ISCH Action TD0904
Time In MEntaL activitY: theoretical, behavioral, bioimaging and clinical perspectives (TIMELY)

TIMELY Satellite Meeting on the "Neurobiology of Time Perception: from normality to dysfunction" Seville, Spain, September 9, 2011

Organizers: Valérie Doyère (FR), Argiro Vatakis (GR), & Elzbieta Szelag (PL)

Information, Programme, & Abstract Book

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Location: This is a satellite meeting of EBBS 2011 (http://www.ebbs-seville2011.com/index.php/welcome) and will take place at the HOTEL MELIÁ SEVILLA, C/ Doctor Pedro de Castro 1, 41003 Sevilla – Spain (more information found at http://www.ebbs-seville2011.com/index.php/meeting-venue).

Participation/Admission: Free

Credits: This meetting is kindly co - supported by the EBBS.

For more information on the meeting or joining TIMELY: contact Argiro Vatakis at argiro.vatakis@gmail.com or visit www.timely-cost.eu.

TIMELY Management Structure

Grant Holder	**CSRI (GR)**
Chair	**Dr. Argiro Vatakis (GR)**
Vice chair	**Dr. Elżbieta Szeląg (PL)**
Secretary	**Dr. Georgios Papadelis (GR)**
Scientific coordinator (Yearly)	**Dr. Fred Cummins (IE)** **Dr. Mark Elliott (IE)** **Dr. John Wearden (UK)** **Dr. Dan Zakay (IL)**

ACTION GROUP 1 - *Conceptual analysis and measurement of time*

WG1a - Coordinator	**Dr. Peter Ohrstrom (DK) & Dr. Anna Eisler (SE)**
WG1a - Co-coordinator	**Dr. Valtteri Arstila (FI) & Dr. Bruno Molder (EE)**
WG1b - Coordinator	**Dr. Hedderik Van Rijn (NL)**
WG1b - Co-coordinator	**Dr. Rolf Ulrich (DE)**

ACTION GROUP 2 - *Exploring factors associated with TP variability*

WG2a - Coordinator	**Dr. George Dellatolas (FR)**
WG2a - Co-coordinator	**Dr. Joseph Glicksohn (IL)**
WG2b - Coordinator	**Dr. Anna Esposito (IT)**
WG2b - Co-coordinator	**Dr. Maria Giagkou (GR)**

ACTION GROUP 3 - *Extending time research to ecologically-valid stimuli*

WG3 - Coordinator	**Dr. Armin Kohlrausch (NL)**
WG3 - Co-coordinator	**Dr. Leon van Noorden (BE)**

ACTION GROUP 4 - *Uncovering the neural correlates of TP*

WG4a - Coordinator	**Dr. Christine Falter (UK)**
WG4 - Co-coordinator	**Dr. Virginie Van Wassenhove (FR)**
WG4b - Coordinator	**Dr. Valerie Doyere (FR)**

