

# **Towards a Psychiatric Electroencephalography: The reasons of the present deadlock as well as a documentation of controversial issues under discussion**

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The present deadlock or even paralysis of clinical electroencephalography in neuropsychiatry goes along with a general disappointment concerning promises and expectations arising from the introduction of computerized quantification techniques offered as complete systems with special software solutions.

Within the past few decades serious research has been increasingly hampered or even substituted by commerce. Retired neuroscientists who had earned their merits many years ago advertised EEG-Systems to assist or even to substitute the psychiatrist in making the “correct” diagnosis.

The following documentation of selected citations from literature comprises the period between 1987 and 2006.

It may be stated in advance that literature is rather void of arguments for justifying correlation studies between the brain-electrical activity on the one hand and behavior (including experiencing as inner behavior) on the other. This fundamental problem that has to be dealt with before starting empirical investigations is precluded from discussion up to now. Instead of, a trial- and error-strategy seems generally accepted as a substitute for this lack. It needs not to be stressed that we never will obtain insights about the relationship between the domain of **function** (represented by the EEG) and the domain of **performance** (comprising acting and experiencing) by this kind of chance-based research. Thus, stubborn empiricists who are reluctant to deal with the epistemological basis of their work (discredited by them as “metaphysical speculations” or “armchair philosophy”) should, at least, be urged to explicate their arguments in favor of a psychophysiological meaning of mere power spectrum variables.

The Task Force of the “American Psychiatric Association” stated in 1991, that *“psychiatrists hope that the successful use of q-EEG ... may be extended some day to the detection of abnormal features in such illnesses as schizophrenia and affective disorder”*.

But, only to “hope” cannot be enough. The “hoping” scientist should also take care of the unsolved problems, methodological shortcomings, and especially the basic errors, listed up chronologically in the following.

## **I Promises and Fictions:**

**“On the other hand, the advantages of this technique are sufficiently clear that in a few years its routine clinical usefulness may well be evident (Hughes JR, 1987)**

**“...these results are the first independent validation of clinical nosology.” (John ER, Prichep LS, Friedman J et al., 1988)**

**“ .. abnormal profiles distinctive for each disorder”.**

**Quantitative EEG is far superior to conventional EEG in its detection of true positives and its ability to discriminate among psychiatric disorders (John ER, 1989)**

**“Extension of the capabilities of the EEG is within easy reach, particularly once techniques are devised for automatic placement of up to 256 electrodes” (Wikswow JP, Gevins A, Williamson SJ, 1993)**

**“Q-EEG is clearly of clinical value”.**

**“The raison d’être of qEEG is to extract, in an objective and quantitative manner, those parameters of clinical EEG that are traditionally obtained by experienced electroencephalographers using unaided visual inspection”.**

**“Issues in application of “Neurometrics” arise primarily from improper application by inexperienced, untrained users.” (Duffy FH, Hughes JR, Miranda F et al. 1994)**

**“Relevant biological measurements may become invaluable adjuncts for the selection and evaluation of treatment and may minimize false starts, decrease severity and shorten duration of symptoms, and markedly reduce costs”.**

**“... of all the imaging modalities , the greatest body of replicated evidence regarding pathophysiological concomitants of psychiatric and developmental disorders has been proved by EEG and QEEG studies”.**  
**(Hughes JR. John ER, 1999)**

**“...QEEG methods offer improved efficacy of patient management and decrease the risk of ineffectual treatment or misdiagnosis”.**  
**(Hughes JR, John ER, 1999)**

## **II Disappointments**

**“EEG-based predictions were more accurate when based on DSM-I and DSM-II criteria than when based on Research Diagnostic or Feighner Criteria using the same patients” (Small JG, Milstein V, Sharpley PH et al., 1984)**

**“In fact, evidence to support the clinical use ... has not yet proved compelling ... have not adequately dealt with the issue of how much new diagnostically relevant information it really provides.” (Weiner RD, 1987).**

“Currently, however topographical mapping (TM) findings should not be used as clinical evidence for cerebral dysfunction in the absence of significant changes by routine testing”. (Fish BJ, 1987)

“However, there are no independent studies corroborating the usefulness of *Neurometrics* in the differential diagnosis of any disorder”. (Fish BJ, Pedley TA, 1989)

“However, the clinical application of EEG brain mapping is still very limited”.

“Overall, these techniques have a very limited clinical usefulness”. (AAN, Report, 1989)

“Because qEEG itself contributes only limited information of direct clinical significance, persons otherwise not qualified to perform differential diagnoses of mental disorders, are not qualified to make diagnoses with qEEG”.

