 and was diagnosed with ASD at 21. Since high school, she had noticed her time perception differed from others. She described two main features: 1) past events appeared as discrete, isolated episodes, not as a continuous flow; and 2) past events felt as if they were occurring in the “present.' She also experienced involuntary, immersive recollections, as if reliving those scenes. Results:
Neuropsychological testing revealed above-average intelligence on the WAIS-Ⅳ (Full IQ: 136, VCI: 122, PRI: 118, WMI: 131, PSI: 149) and above-average memory performance on the WMS-R (General Memory: 128, Verbal Memory: 128, Visual Memory: 112, Attention: 116, Delayed Recall: 125). In a task requiring memorization of numbers randomly placed in 52 squares (Luria 1968), she encoded them within ten minutes and recalled 85% after one month. In a McTaggart’ s A series task (Tang et al. 2021; Futamura et al. under review), she correctly recognized tense differences but classified both past and future sentences as close to the "present," disregarding temporal distance. Discussions:
The patient had difficulty sensing the flow of time and distinguishing past from present. Her strong episodic memory suggests that insufficient forgetting—potentially associated with persistent focus on outdated memories and reduced adaptability (Awasthi et al., 2019)—may also disrupt the normal perception of time passage from past to present.

Keywords: perception of time passage, autism spectrum disorder, episodic memory

Time attitudes and psychological distress: Exploring the interface between temporal representation and affect

*Thiago Bonifácio[1], André Mascioli Cravo[1]

1. Federal University of ABC

This study explored the relationships between time-related attitudes, emotion regulation strategies, and psychological distress in a Brazilian sample (N = 625) using online self-report measures. Participants completed the Adolescent and Adult Time Attitudes Scale, Time Meaning and Metaphors Questionnaires, Regulation of Emotion Systems Survey, and the Depression, Anxiety, and Stress Scale (DASS-21). Bootstrapped correlation analyses showed strong positive associations between negative time attitudes, rumination, and psychological distress, especially depression. Present-negative attitudes were most strongly linked to depressive symptoms ($r = 0.62$, $p < .05$), along with general negative views of time (Meaning: $r = 0.48$; Metaphors: $r = 0.33$; $ps < .05$). In contrast, positive time attitudes correlated negatively with distress and positively with cognitive reappraisal ($r = 0.28$, $p < .05$). Random Forest regression analyses predicted psychological outcomes with modest accuracy: $R^2 = 0.24$ for anxiety (RMSE = 3.57), 0.50 for depression (RMSE = 3.91), and 0.27 for stress (RMSE = 3.46), all outperforming baseline models. Feature importance analyses identified key predictors: For anxiety: past-negative attitudes, age, and negative time metaphors. For depression: present-negative and present-positive attitudes, and general affective time evaluations. For stress: present-negative attitudes, affective time evaluations, and rumination. These results highlight the relevance of time attitudes, especially those related to the present, in the psychological well-being of adults. We suggest that time attitudes likely reflect rather than cause distress. Based on our findings, we propose two hypotheses: (1) the early marker hypothesis, where negative time attitudes may precede other symptoms; and (2) the open-window hypothesis, where time-related attitudes or beliefs offer a less stigmatizing path to early mental health interventions.

Keywords: Time attitudes, Psychological distress, Emotion regulation, Mental health

Victims living in the now: A developmental glimpse on time perspectives through a criminological lense

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The prioritization of the present has for long been considered in Criminology as the most important individual-level predictor of crime. However, time perspectives were proposed as a relatively stable personality trait. Therefore, the discipline has neglected the investigation of factors that shape such a present orientation.

Inspired by current developments in psychology, this work set out to identify environmental factors that contribute to increases in present orientation. This is done using longitudinal data from a big representative sample of Swiss adolescents.

The results identify that victims of violent crimes report more present orientation and decreased future orientation. Mediation analyses show that these changes in time perspective in response to victimization are, in turn, associated with an increased risk to commit crime.

The prioritization of the present can thus explain the prominent criminological observation that victims are more likely to offend themselves. Peer processes following victimization appear to promote the increased focus on the present. Revealing these mechanisms in the development of time perspectives that contribute to crime can inform practical interventions to reduce crime.

