logical questions about scalp potential mapping (type of projection, type of interpolation, spatial sampling . . .); (2) interpretative questions arising when one wishes to infer, from these maps, the localization of the active underlying neuronal structures; (3) improved lecture of evoked potential maps by using scalp current density (SCD) mapping. SCD maps are obtained by high-pass spatial filtering the potential maps; they display scalp sinks and sources of current; their methods of computation, properties and limitations (Perrin, 1987, 1989) are presented both from simulation models and experimental data.

In the second part of the presentation, one examines what combined studies of scalp potential and current density maps can contribute to the psychophysiology of audition. A recent model for the role of automaticity and attention in audition (Näätänen, 1990) relies on the neurophysiological mechanisms underlying three ERP responses: the N1, the Mismatch Negativity (MMN) and the Processing Negativity (PN). SCD analysis allows us to dissociate each of these responses in several subcomponents reflecting the activity of different brain generators, that could be related to specific brain functions. In addition to the classical activities in auditory areas, the N1 and MMN present sharp components over the frontal hemiscalp, that could be related to an automatic shift of attention caused by detection of a discrete stimulus (N1) or a change in a series of homogenous stimuli (MMN).

Bit-mapped ERPs (CNV Complex) in the study of cortical association area connections

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The most important current problems relative to the recording procedures and methods of analysis, including spatio/temporal topographic maps, of some cognitive event-related potentials (ERPs: CNV complex etc.) in normal and pathological conditions are discussed. After these initial premises of neurocognitive electrophysiology, the results are synthesized for 9 patients where the effects on multicomponent CNV complex formation of surgical, traumatic or spontaneous deafferentation or destruction of prefrontal cortical areas have been examined. The hypothesis is put forward that an important role is played in the genesis of several ERPs by the bidirectional homohemispheric long- and short-distance pathways which connect associative parieto-temporal and occipital cortical areas to the frontal ones. Differences in latency of 8.5–12.8 ms were measured between the post-warning auditory temporo-parieto-central N1a, N1b and the more frontal corresponding components. This time-lapse is probably accounted for by the homohemispheric transcortical conduction time (about 1 ms/cm) along essentially monosynaptic bidirectional pathways.

Physiological and psychological bases of sensory-motor and cognitive processes in children

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The ontogenetic aspects and the spatial organization of movement-related brain macropotentials recorded during the execution of a self-paced, interactive, goal-directed, skilled performance task (SPT) are reviewed. The subjects were requested to perform a self-paced left hand button press which had as a result the initiation of the sweep of an oscilloscope. The sweep had to be stopped by a right hand press within 40–60 ms from its initiation. The developmental study conducted in 119 children from the age of 6 years to adolescence has demonstrated that these potentials have a specific and independent appearance of the BP in the parietal areas and of SPP in the frontal areas after 10 years of age seems to be in relation to the structural and functional maturation of these associative areas that mature after this age and are specialized in programming, evaluation of voluntary and goal-directed behaviour and in the realization of constructive praxias and complex forms of spatial analysis and synthesis. The relationship of these brain potentials with the outcome of the performance, in terms of

target performance and level of accuracy, was present in frontal and precentral areas but not in the parietal areas. The SPP amplitude in the parietal areas does not change with the outcome of the performance, indexing more the perceptual abilities of the parietal areas while the SPP in the frontal and precentral areas marks the processes related to the evaluation of performance.

Electrophysiological study of cognitive functions in Parkinson's disease

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James Parkinson, describing the disease known under his name, said 'the senses and the intellect remain uninjured'. Indeed, we now know in Parkinson's disease there are a lot of mental disturbances, globally termed 'bradiphrenia'. Our approach to the study of bradiphrenia was represented by the Contingent Negative variation (CNV) and the P3 component of the Event-related Potentials (ERPs).

CNV and P3 were recorded, the first in 10 and the second in 18 Parkinsonian patients (PP), after a pharmacological wash-out and during L-Dopa therapy, EEG activity was recorded in C_z, P_z, P3, P4 referred to bimastoid electrodes. In PP, we have found a significantly increased amplitude of CNV during L-Dopa treatment if compared with their basal values.

Moreover, basal P3 latency of PP was significantly prolonged if compared with that of our standard group, but during dopaminergic therapy there was not a statistical difference between them.

Just to verify that P3 latency recovery was due to a specific action of L-Dopa on cognitive functions of PP and not to an aspecific activating effect on the drug, we recorded P3 in a group of 12 healthy volunteers after L-Dopa administration. In all the subjects, except one, we have found an increased P3 latency after L-Dopa.

Our results can be ascribed to a more diffuse dopaminergic deficit in PP in other systems than the nigro-striatal one.

For a better characterization of PP's cognitive disfunctions, now we intend to study the Readiness Potential (RP or BP) or Premotor Potential.

The use of spatial filtering and high resolution spectral imaging in the characterization of various components of the alpha band

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Theorizing about alpha activity may be complicated by the possibility that alpha rhythm is not a unitary phenomenon. However, distinguishing between components of alpha on the basis of their frequency alone is hampered by the observation that different subjects are characterized by alpha activity with different basic frequencies. On the other hand, the combined use of techniques that enhance the resolution of the signal in the frequency and in the spatial domain may help differentiating various components of the alpha band. This approach enables the identification of three components, that differ in terms of power, frequency, spatial distribution, and response to experimental manipulations. The advantages obtained with this approach are exemplified by a comparison of the alpha activity in young and elderly people. In fact, the alpha rhythm recorded at rest with closed eyes has been described as more anterior in elderly subjects with respect to young subjects. A component-based analysis, however, reveals that the two groups of subjects show similar components of alpha, with similar parameters. What differs between these two populations is the balance between the components: elderly subjects show a marked reduction of the posterior (occipital), while the anterior (temporal and parietal) components are relatively preserved.