September 9th, 2011

8:00 – 8:15	Coffee, Registration, & Welcome
	Constructed Time **Chair: Jordi Navarra (Fundació Sant Joan de Déu, Hosp. Sant Joan de Déu, Spain)** **Discussant: Virginie van Wassenhove (NeuroSpin / Neuroimagerie Cognitive, CEA, France)** **Bruno Mölder (Inst. of Philosophy and Semiotics, Univ of Tartu, Estonia)**
8:15 – 8:45	Valtteri Arstila (Dept. of Philosophy, Univ of Turku, Finland) Why the transitivity of perceptual simultaneity should be taken seriously
8:45 – 9:15	Argiro Vatakis (Cognitive Systems Research Institute, Athens, Greece) Temporal Recalibration: Asynchronous Audiovisual Speech Exposure extends the Temporal Window of Multisensory Integration
9:15 – 9:30	*Coffee Break*
9:30 – 10:00	Toemme Noesselt (Dept. of Neurology, Otto-von-Guericke Univ, Germany) Neural Basis of Multisensory Synchrony Processing
10:00 – 10:30	Daniel Bratzke (Dept.Cognitive and Biological Psychology, Univ of Tübingen, Germany) Perceptual Learning in Research of Time Perception
	Neuropathology and Rehabilitation **Chair & Discussant: Marc Wittmann (Department of Empirical and Analytical Psychophysics, Institute for Frontier Areas of Psychology and Mental Health, Germany)**
10:30 – 11:00	Melissa J. Allman (Kennedy Krieger Institute, USA) What individuals with autism reveal about their experience and sensitivity to time
11:00 – 11:15	*Coffee Break*
11:15 – 11:45	Valérie Doyère (Center Neurosciences Paris-Sud, CNRS Univ Paris-Sud, France) Timing in an Animal Model of Huntington Disease: Presymptomatic Indicator of Alteration in Prefronto-Striatal Processing
11:45 – 12:15	Elzbieta Szelag (Lab Neuropsychology, Polish Academy of Sciences, Nencki Institute of Experimental Biology, Poland) The Application of Temporal Training in Neuropsychological Rehabilitation: Psychophysical, Electrophysiological and Neuroimaging Evidence
12:15 – 13:00	*Lunch Break*
	Networking and Modelling **Chair: Bruce L. Brown (Dept of Psychology, Queens College, USA)** **Discussant: John Wearden (Dept of Psychology, Keele Univ, UK)**
13:00 – 13:30	Armando Machado & Jeremie Jozefowiez (Inst de Educacao e Psicologia, University of Minho, Portugal) Time, Memory, and Context: SET or LeT? Place your bet.
13:30 – 14:00	Warren Meck (Dept of Psychology and Neuroscience, Duke University, USA)

	Neurobiological Models of Interval Timing
14:00 – 14:30	Hedderik van Rijn (Dept Artificial Intelligence, Univ of Groningen, Netherlands) An Integrated Theory of Prospective Time Interval Estimation: The Role of Cognition, Attention and Learning
	Closing of the Satellite Meeting

Abstracts

Valtteri Arstila (Finland)
Why the transitivity of perceptual simultaneity should be taken seriously

When two stimuli, A and B, are presented in a very brief asynchrony, people often judge them to be simultaneous. This makes it possible that there could also be a third stimulus, C, that we judge to be simultaneous with B but not A. In line with this, Sean Kelly has argued that perceptual simultaneity is an intransitive relation and that this makes it impossible to give a simple answer to the question "which events do we experience as simultaneous". On the contrary, he maintains that even though A and B seem to us simultaneous, we cannot conclude that we experienced them simultaneously. Accordingly, our reflection on our experiences does not reveal all the details of our experiences. In this talk, I will argue why it should remain an open question whether perceptual simultaneity is transitive or intransitive relation, and why addressing this question would be a fruitful empirical endeavor.

Argiro Vatakis (Greece)
Temporal Recalibration:Asynchronous audiovisual speech exposure extends the temporal window of multisensory integration

An examination was conducted regarding whether monitoring asynchronous audiovisual speech induces a general temporal recalibration of auditory and visual sensory processing. Participants monitored a background (adapting) continuous audiovisual speech/music stream. This background stream was superimposed over target simple or complex audiovisual stimuli. The background speech/music stream could either be presented in synchrony, or else with the auditory stream lagging by 300 ms. A dual task was completed: temporal order judgments regarding whether the target auditory stream or the target visual stream occurred first; monitored the background stream for targets. In two experiments, the targets were composed of simple auditory and visual stimuli with a speech/music background. The results showed that, while monitoring desynchronized speech/music, participants required a longer interval between the auditory and visual streams in order to perceive their temporal order correctly, suggesting a widening of the temporal window for audiovisual integration. Given that this outcome could have been driven by the use of speech as the background stimulus, an investigation was conducted on the consequences of monitoring asynchronous audiovisual speech on the temporal perception of simultaneously-presented vowel-consonant-vowel stimuli. Similar results were obtained suggesting that the consequences of adapting to asynchronous speech extends beyond the case of simple stimuli and can even affect the perception of more complex speech stimuli.