Keywords: time perspective, present orientation, development, crime, person-environment interactions, longitudinal structural equation models

Visual attention of infants in early interactions: Comparing early processing of music and language

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1. Universidad de Granada, 2. McMaster University, 3. Université de Picardie, 4. Université de Bourgogne

Given the immature cognitive development of newborns, caregivers naturally engage with them using distinctive ways of speaking and singing, with modified acoustic characteristics compared to adult-directed productions. These early interactions play a crucial role in building emotional and social connections and language development, although the core aspects of such interactions between infants and caregivers remain understudied. Recent evidence suggests that the rhythm of infant-directed (ID) songs helps guide infants' attention to emotionally and socially relevant facial regions. In fact, infants are more likely to look at the caregiver's eyes at the time of the strong beats of the song. In the present longitudinal study, we examined the extension of this phenomenon to ID speech and ID songs in native and non-native languages with different rhythmic patterns (stress-timed vs. syllable-timed languages; e.g., English and Spanish) throughout the first year of life (at 4, 6, and 12 months of age). Eye tracking while infants watched videos of ID speaking and singing revealed that four-month-olds' eye movements were entrained to temporal regularities in both ID songs and ID speech, in native and non-native languages. Time histograms showed that infants were more likely to look at the eyes during the beat/stressed vowels. In addition, we observed oculomotor tracking of the ID productions with time response function models. We are now examining how this rhythm tracking changes when infants are 6 and 12 months old, and how it relates to electroencephalography measures of auditory rhythm tracking. This study contributes to our understanding of the role of auditory and visual rhythmic entrainment in early language acquisition and social-affective skills.

Keywords: infant-directed singing, infant-directed speech, rhythm, visual attention, eye-tracking

Visual causality detection capabilities in individuals treated for prolonged early-onset blindness

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1. MIT, 2. Dr Shroff’ s Charity Eye Hospital

The ability to identify causal relationships between visual objects critically depends on the detection of temporal regularities in the environment. Albert Michotte’ s pioneering studies demonstrated that certain relationships between visual events lead observers to perceive them as causally linked. The ability to attribute causality in such displays emerges early in development. This raises important questions about the roots of this proficiency. Specifically, does this capacity depend on early visual experience with inter-object interactions, or is it resilient to prolonged early-onset visual deprivation? Here, we studied a unique group of children from rural India who were born blind and received sight-restoring surgeries late in childhood. These children viewed animations akin to Michotte’ s, designed to assess their ability to discriminate causal from non-causal interactions. Stimuli included one causal event ("direct launching", where one moving disk hits another, causing it to immediately continue along the same trajectory) and three non-causal events, introducing a spatial gap, a temporal gap, or both between the disks. Participants viewed one causal and one non-causal animation and selected the sequence depicting the causal interaction. Results reveal low performance immediately post-surgery but rapid and marked improvements within the first postoperative month. Interestingly, a similar trajectory of rapid improvement was observed in a separate experiment conducted with the same children, probing their sensitivity to the Gestalt principle of common fate, in which they judged the direction of visual elements moving together. To sum, these findings highlight the resilience of visual causality detection based on temporal regularities to early-onset visual deprivation, underscore the remarkable plasticity of the visual system into late childhood, and suggest a possible role for temporal processing in facilitating rapid visual development post-surgery.

Keywords: causality detection, spatiotemporal processing, late sight onset, congenital blindness

Performance of late-sighted children on the temporal order judgement task

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Determining whether visual events occur simultaneously or sequentially critically impacts perceptual inference. Simultaneity has been shown to aid object discovery, a capacity essential for newborns in making sense of their sensory environment. Here, we examined whether early visual experience is necessary to acquire temporal order judgment capabilities in the visual domain. To this end, we studied individuals with prolonged visual deprivation due to congenital cataracts who received sight-restoring surgeries later in childhood. We examined two groups: 15 late-sighted individuals assessed several years after surgery, and 13 tested pre-operatively, then one week and one month post-operatively. Additionally, 22 normally sighted, approximately blur-matched controls completed the same experiment. Participants indicated which of two briefly presented visual bars appeared first, with temporal gaps between 17 and 500ms. The results reveal that, several years post-surgery, late-sighted participants performed comparably to controls. However, performance one week and one month following surgery was indistinguishable from pre-operative levels and remained significantly below that of the long-term follow-up group. Thus, proficiency in temporal judgments develops gradually with continued visual exposure. The data also suggest that the mechanism of time-based binding may contribute to the visual learning that the late-sighted undergo. Taken together, these findings reveal that early experience is not critical for acquiring temporal order judgment capabilities and highlight the feasibility of acquiring such capabilities despite early-onset, prolonged visual deprivation. This indicates that neural plasticity for developing this ability remains available into late childhood, with important implications for understanding temporal processing, perceptual organization, and rehabilitation prospects for children treated for early blindness.

