

Follow-up study on oscillatory brain activity in adolescents

The diploma thesis will be based on a study of Fehr et al. (2002) dealing with MEG power spectra differences between adolescents (13 subjects aged between 11 and 16 years) and adults (39 subjects aged between 18 and 68 years). They reported differences in the 17 previously defined frequency bands estimating absolute and relative frequency band power values from 1.5 Hz to 70 Hz. Power values were clustered and analyzed for different brain regions. The used paradigm included three conditions:

1. eyes closed/ resting condition
2. eyes open/ resting condition
3. watching a multi-stable figure attentively

In summary the results showed a negative correlation between age and absolute delta, theta, alpha-low, beta and relative alpha-low frequency bands for the adolescent group and a positive correlation between age and absolute beta-low, beta-high, gamma, relative beta-low and beta-high bands for the adults. Furthermore the relative delta power decreased with age.

According to previous studies (e.g. Thatcher et al., 1994, Somson et al., 1997 and Dierks et al., 1993) these results might be due to age-related brain maturation processes.

The diploma thesis will be based on a one-year follow-up MEG measurement of the same 13 adolescents using the above mentioned paradigm. Oscillatory brain activity and possible changes in the 17 described frequency bands will be examined again.

First, the goal will be to analyze the changes of oscillatory brain activity in the different frequency bands after one year in regard to absolute and relative power spectra. Secondly, activity of frontal, fronto-temporal, central, posterior-temporal and posterior regions will be analyzed in the source space using the high resolution of 148 MEG channels. Age-related changes in psychophysiological parameters due to brain activity are usually examined by cross section studies. Therefore the present project provides an advanced methodological and structural approach to the topic.

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Literature:

[1] Fehr, T.; Bott, C.; Haerberle, A.; Rockstroh, B. (2002): MEG power spectrum and age: Differences between adolescents and adults. In: Nowak, H.; Haueisen, J.; Gießler, F.; Huonker, R. (eds.): BIOMAG 2002 - 13th Int. Conference on Biomagnetism, Jena, Germany. Berlin, Offenbach: VDE Verlag GmbH: 320-322.

[2] Thatcher, R., W.: cyclic cortical reorganization: origins of human cognitive development. In: G. Dawson and K. Fischer (Eds.): Human Behavior and the Developing Brain (pp. 232-266). New York: Guilford, 1994.

[3] Pitzer, A.; Polich, J.: EEG, ERP's and cognitive development. Society for Psychophysiological Research-Meeting, Abstract, 1997

[4] Somsen, R.,J.,M.; Klooster, B.,J.,v.; Molen, M.,W.,v.; Leeuwen, H.,M.,P.,v.; Licht, R.: Growth spurts in brain maturation during middle childhood as indexed by EEG power spectra. Biological Psychiatry 44 (1997) p. 187-209

[5] Dierks, T.; Ihl, R.; Maurer, K.: Age-related changes of spontaneous EEG described by equivalent dipoles. International Journal of Psychophysiology 15 (1993) p. 255-261