

## **Life-Span Changes in Electrophysiological Patterns Associated with Temporal Discrimination**

### **Results:**

The present project aimed at investigating neural correlates of time processing in the life-span. To this aim three lines of research were carried on.

The first line concerned the development of new methodological tools for the analysis of EEG signal.

A novel channel reactivity based (CRB) method has been created for individual alpha frequency (IAF) computation. The CRB method is based on quantitative indexes and criteria and relies on task-specific alpha reactivity patterns rather than on the presence of peaks in the EEG spectrum. In order to improve time-frequency analyses of EEG data, we applied a wavelet-based methodology using a continuous wavelet transform with a complex Morlet as mother function. Furthermore, event-related potentials (ERPs) were measured using a single-trial approach to estimate the intra individual variability (IIV) of P300 parameters (latency and amplitude).

The second line identified cognitive and neural mechanisms underlying time processing in young and older adults.

The overall findings were very promising. By testing healthy subjects, we could clarify cognitive processes engaged in time processing, especially related to memory. Furthermore, by means of the EEG/ERP methodology we could elucidated the role of frontal and parietal brain regions involved in such processing, and their development and decline with age.

The third line examined cognitive performance and electrophysiological patterns associated with timing and related cognitive processes in pathological populations, such as minimal hepatic encephalopathy, Parkinson's disease, preterm newborns, and ADHD.

Both behavioral and ERP data in patients supported the hypothesis that the processing of time in the range of hundred milliseconds to few seconds is impaired in such clinical populations. Results might further have implications in the diagnostic and rehabilitation protocols.

## **Published Works:**

### *Peer reviewed publications*

- Tarantino, V.**, Ehlis, A-C., Baehne, C. G., Boreatti-Huemmer, A., Jacob, C. P., **Bisiacchi, P. S.**, & Fallgatter, A. J. (In preparation). Mechanisms of time processing in adult with ADHD: an ERP study.
- Mento, G., **Tarantino, V.**, Sarlo, M., & **Bisiacchi, P. S.** (submitted). Passive time processing: a high-density event-related potential study.
- Tarantino, V.**, Cona, G., Bianchin, M., & **Bisiacchi, P. S.** (Under revision) Monitoring mechanisms in time-based and event-based prospective memory: the influence of cue predictability.
- Schiff, S.**, D'Avanzo, C., Cona, G., Goljahani, A., Montagnese, S., Volpato, C., . . . **Bisiacchi, P.** (2014). Insight into the relationship between brain/behavioral speed and variability in patients with minimal hepatic encephalopathy. *Clinical Neurophysiology*, *125*(2), 287-97. doi: 10.1016/j.clinph.2013.08.004
- Mento, G., **Tarantino, V.**, Sarlo, M., & **Bisiacchi, P.** (2013). Automatic temporal expectancy: a high-density event-related potential study. *PLoS One*, *8*(5): e62896. doi: 10.1371/journal.pone.0062896
- Cona, G., Arcara, G., **Tarantino, V.**, & **Bisiacchi, P.** (2012). Age-related differences in the neural correlates of remembering time-based intentions. *Neuropsychologia*, *50*(11), 2692-2704. doi: 10.1016/j.neuropsychologia.2012.07.033
- Cona, G., Arcara, G., **Tarantino, V.**, & **Bisiacchi, P. S.** (2012). Electrophysiological Correlates of Strategic Monitoring in Event-based and Time-based Prospective Memory. *PLoS ONE*, *7*(2), e31659, doi:10.1371/journal.pone.0031659
- Goljahani, A., D'Avanzo, C., **Schiff, S.**, Amodio, P., **Bisiacchi, P. S.**, & **Sparacino, G.** (2012). A novel method for the determination of the EEG individual alpha frequency. *NEUROIMAGE*, *60*, 774-786.
- Chiarelli, V., El Yagoubi, R., Mondini, S., **Bisiacchi, P. S.**, & Semenza, C. (2011). The Syntactic and Semantic Processing of Mass and Count Nouns: An ERP Study. *PLoS ONE*, *6*(10), 1-15. doi: 10.1371/journal.pone.0025885
- D'Avanzo, C., **Schiff, S.**, Amodio, P., Sparacino, G. (2011). A Bayesian method to estimate single-trial event-related potentials with application to the study of the P300 variability. *Journal of Neuroscience Methods*, *198*(1), 114-124.
- Tarantino, V.**, Ehlis, A-C., Baehne, C., Boreatti-Huemmer, A., Jacob, C., **Bisiacchi, P.**, & Fallgatter, A. J. (2010). The time course of temporal discrimination: An ERP study. *Clinical Neurophysiology*, *121*,43-52.
- D'Avanzo, C., **Tarantino, V.**, **Bisiacchi, P.**, & **Sparacino, G.** (2009). A Wavelet methodology for EEG time frequency analysis in a time discrimination task. *International Journal of Bioelectromagnetism*, *11*(4); 185-188.

## **Area(s) of interest:**

Cognitive neuroscience

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