Keywords: temporal order judgements, simultaneity, late sight onset, congenital blindness, temporal processing

Oral | Attention, Multisensory, Time Perception

Fri. Oct 17, 2025 3:30 PM - 5:00 PM JST | Fri. Oct 17, 2025 6:30 AM - 8:00 AM UTC Room 2(West B1)

[O3] Oral 3: Attention, Multisensory, Time Perception

Chair:Yuki Murai(National Institute of Information and Communications Technology)

3:30 PM - 3:45 PM JST | 6:30 AM - 6:45 AM UTC

[O3-01]

Discrete vs. continuous timer bars: How visual segmentation shapes the perception of time "running out"

*Jasmindeep Kaur[1], Jiaying Zhao[1], Joan Danielle Ongchoco[1] (1. The University of British Columbia (Canada))

3:45 PM - 4:00 PM JST | 6:45 AM - 7:00 AM UTC

[O3-02]

Neural Dynamics of Motor-Induced Attention during the Encoding and Retention of Temporal Intervals

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

4:00 PM - 4:15 PM JST | 7:00 AM - 7:15 AM UTC

[O3-03]

The priority accumulation framework – attention in time and space

*Mor Sasi[1], Daniel Toledano[1], Shlomit Yuval-Greenberg[1,2], Dominique Lamy[1,2] (1. Tel Aviv University (Israel), 2. Sagol school of neuroscience (Israel))

4:15 PM - 4:30 PM JST | 7:15 AM - 7:30 AM UTC

[O3-04]

Multisensory Integration and Delay Adaptation in Sensorimotor Timing

*Lingyue Chen[1], Loes C.J. van Dam[1], Zhuanghua Shi[2] (1. Technische Universität Darmstadt (Germany), 2. Ludwig-Maximilians-Universität München (Germany))

4:30 PM - 4:45 PM JST | 7:30 AM - 7:45 AM UTC

[O3-05]

Memory encoding for new information, not autobiographical memory load, predicts age-related acceleration in subjective time passage over the last decade

*Alice Teghil[1,2], Sebastian Wittmann[3], Adele Lifrieri[1], Sophia Saad[3], Maddalena Boccia[1,2], Marc Wittmann[3] (1. Department of Psychology, Sapienza University of Rome (Italy), 2. Cognitive and Motor Rehabilitation and Neuroimaging Unit, IRCCS Fondazione Santa Lucia, Rome (Italy), 3. Institute for Frontier Areas of Psychology and Mental Health, Freiburg (Germany))

4:45 PM - 5:00 PM JST | 7:45 AM - 8:00 AM UTC

[O3-06]

Interference between time and space in advanced age

*Cindy Jagorska[1], Isa Steinecker[1], Martin Riemer[1] (1. Technical University Berlin (Germany))

Discrete vs. continuous timer bars: How visual segmentation shapes the perception of time "running out"

*Jasmindeep Kaur[1], Jiaying Zhao[1], Joan Danielle Ongchoco[1]

