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"

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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

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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

*Alice Teghil[1,2], Sebastian Wittmann[3], Adele Lifrieri[1], Sophia Saad[3], Maddalena Boccia[1,2], Marc Wittmann[3]

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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

*Cindy Jagorska[1], Isa Steinecker[1], Martin Riemer[1]

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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