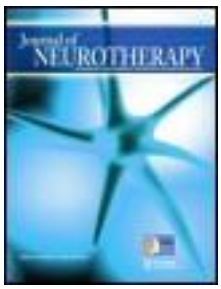

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Selected E-ISNR 2004 Conference Presentation Abstracts

Silvana Galderisi , Armida Mucci , Umberto Volpe , Lucio Vacca , Paola Bucci , Mario Maj , John Gruzelier PhD , Jochen Kaiser , Niels Birbaumer , Dietrich Lehmann & Roberto D. Pascual-Marqui PhD

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Selected E-ISNR 2004 Conference Presentation Abstracts

Emotional Processing in Subjects with Panic Disorder

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Introduction

Subjects with panic disorder (PD) have high scores on alexithymia, a tendency to interpret ambiguous stimuli as threatening and an attentional bias toward threat-related cues. Several findings suggest that a dysfunction of temporo-limbic regions, in particular those of the right hemisphere, involved in emotional processing, might underlie these characteristics (Galderisi et al., 2001).

Method

Alexithymia was evaluated by the Toronto Alexithymia Scale-20 items (TAS-20) in 17 drug-free patients with DSM-IV PD and 21 healthy comparison (HC) subjects. ERPs were recorded from 30 channels during a visual target detection task, in which stimuli with different emotional valence (neutral, erotic, threat-related and phobic) were used as distractors. The Low Resolution Electromagnetic Tomography (LORETA; Pascual-Marqui, Michel, & Lehmann, 1994) was used to identify cortical generators of the ERP P3a component for distractors.

Results

Using a cut-off of 61 for the TAS-20, alexithymia was observed in 44% of the patients with PD and in none of the HC subjects. P3a cortical

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sources for erotic versus neutral distractors revealed in HC subjects activations in the left insula, precentral and superior temporal gyrus, and right anterior cingulate; while in PD patients the activations involved the left inferior frontal and superior temporal gyrus, and a deactivation was observed in the right parieto-temporal regions. When comparing threat-related and neutral stimuli, in HC subjects no difference in P3a sources was found while in PD subjects a reduced activation of the right temporal regions was observed.

Conclusion

The results confirm the presence of a reduced activation of right hemisphere integrative areas during emotional stimuli processing in subjects with PD.

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Theta States Through Neurofeedback, Hypnosis and Energy Medicine

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First the efficacy of the enhancement of alpha theta in elevating artistry to a professionally significant degree in conservatory students was outlined, as it represents the first attempt to validate the protocol as a sole intervention. The implications were discussed of ancillary experiments designed to explore relaxation as a mediator, temporal changes in theta-alpha ratio within and between sessions, and post-training alterations of the topographical EEG. The relative influences of faster wave training on performance were also outlined. A phenomenological analysis of the musicians' experience was reviewed, and together the results were considered in the light of the historical development of alpha theta training and earlier applications aimed at treating anxiety and addiction. The limitations of our current state of knowledge about the applicability

of this paradigm were considered and open discussion was encouraged. Current knowledge about the role of theta in psychological processing was covered. Can other interventions such as autonomic biofeedback, meditation, hypnosis and energy medicine achieve similar goals? Comparative studies are underway.

Unlocking the Locked-In: Brain-Computer Communication in Paralysed Patients

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Introduction

Neurological disorders like cortico-subcortical stroke or degenerative neuromuscular diseases can lead to "locked-in" syndrome, a state of complete motor paralysis with intact sensory and cognitive functions. One of the most terrifying aspects of this syndrome is the loss of the ability to communicate.

Methods

To re-establish communication in severely paralysed patients, we have developed an EEG-based brain-computer interface. Visual feedback of electrocortical activity and operant conditioning has been combined to train patients to operate this communication device by generating shifts in their slow cortical potentials. When a patient has achieved reliable control over his/her slow cortical potential shifts, these responses can be used to select or reject items (letters, commands, links in an internet browser) presented on a computer screen.

Results

Recent progress in research on brain-computer communication in the severely paralysed includes a better understanding of the cortical mecha-

nisms underlying the voluntary production of slow cortical potential shifts. Functional magnetic resonance imaging in both healthy volunteers and patients with neurodegenerative diseases has shown that during the preparation interval preceding a required slow cortical potential shift, there were increased activations in widespread central and precentral regions. During the active phase, this was followed by distinct activation differences in the vicinity of the feedback electrode.

Conclusions

Future developments include feedback and self-regulation of regional brain activity using real-time functional magnetic resonance imaging.

EEG and ERP Microstates: The Atoms of Thought and Emotion

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Studies of human brain electric fields indicate that the "stream of consciousness" actually consists of identifiable, brief building blocks. This is based on the observation that momentary landscapes of the spatial distribution of brain electric potential change in a discontinuous manner. Short periods of quasi-stable potential landscapes (~100 ms), called 'microstates,' are concatenated by rapid transitions. Since different distributions of scalp potential must have been produced by different neural activity, different microstates can reasonably be assumed to incorporate different brain functions. In schizophrenic patients before medication, microstates of two classes (defined by potential landscapes) were shorter in duration than those of controls, suggesting precocious termination of certain classes of information processing in the patients. Moreover, sequencing of the microstates was different in the patients, suggesting deviations in "mental syntax" in schizophrenic disorder. The hypothesis that different microstates incorporate different brain functions was supported by microstate studies during spontaneous mentation (prompted reports during the "stream of consciousness") and during reading of single nouns: microstates preceding reports of spontaneous, visual imagery differed from microstates preceding reports of spontaneous, abstract thought in the same way as microstates after reading an imagery-inducing noun differed from microstates after reading an abstract thought-inducing

noun. In both experiments, LORETA functional tomography showed stronger right posterior activity for visual imagery, and stronger left anterior activity for abstract thought, regardless whether spontaneously occurring or reading-induced. These results suggest that it is promising to establish a dictionary and syntax of the microstates, the psychophysiological "atoms of thought and emotion," the building blocks of mentation.

Functional Wiring of the Brain Based on Virtually Implanted Electrodes

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Background

A large number of ERP connectivity and synchronization studies utilize measures of coherence and phase locking computed from pairs of multi-channel scalp electric potential differences. ERP signals contain information on brain activity. However, a well-known fact about the EEG/ERP inverse problem insures that the electric potential difference at a certain scalp location does not necessarily reflect the activity of the underlying cortex. In this study, electric neuronal activity is estimated with standardized low resolution brain electromagnetic tomography (sLORETA; Pascual-Marqui, 2002). These signals are then used as a basis for assessing, directly, functional intracortical connectivity.

Methods

Three-dimensional (3D) spatio-temporal signals of electric neuronal activity are estimated with sLORETA. This method is uniquely capable of exact (zero error) localization. In addition, it has the lowest spatial dispersion as compared to other published 3D linear, discrete, distributed EEG/MEG tomographies. sLORETA provides high time resolution signals of virtually implanted electrodes throughout the cortex. These 3D spatio-temporal signals are then analyzed in terms of independent components (Cardoso, 1989) with independence being forced in the time domain, not in the spatial (cortical) domain.

Results

In a hemifield visual ERP experiment, time lagged interhemispheric connections between the visual cortices are demonstrated. These results are remarkably similar to those produced by microstate segmentation modeling.

Conclusions

It may seem paradoxical that independent component analysis (ICA) should yield information on connectivity since these two concepts are quite at odds with each other. The fact is that with this implementation of ICA, independence is forced on the time series of activations, while the spatial, 3D, dimension contains the information on intracortical connections. Experimental validation has been presented for method, which proves to be a powerful tool for modeling the functional wiring of the brain.

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