LETTER TO THE EDITOR

Individual Brain Maturity: From Electrophysiology to fMRI

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Dosenbach et al. (2010) recently reported that individual functional brain maturity can be estimated from only 5 min of functional magnetic resonance imaging (fMRI) data at rest, explains 55% of the sample variance, and "could one day … aid in the screening, diagnosis, and prognosis of individuals with disordered brain function". Surprisingly, their report makes no reference to strikingly similar electroencephalogram (EEG) research published more than a decade ago.

In fact, speculations on 'physiological time', conceived as a proper time-scale of organismic development and related non-linearly to physical (chronological) time, have been around since early 20th century (Carrel 1931). More specifically, indices of functional brain maturation estimated from resting-state brain activity were proposed in the 1970s (Matoušek and Petersén 1973a, b). Statistical approaches at differential diagnosis of brain (dys)functions dubbed 'neurometrics' (John et al. 1977, 1988) included 'developmental equations' of frequency domain EEG-parameters validated across countries and ethnicities (John et al. 1980; Ahn et al. 1980). Similar developmental changes were subsequently reported for non-linear dynamics (Meyer-Lindenberg 1996), functional microstates (Koenig et al. 2002), or global descriptors (Wackermann and Allefeld 2009) of the EEG. Importantly, Wackermann and Matoušek (1998) proposed 'EEG age' as a reliable measure of individual brain maturation, which was based on a nonlinear relation between log-transformed frequency profiles of the resting EEG and log-transformed chronological age, and accounted for nearly 80% of the sample variance.

These important parallels support a neural origin of the hemodynamic findings published by Dosenbach et al. (2010), and raise intriguing questions regarding the physiological link between fMRI connectivity and spectral EEG composition. Discussing such questions would be in line with the fruitful tradition of brain maturation studies paying attention to historical continuity (Toga et al. 2006). Furthermore this past experience also suggests some caution regarding the claimed potential of Dosenbach et al.'s study for screening, diagnosis and prognosis of neuropsychiatric disorders. These remarks are not to relativize the innovative character of their fMRI application and the importance of their findings, but to frame them into the context of research of the last few decades.

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