“The ability of qEEG to help in the diagnosis of (non-organic disorders), such as schizophrenia or depression, is not yet established”.

“At this time, the ability of any qEEG procedure to make psychiatric diagnoses or to discriminate between various groups of psychiatric patients and normal subjects is not well established”. (APA, Report, 1991)

“”Although computerized topographical mapping was commercially developed in the 1980s, it did not obviate the need for examination of wave form morphology of the EEG traces and had little impact on clinical practice”. (Wikswa JP, Gevins A, Williamson SJ, 1993)

**“CEEG remains highly controversial in the clinical setting, with statements from individual experts and from several medical speciality societies warning against its potential for error, misinterpretation, and abuse. There is a paucity of actual data about the use and validity of CEEG in clinical practice”. (Epstein CE, 1994)**

**“However no sensitivity, specificity, or other similar accuracy measures were reported so the applicability of these general results to individual patients is unclear”. (Prichep LS, John ER, Ferris SH et al. 1994)**

**“The practical clinical problem is that even very significant between-group statistical differences on a measure do not necessarily mean that the measure is capable of classifying individuals into their respective groups with any useful degree of accuracy”. (Knott V, Bakish D, Lusk S et al., 1996)**

**“Although abnormalities have been reported repeatedly in EEG and QEEG studies of patients in the above categories, consistent patterns have not yet been discerned”. (Hughes JR, John ER, 1999)**

**“Serious controversy begins when qEEG data recorded from a patient are compared statistically with normative data bases, on the assumption that clinically significant psychiatric disturbances may be accompanied by statistically significant abnormalities in brain activity” (Coburn HL, Lauterbach EC, Boutros NN et al. , 2006)**

## Unsolved problems and shortcomings and errors

“Perhaps the most vexing problem in brain mapping is the intersubject and extrasubject reproducibility and variability”.

“...the selection of one given epoch to represent the EEG of a given subject offers many potential problems”. (Hughes, 1987)

“The portrayal of cortical landmarks ... gives the false impression that anatomic resolution to the level of a single cerebral gyrus can be accomplished”.

“The mapping of statistical measures has also been questioned, in that the establishment of a difference on statistical grounds does not necessarily imply an abnormality in a pathological sense”.

“Furthermore the compressing of many minutes of EEG data into the form of a few maps ignores the time varying nature of the EEG”. (Weiner RD, 1987)

“Up to several thousand variables have been analyzed in patients and control groups often containing fewer than 20 persons”.

“Another problem is that many EEG features are correlated. The number of statistical tests is relatively unrestricted. There is no basis for making a priori assumptions about particular quantitative features”.

“The validity of the conclusions drawn from the results of John’s studies is doubted because no relationship could be demonstrated to specific brain dysfunctions which could be used for differential diagnosis”.

“Manufacturers offer systems containing normative data from control groups and invite the user to determine the statistical significance or likelihood that a given patient belongs to a particular diagnostic group. For this approach to work in practice, however, the user must first have an

**accurate working diagnosis! Because of the circular reasoning we do not believe that this approach has either scientific or clinical value”.**

**(Fish BJ, Pedley TA, 1989)**

**“ ...the computer method has the potential drawback that only a brief segment is shown, whereas conventional EEG records display many minutes of activity ...”**

**“Unfortunately, advertisements and promotional material from some manufacturers of qEEG instruments have gone beyond the existing scientific evidence to make claims of diagnostic utility”.**

**(APA, Report, 1991)**

**“But most of the alleged abnormalities lack any definite correlation with ... Nonetheless; the interpreters of these CEEGs designated all such findings as *consistent with* or as *almost certainly due* to the presenting clinical complaint”. (Epstein CE, 1994)**

**“In QEEG, multichannel recording of the eyes-closed resting or background EEG ... a sample of ... usually 1 to 2 minutes is analyzed”.**

**(Hughes JR, John ER, 1999)**

**“The finding of a much higher abnormality rate in healthy subjects than expected by chance calls into question the statistical adequacy of the normative healthy subjects data bases and of the specific statistical procedures used to determine abnormality” (Coutin-Churchman P, Anez Y, Uzcategui M et al. . 2003).**

**“Since the spectral composition of brain electrical activity changes systematically as a function of normal aging, qEEG systems use either age-**

**stratified normative data bases ... or age regression ... to enhance sensitivity and specificity while avoiding age-related bias”.**

(Regarding this specific point one cannot restrain from referring to the compelling empirical evidence, according to which no essential EEG changes occur along with normal aging. This is one of many reasons why comparisons of an individual EEG with a normative data base must be misleading.)