1. The University of British Columbia

Our lives are flooded with visual reminders of time slipping away —from ticking clocks to countdowns timers, that all depict a sense of time “running out”. In time perception, the same duration can feel longer or shorter as a function of various factors (e.g., attention, predictability) —but we know less about the factors that influence the perception of how much time is left. In visual processing, a key discovery is that while sensory input may be a continuous wash of light, what we experience —what the mind parses —are discrete objects and events. Here we explored how discreteness structures our sense of time running out. Observers completed a multi-item localization (MILO) task, where they clicked on multiple targets in a sequence. In every trial, there was a black-bordered rectangular ‘timer-bar’ initially filled with a color that emptied over a period (e.g., 3 seconds) to visually depict the passage of time. The color diminished either *continuously*, gradually and evenly depleting throughout, or *discretely*, in which the bar was segmented into discrete chunks that disappeared at regular intervals. To measure perceived urgency of time ‘running out’, we examined inter-click latencies (i.e., the time between clicks). Results revealed longer inter-click latencies for discrete (compared to continuous) timer-bars, suggesting greater urgency in the continuous case. This difference disappeared in a separate experiment, where the bar was instead filled over time continuously or discretely, with a reliable interaction between experiments —suggesting that effects could not simply have been a function of one condition being more distracting than another. Thus, discreteness may have distinct effects on our sense of time running out versus time accumulating. Segmentation in visual depictions of time depletion may make time feel more “manageable,” altering our sense of urgency in time-sensitive tasks.

Keywords: event perception, time scarcity

Neural Dynamics of Motor-Induced Attention during the Encoding and Retention of Temporal Intervals

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Accurate timing is essential for perception, decision-making, and action. Theories ranging from pacemaker-accumulator models to population dynamics converge on a key role for attention in modulating time perception. For instance, the Attentional Gate Theory (Zakay & Block, 1994) proposes that perceived duration increases with attentional allocation. Yet, how attention operates across encoding and retention phases, especially under momentary motor demands, remains less understood. To investigate this, we used a time reproduction paradigm while recording EEG, manipulating attentional load through continuous force exertion. Participants reproduced three interval durations (2, 3, or 4 seconds) under both force and no-force conditions. Linear mixed-effects modeling revealed that reproduced durations scaled with interval length ($p < .001$), indicating accurate encoding. However, reproductions were overall shorter under force ($p < .001$), especially at longer intervals (interaction $p = .002$), suggesting under-reproduction due to heightened attentional load. Variability increased with interval length ($p < .001$), in line with Weber' s Law, but was not modulated by force. EEG analyses showed that alpha (8–12 Hz) desynchronization increased with interval length, peaking just before interval offset ($p < .0001$), consistent with temporal anticipation (Rohenkohl & Nobre, 2011). Crucially, alpha desynchronization during both encoding and retention predicted the reproduced durations, particularly for longer intervals ($p < .001$). Moreover, encoding under force elicited greater alpha desynchronization in EEG channels ipsilateral to the effector hand ($p < .01$). These findings suggest that alpha oscillations mark temporal attention and support the encoding and maintenance of time across both visual and motor regions. Our results extend timing theories by showing that sustained alpha desynchronization under motor load reflects the dynamic allocation of attentional resources during temporal processing.

Keywords: Timing, Memory, Alpha desynchronization, Force exertion, EEG

The priority accumulation framework –attention in time and space

*Mor Sasi[1], Daniel Toledano[1], Shlomit Yuval-Greenberg[1,2], Dominique Lamy[1,2]

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Most visual-search theories assume that our attention is automatically allocated to the location with the highest priority at any given moment. The Priority Accumulation Framework (PAF) challenges this assumption. It suggests that attention-guiding factors determine both when and where attention is deployed. Accordingly, some events are more likely to trigger shifts of attention (“when” dimension), and the spatial distribution of these shifts depends on the priority weights that have accumulated at each location based on past and present events.
In four experiments, we tested the predictions of this hypothesis against competing accounts. We examined overt attention by recording first saccades in a free-viewing spatial cueing task. We manipulated search difficulty, cue salience, spatially specific vs. non-specific events, as well as the time interval between events.
Consistent with PAF’s predictions, only a minority of first saccades occurred early in response to the irrelevant event (attentional capture), and most occurred later, in response to the action-relevant event. In addition, we showed that for all types of events, the spatial distribution of first saccades depended on the priority accumulated at each location from previous and current events (e.g., previous target locations, cue, target-distractor similarity), with the weight of previous events increasing with search difficulty.
Our findings provide strong support for the critical predictions of PAF. By offering a mechanistic account of how visual attention is allocated in space and in time, PAF provides an integrative and parsimonious account of attentional behavior that resolves enduring controversies about the factors that guide our attention.