Toemme Noesselt (Germany)
Neural basis of multisensory synchrony processing

In our everyday life many events stimulate more than one of our sensory modalities and our brain needs to integrate or segregate the incoming information. Temporal proximity is one key factor which determines how information should be handled. In this talk I will focus on the neural basis of audiovisual synchrony processing in the human brain when confronted with simple non-semantic stimuli. In particular, the involvement of putative unisensory cortex in multisensory temporal perception will be reviewed. In addition we will focus on the temporal dynamics of these integration processes, and we will discuss whether temporal integration occurs early or late in the human brain. Finally, we will review recent animal studies on audiovisual temporal perception and compare those results with the outcomes of human studies.

Daniel Bratzke (Germany)

Perceptual learning in research of time perception

Perceptual learning is a prominent research paradigm to elucidate the mechanisms underlying the perception of time. In this paradigm, participants are usually trained to discriminate the duration of a target stimulus against the duration of a standard stimulus. For example, the target and the standard could be auditory stimuli of 220 msec and 200 msec duration, respectively. After several training sessions, participants are probed with different stimuli (e.g., stimuli with different standard durations, different sensory modalities, or different intensity characteristics) in order to examine whether the acquired performance on temporal discrimination transfers to these newly experienced stimuli. Transfer effects in this paradigm are employed to address the question whether or not range-specific timing mechanisms exist and whether timing mechanisms are amodal or not. In this talk, I will briefly review and evaluate previous and current research and the conclusions that have emerged so far from this paradigm. I will also critically review previous research methods of perceptual learning and make some suggestions on research designs, psychophysical measures of discrimination performance, and statistical issues, which may help to improve future research.

Melissa J. Allman (United States & United Kingdom)

What individuals with autism reveal about their experience and sensitivity to time

Typical infants are born with a basic ability to estimate duration and appear sensitive to the temporal properties of events in their social and non-social environments—highlighting its importance to cognitive and behavioral development, temporal competence continues to show improvements across infancy and childhood. Previous commentaries that propose aspects of the autistic phenotype might be related to anomalies in temporal competence will be outlined, and empirical evidence pertaining to timing processes in autism reviewed. Two studies of time perception in children with autistic disorder will receive particular attention (employing methods adapted from the animal laboratory): previous results from a temporal bisection task, and recent findings from a temporal ordinal comparison procedure using fMRI. It will be proponed that on the one hand, the evidence to-date is in its 'early days' and is based on a limited number of studies; yet on the other hand, the idea that autism might be related to difficulties with aspects of psychological time is feasible and garnering support. Potential implications of a 'temporal deficit hypothesis' for improving the training and treatment of individuals with autism will be highlighted.

Valérie Doyère (France)

Timing in an animal model of Huntington disease: presymptomatic indicator of alteration in prefronto-striatal processing

Prefronto-striatal circuits are thought to play a critical role in temporal processing. Huntington's disease (HD) is a neurodegenerative disease linked to an extended CAG repeat expansions within the coding region of the huntingtin gene, and results in a progressive neurodegeneration of the GABAergic medium-sized spiny neurons of the striatum. Cognitive decline and psychiatric disorders precede motor symptoms. Thus, we sought whether disruption of temporal processing in the supra-seconds range may be one of the presymptomatic impeded cognitive functions that precede motor deficits. We used a transgenic rat model of HD with 51 CAG repeats which closely resembles the human late onset HD phenotype. Supra-second temporal bisection tasks and in vivo electrophysiological studies show disruption of temporal processing related to prefronto-striatal dysfunction at a presymptomatic stage. Our results suggest that disrupted executive function may be linked to dysfunctional fronto-striatal network at a presymptomatic stage of HD.

Timing, as a presymptomatic marker of the disease, may therefore be a valid tool for testing efficiency of candidate therapeutics in the next future.