**“A major problem faced by the psychiatrist wishing to assess the practical usefulness of commercial qEEG systems, is that information about most systems’ capabilities is extremely difficult to obtain. The FDA has in the past placed severe restrictions on the information available to potential users, even forbidding a listing of the specific analyses available, and the ludicrous situation has arisen wherein, even after purchasing one major system, the buyer finds no such listing in the user manual”.**

**“A partial solution would be to list each discriminant currently available and the specific literature references supporting it, but this has not been done”. (Coburn KL, Lauterbach EC. Boutros NN, 2006)**

The general impression to be gained from the citations is that EEG has reached its limits and will be replaced by other methods. By the way, it is rather funny if one asserts that an increase of electrodes up to 256 will bring the breakthrough (Wikswow et al. 1993).

Among the few articles published within the last decade two revealing reviews are to be mentioned (Hughes, 1996; Hughes and John, 1999). Obviously, they were written in order to contest the general loss of importance of and interest in the clinical EEG, negatively affecting the selling rate of their products. The arguments delivered in favor of the unchanged usefulness of the EEG in Psychiatry are disappointing scanty. Firstly, we learn that:



*“The major reason for a referral to EEG from Psychiatry is to obtain evidence of an organic etiology for mental disorder”* (Hughes, 1996). This is exactly what the German neurologist Richard Jung stated already 60 years ago. In a subsequent article the authors felt the need to enrich this meagre argument by a supposedly more impressive point:

*“As many as 64% to 68 % of EEGs in psychiatric patients provide evidence of pathophysiology and these results have additional utility beyond simply ruling out organic brain lesions”* (Hughes and John, 1999). Regrettably, nothing is said wherein this “additional utility” could consist. This informational deficit is easy to explain when one takes the methodological background of the review into account. The authors restricted themselves to a mere screening of literature, listing up every report about a relationship between a clinical diagnosis and an “EEG abnormality”. No attempt was made to weight the respective importance of these (generally not replicated) findings according to their plausibility.

Neither the unsolved, or better unsolvable problem of making the “correct” clinical diagnosis in view of competing classification systems and rules, nor the similarly unsettled problem of defining “EEG-abnormality” have been touched. Instead of a theory-driven investigation of psycho-physiological correlations the authors delivered not more than a mere listing up of abstracts, a work that could have been done by their secretary as well. Instead of scientific arguments they preferred formulations like the following: *“There is broad consensus, that ...”* . Basically, the authors admit their failure in dealing with a psychophysiological or psychiatric EEG when they resume:

*“Although abnormalities have been reported in EEG and QEEG studies of patients ... consistent patterns have not yet been discerned”*.

One hardly will dispute that this clear statement is at variance with the assertion of these (as well as other authors) of having developed the visual EEG towards a highly sophisticated computer based tool that is capable to make psychiatric differential diagnosis more objective or scientific.

To take a new run in developing EEG towards a scientific neuropsychiatrically useful tool that complies with scientific standards requires “going back to the future”. In doing so one has to reconsider both its topography and dynamics (see **Ulrich G: Psychiatric Electroencephalography, 2002**, free download from this homepage or from [www.wischsoft.de](http://www.wischsoft.de) (updated and improved English version of: Psychiatrische Elektroenzephalographie, G. Fischer, Jena 1994). Our unconventional but by no means new view on EEG being explained in detail in this book is at variance with the Mainstream as expressed by the above citations. But in the long range it seems inevitable that our psychophysiological concept will be taken up, simply because there is no alternative to it. Therewith we take up the project of Hans Berger (1920) which was interrupted from several reasons. To Berger “Psychophysiologie” – a term coined by him – consists of showing up correlations between two distinct domains of description without reducing the one in favor to the other. The empirical correlating of phenomena belonging to logical and ontological distinct categories requires an integrative theoretical frame. This frame is the premise of psychophysiology as a scientific discipline and follows from the axiom of a mutual dependence of brain and mind. But even here, we are in danger of an erroneous and misleading “Tacit assumption”, i.e. to stipulate that brains **produce** mind. If this were the case, then **function** (dealt with by physiology) would produce **performance** (dealt with by psychology). But this exactly has to be excluded on empirical grounds. The relation between: function and performance is rather one of coincidence (see H. Jackson’s “doctrine of concomitance” or A. Prinz v. Aursperg’s “Koinzidentalparallelismus”). In order to avoid the fallacy of eliminative reductionism (categorical fallacy), it is of utmost importance to always hold strictly apart these logically distinct and epistemologically incommensurable naturally given categories or “explanatory principles”.

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