Keywords: Visual-search, Eye-tracking, Attention, Capture

Multisensory Integration and Delay Adaptation in Sensorimotor Timing

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Subjective time perception can shift based on how the brain integrates sensory and motor signals. When temporal discrepancies occur between an action and its sensory feedback, the brain adjusts to maintain a coherent temporal experience. Using an adaptation-test paradigm, we investigated how humans adapt to delays between actions and feedback (visual or tactile), and how the brain weights these inputs in unimodal and bimodal contexts.
Across six experiments, we introduced delays between a button press and the resulting feedback. In the adaptation phase, participants experienced either no delay or a fixed 150 ms delay. In Experiment 1 and 2, the test phase tested the after-effect with 0ms delay trials, while in Experiment 3 to 6, the delay in the test trials varied from 0 to 150 ms. We manipulated whether feedback was visual, tactile, or both. Experiments 1 and 2 investigated uni-modal adaptation to visual delays and showed that participants implicitly incorporated 40% of the 150 ms visual delay into their reproduction. Experiments 3 and 4 focussed on uni-modal tactile or visual delays and participants incorporated 69% of the delay for tactile adaptation and 48% for visual adaptation. This demonstrates a greater reliance on tactile than visual feedback in the time domain. Experiments 5 and 6 extended these findings to a bimodal visuotactile context. Here, tactile feedback again dominated when a temporal conflict was introduced between tactile and visual feedback: participants adjusted to tactile delays even when visual feedback was synchronized with the action, and vice versa no adjustment to visual delays was observed when tactile feedback was synchronized with the action.
These results suggest that delay adaptation is partial and modality-dependent, with stronger reliance on tactile feedback in both uni- and bimodal contexts. These findings indicate an integration mechanism where the brain prioritizes tactile over visual input in sensorimotor timing.

Keywords: Multisensory Integration, Delay Adaptation, Sensorimotor Timing

Memory encoding for new information, not autobiographical memory load, predicts age-related acceleration in subjective time passage over the last decade

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The widely observed phenomenon that the perceived speed of time passage over the past decade increases with chronological age has been consistently replicated across several studies in different countries. The present study aimed to investigate potential mechanisms underlying this effect, examining the role of autobiographical memory and cognitive functioning. A sample of 120 individuals aged 20-91 was assessed on subjective time perception for the preceding year and decade, the quantity and significance of autobiographical memories from those periods, and overall cognitive status. Results confirmed the age-related increase in perceived temporal acceleration over the past decade. However, no significant association was found between perceived time passage and the number or subjective value of retrieved autobiographical memories. Contrary to prevailing assumptions, older adults reported more vivid and personally meaningful recollections. Instead, reduced cognitive functioning, and specifically lower ability to form new memories as assessed through delayed memory recall, emerged as a significant mediator of accelerated time perception with age. Findings suggest that age-related cognitive decline leading to reduced ability to encode novel memories, rather than diminished autobiographical memory content, is a critical factor in the subjective experience of time compression in older adults.

Keywords: Time perception, Passage of time, Age, Cognitive functioning, Autobiographical memory

Interference between time and space in advanced age

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Perceptual interference between time and space has been reported in neonates, infants, children and young adults, but to date it is unknown how space-time interference develops in advanced age. This is unfortunate, because aging is accompanied by cognitive decline, typically encompassing spatial as well as temporal processing. Moreover, changes in temporal as well as spatial perception have been associated with pathological aging. However, as primary deficits in time and space perception could be concealed by substitution strategies, space-time interference provides an indirect way for detecting these deficits. To bridge this research gap, we conducted an experiment by testing these interference effects in older (60+) and younger (18-35) participants. For that, we asked our participants to reproduce the temporal duration or the spatial size of realistic 3D stimuli and of abstract 2D stimuli. The results show that space judgments of older versus younger adults are more affected by irrelevant temporal information (time-on-space effect), whereas the reverse space-on-time effect was not significantly different between age groups. Together, our findings provide first knowledge on the healthy development of space-time interference in advanced age.

Keywords: space-time interference, aging, virtual reality