Elzbieta Szelag (Poland)
The application of temporal training in neuropsychological rehabilitation: psychophysical, electrophysiological and neuroimaging evidence

Timing provides a structure for human cognition. A developing consensus among researchers is that cognitive deficits are characterized by timing deficits. Furthermore, research indicates that specific temporal training has a great impact in neurorehabilitation. In our studies we focused on following questions: (1) can the temporal training reduce comprehension deficits in aphasic patients; (2) can temporal training ameliorate cognitive function in healthy volunteers? (3) are there any changes in brain activation following this training? The specific temporal training was applied in aphasic patients, healthy elderly volunteers or young students. In all these groups we observed significant improvements in cognitive function after temporal training. In aphasics, ameliorated auditory comprehension was evidenced. In elderly volunteers improvements were observed in associative learning, memory span, vigilance and divided attention. In young students improvements in associative learning, alertness, divided attention, short-term and working memory were accompanied by electrophysiological correlates (increased amplitude of evoked potentials 330–600 ms after stimulus presentation observed in timing task). Using fMRI, we found in young students additional activation after temporal training in right prefrontal cortex (BA 10) in timing task. These results indicate that timing studies are crucial for neurorehabilitation.

Armando Machado & Jeremie Jozefowiez (Portugal)
Time, Memory, and Context: SET or LeT? Place your bet.

I will contrast two models of how animals learn to time arbitrary events in the range of seconds to minutes. The first, Scalar Expectancy Theory or SET, is an information-processing model that has influenced significantly the psychological and neurobiological studies of timing. SET accounts well for an impressive range of results obtained with animals and humans, children and adults, under normal and abnormal conditions; it is therefore a strong and worthy null hypothesis. The alternative hypothesis is the Learning-to-Time, or LeT, model. In contrast with its rival, LeT stresses the distributed, context-dependent nature of temporal memories. In this talk I will describe the structure of each model and how it accounts for simple temporal learning tasks. Then I will summarize some experiments that tested the models' different conceptualizations of temporal memory. Finally, I will argue that the results strongly suggest that we reject the null hypothesis – perhaps like all memory, temporal memory also is context dependent.

Warren Meck (USA)
Neurobiological Models of Interval Timing

The ability of the brain to process time in the seconds-to-minutes range is a fascinating problem given that the basic electrophysiological properties of neurons operate on a msec time scale. Neuropsychological studies of subjects with damage to the basal ganglia have indicated that these structures play an important role in timing and time perception. Parkinson's patients, for example, show evidence of a slowed internal clock and the "coupling" of durations stored in temporal memory when tested off of their dopaminergic medication. These studies have shown that the normal cognitive functions of the basal ganglia are heavily dependent upon dopamine-

regulated neuronal firing in the cortex and striatum. Moreover, the electrophysiological properties of medium spiny neurons within the basal ganglia suggest that networks of these cells may serve as a coincidence detector of cortical and thalamic oscillatory/ beat frequency input in order to provide the basis for duration discrimination. Recent electrophysiological data obtained from the prefrontal/cingulate cortex and the anterior dorsal striatum indicate that spiny neurons are able to encode specific durations in their firing rate in a "perceptron-like" manner. These findings correspond well with functional neuroimaging data and lend support to striatal beat-frequency models of interval timing.

Hedderik van Rijn (Netherlands)
An Integrated Theory of Prospective Time Interval Estimation: The Role of Cognition, Attention and Learning

A theory of prospective time perception is presented that extends existing theories by incorporating it as a module in an integrated theory of cognition, allowing predictions about attention and learning. First, a time perception module is established by fitting existing datasets (interval estimation, bisection and impact of secondary tasks on attention). The module is subsequently used as a part of the ACT-R architecture to model a new experiment that combines attention, learning, dual tasking and time perception. Finally, the model predicts learning and attention in a new experiment. The model fits and predictions demonstrate that the proposed integrated theory of prospective time interval estimation explains detailed effects of attention and learning during time interval estimation.