Movement Synchronisation in Time and Space: Techniques for Data Collection and Analysis

15th July 2009, 2pm – 6:30pm
Music Department, Lille 3, Univ Lille Nord de France

This year's RPPW will host an additional half day workshop on techniques in data collection and analysis for timing and synchronisation experiments.

In the session, four researchers will present state of the art software tools and methods that have allowed them to successfully complete timing experiments requiring millisecond accuracy in presentation and capture of data.

Following the talks, hands-on sessions will allow the attendees to try out the methods themselves and learn how to incorporate them into their own experiments. In addition, motion capture experts, Qualisys, will be on hand to provide advice on capturing three dimensional movement data in synchronisation experiments.

This will be an informal workshop, allowing plenty of time for discussion and sharing of techniques between the timing research community.

QUALISYS Motion Capture Systems

UNIVERSITY OF BIRMINGHAM

Lille 3 UNIVERSITE CHARLES-DE-GAULLE

Workshop Programme

Time	Event
13:00 – 13:30	Arrival and Coffee
13:30 - 13:45	**Welcome from the RPPW Committee** *Alan Wing, Yvonne Delevoye-Turrell, Mark Elliott*
13:45 - 14:00	**Talk:** MatTAP, A Matlab toolbox for sensorimotor synchronisation experiments. *Mark T. Elliott, University of Birmingham, UK*
14:00 - 14:15	**Talk**: JaDe and the Impulsionneur: A set-up for the study of sequences of pulse intervals. *Christian Graff, Université Pierre Mendès France*
14:15 - 14:30	**Talk:** Timing sequences – trying to discriminate between power laws and non-stationary processes. *Andreas Daffertshofer, VU University Amsterdam, The Netherlands*
14:30 - 14:45	Coffee Break
14:45 - 15:00	**Talk**: SpaceTap, Recording movement responses in space and time. *Madelain Laurent, Université Lille Nord de France*
15:00 – 15:15	**Talk:** Qualisys, 3D Motion Capture
15:15 – 15:20	Transfer to Workshops

15:20 - 15:55	**Workshops:** Group A: MatTAP Group B: JaDe Group C: SpaceTap Group D: Timing Sequences
15:55 – 16:30	**Workshops:** Group A: Timing Sequences Group B: MatTAP Group C: JaDe Group D: SpaceTap
16:30 - 16:45	Coffee Break
16:45 - 17:20	**Workshops:** Group A: SpaceTap Group B: Timing Sequences Group C: MatTAP Group D: JaDe
17:20 - 17:55	**Workshops:** Group A: JaDe Group B: SpaceTap Group C: Timing Sequences Group D: MatTAP
17:55 - 18:00	**Final Comments and Close** *Alan Wing / Yvonne Delevoye-Turrell*

Talk Abstracts

MatTAP: A Matlab toolbox for sensorimotor synchronisation experiments.

Mark T. Elliott, Andrew Welchman, Alan Wing
SyMoN Lab, Behavioural Brain Sciences Centre, School of Psychology, University of Birmingham, UK.

I will present a new suite of tools for use within the MATLAB programming environment, compatible with Microsoft Windows and a range of data acquisition hardware. The MatTAP toolbox allows flexible generation of timing cues with high temporal accuracy, the capture and automatic storage of corresponding participant responses and an integrated analysis module for the rapid processing of results. A simple graphical user interface is used to navigate the toolbox and so can be operated easily by users not familiar with programming languages. However, it is also fully extensible and customisable, allowing adaptation for individual experiments and facilitating the addition of new modules in future releases.

In the workshop, participants will learn how to run sensorimotor synchronisation experiments using the software and subsequently, analyse the data. Software will be available to install on participants' own laptops, while a full setup with data acquisition hardware will also be available for demonstration.

JaDe and the Impulsionneur: A set-up for the study of sequences of pulse intervals

Christian Graff
Centre de Biologie du Comportement, Laboratoire de Psychologie et Neurocognition, Bâtiment Sciences de l'Homme et Mathématiques, Université Pierre Mendès France.

JaDe is a program for the study of phenomena that can be modeled as time point series, i.e. sequences of constant pulses. Pulses are brief events (taps, clicks, animal chirps or calls, electric-fish discharges, etc.) that are separated by variable time intervals called IPIs (Inter-Pulse Intervals). JaDe can be installed on the Java platform of any computer holding Windows XP or Vista. JaDe processes sound files in WAV-format, so it just requires the PC soundboard. An additional hardware device, called "Impulsionneur" may be plugged in place of the microphone for the acquisition of standardized finger-tapping activity, or to enter electronic pulses originating from a detector apparatus or a push-button. For sound signals, a microphone is the basic input device that can also be used as a tapping detector.

Raw sequence files can be recorded by JaDe directly. They can as well be recorded or processed by more-sophisticated audio softwares such as Audacity. JaDe's core function is a virtual Schmitt-trigger for WAV files that recognizes each brief sound event, based on its amplitude, and turns it into a standardized pulse. IPIs are then measured and their sequence saved in simple ASCII data-file. Large sets of data files in one directory may be processed together to provide one output ASCII table. Lines correspond to each sequence data-file, and columns to various statistic descriptors such as IPI mean and variance expressing tempo and regularity. ASCII data- and table- files may be processed by any statistic or spreadsheet program.

With help of a user's manual, JaDe and the associated Impulsionneur have been thoroughly used in research and in lab courses by undergraduate psychology students.

Timing sequences – trying to discriminate between power laws and non-stationary processes

Andreas Daffertshofer
Research Institute MOVE, VU University Amsterdam, The Netherlands

Timing sequences often contain long-range correlation, which are considered to reflect scale-free or power law characteristics in motor control. Yet there is an ongoing debate whether these correlations do indeed represent power laws or are a mere by-product of (deterministic) non-stationarities in the data like linear or parabolic trends, level shifts, et cetera. The latter are known to alter estimates of, for instance, spectral 1/f-distributions via periodogram methods. Several analyses will be discussed that are either (almost) invariant against non-stationary effects (e.g., detrended fluctuation analysis and wavelet-based log-scale diagrams) or rather sensitive for drift by showing large deviations of straight-line forms (e.g., rescaled adjusted range statistics). Analyses will be illustrate using data of rhythmic tapping and rhythmic isometric force production.

SpaceTap: Recording movement responses in space and time.

Laurent Madelain, Yvonne Delevoye-Turrell
Laboratoire URECA, Université Charles-de-Gaulle Lille III, Lille, France

Aim: We developed experimental paradigms to disentangle the effects of attention and motor control. The tasks used are similar to those requiring sensori-motor tapping triggered by a metronome, but considering in addition the problem of space. More specifically, subjects were required to tap a series of visual targets placed around a clock, either with the finger or with the eye.

Software: In order to quantify the space and time accuracy of the sequential tapping movements, we developed a software based on the MatTAP algorithm (Elliott et al. 2009) for the measure of timing asynchronies. As such, we have included in our Matlab algorithm the calculation of both time and space errors as well as the inter response interval (IRI). However, in addition, Space&Time uses the information about the spatial position of the target in order to define not only the asynchrony with respect to time, but also with respect to space location.

Interest: For cognitive sciences, these measures provide the means to quantify the accuracy, the efficiency and the fluency of the motor system in the planning and execution of sequential movements. It also enables to compare and to generalize theoretical interpretations from one system (eye) to another (hand), and vice versa. Thus, this approach permits to develop an integrative approach of motor behavior for attention.