Universität Zürich

Akademischer Bericht 2003

Psychiatrische Universitätsklinik Zürich:

The KEY Institute for Brain-Mind Research

Leitung in der Berichtsperiode:
Frau Dr. Kieko Kochi

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Zusammenfassung

Das mit privaten Mitteln finanzierte "KEY Institute for Brain-Mind Research" ist an der Psychiatrischen Universitätsklinik lokalisiert und mit der Klinischen Direktion von Prof. Dr. Daniel Hell assoziiert. Es führt mit dieser Direktion auch gemeinsame Projekte durch.

Im Berichtsjahr wurde die Entwicklung der LORETA-Tomographie-Methode weitergetrieben. LORETA sowie EEG-Mikrozustands-Analyse wurden zur Analyse der Hirnelektrischen Felder bei kognitiven und emotionalen Prozessen gesunder und kranker Personen angewandt.

1 Forschung

The KEY Institute for Brain-Mind Research
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(Mr) Dr. R.D. Pascual-Marqui <pascualm@key.unizh.ch>
(Mr) H. Katayama, MD, PhD <katayama@key.unizh.ch>

Überblick und Forschungstätigkeit

Members of the KEY Institute published papers in scientific journals (see listing). Several Institute members were invited to lecture at other Universities and at scientific congresses. Oral and poster reports were presented at scientific congresses (see listings).

Work on brain electric field data from schizophrenic patients was continued. EEG Microstate analysis ("atoms of thought") was done on data from productive, first episode, medication naive patients and matched controls from three collaborating institutions (in Naples, Osaka, and Berlin), and from productive, chronic patients (Moscow). LORETA tomography that permits to construct functional images of the brain from EEG data revealed, in the aberrant "atoms of thought" of the patients, increased activity maximal anterior left, in agreement with our earlier findings in an independent data set. Further work concerned the rules of sequential concatenation of the microstates ("syntax"). Systematic aberrations were observed in the patients compared to controls.

Another line of study was centered around the automatic, involuntary, nonconscious installation of information processing procedures by the brain. Normal subjects read successive words from a computer display, with the task to repeat the last word if – at random – a question mark followed the last word, thus suggesting a memory task. But, the words were (1) emotion positive or negative, or (2) imaginable or abstract. Without subjects' conscious attention to or awareness of the emotional valence or imaginability, microstate analysis identified brief post-stimulus epochs where brain activity differed as function of imaginability

(at ~280ms) or, repeatedly, of emotion content (at ~100, ~200, and 250ms). LORETA functional tomography clarified that reading abstract words automatically caused predominant left-frontal, visual words right-occipital activity. Reading emotion positive words automatically caused predominantly more anterior, negative words more posterior activity, but that in the different post-stimuls epochs lateralization of the activity switched from left to right, for both positive and negative valence.

Methodology is being developed to describe functional connectivity on the basis of brain electric data in a non-ambiguous way. Conventional computation of EEG coherence and phase angle relations between scalp locations produces ambiguous results as to brain areas, because locations on the scalp do not necessarily reflect activity from perpendicularly underlying areas (electric generators are oriented). Nonambiguous results of coherence and phase angles can be obtained employing intracerebral model generators (e.g., LORETA areas of interest) of the scalp-recorded data. The approach is being applied to data from psychotic patients, and from normals in altered states of consciousness.

New artificial neural networks are developed for improved probability density estimation and self organizing maps. Applications in structural biology by 3D-electron microscopy, and in DNA arrays are being worked out. This project is done in collaboration with the Universidad Autónoma de Madrid (UAM), the National Center for Biotechnology (CNB), and the Spanish High Research Council (CSIC): http://biocomp.cnb.uam.es/Biocomp/public/AboutUs/Activities

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Die detaillierte Beschreibung der einzelnen Projekte ist in der Forschungsdatenbank enthalten.

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2 Lehre

2.1 Studium

D. Lehmann with R.D. Pascual-Marqui, together with others: each semester, a 3-day-Block-Course on "EEG-Fields and Brain functions". The course is held at the Zurich University Center for Child and Juvenile Psychiatry, and is coordinated by PD Dr D. Brandeis.

2.2 Weiterbildung, Fortbildung

R.D. Pascual-Marqui: A one-day LORETA training course the Department of Psychology/Neuropsychology (Prof. Dr. L. Jäncke), University of Zurich, June 2003.

L.R.R. Gianotti: Elektrophysiologische und affektive Korrelate des Glaubens an paranormale Phänomene. (Dept. of Cinical Psychiatry, University of Bern, 12 May 2003).

3 Nachwuchsförderung

Dr. L.R.R. Gianotti, who has done her dissertation work at the KEY Institute for a doctoral degreee at the Faculty of Arts of the University of Zurich has been appointed Research Member at the KEY Institute.

5 Dienstleistungen

5.3 Dienstleistungen zugunsten der Öffentlichkeit

Prof. D. Lehmann presently serves on the Editorial Boards of the following scientific Journals: "Cognitive Brain Research“, "Psychiatry Research: Neuroimaging" and "Neuropsychobiology“.

6 Aussenbeziehungen

6.1 Inneruniversitäre, nationale und internationale Beziehungen in Forschung und Lehre

PD Dr. D. Brandeis
Brain Mapping Research
Department of Child and Adolescent Psychiatry
University of Zürich
Zürich, Switzerland

PD Dr. P. Brugger,
Neuropsychology Unit,
Dept. of Neurology,
University Hospital Zurich
Zürich, Switzerland

Dr. J.-M. Carazo
Deputy Director for Research
Centro Nacional de Biotecnología.
CSIC.Campus de la Universidad Autónoma de Madrid
Cantoblanco Madrid, Spain

Prof. S. Galderisi
Dept. of Psychiatry
University of Naples SUN
Naples, Italy

Prof. J. Gruzelier
Dept. of Cognitive Neuroscience and Behaviour
Imperial College of Science Technology and Medicine
London, United Kingdom

Prof. K. Hirata MD DSc
Dept. of Neurology
Dokkyo University School of Medicine
Mibu Tochigi, Japan

Prof. E.R. John
Brain Research Laboratories
School of Medicine
New York University
New York, USA

Prof. T. Kinoshita
Dept. of Neuro-Psychiatry
Kansai Medical University
Moriguchi Osaka, Japan

Dr. T. Koenig
University Hospital of Clinical Psychiatry
Bern, Switzerland

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P.D. Dr. U. Schreiter Gasser
Center of Geriatric Psychiatry (CGP)
Departement of Psychiatry
University of Zurich
Zurich, Switzerland

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Institute of Higher Nervous Activity and Neurophysiology
Russian Academy of Sciences
Moscow, Russia

M.D. Ph.D. H. Tanaka
Dept. of Neurology
Dokkyo University School of Medicine
Mibu Tochigi, Japan

M.D. Ph.D. N. Tsuno
Department of Psychiatry
Jikei University School of Medicine

Minato-ku
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Prof. D. Vaitl
Dept. of Psychobiology
University of Giessen
Giessen, Germany

Dr. J. Wackermann
Psychophysics Laboratory
Institut für Grenzgebiete der
Psychologie und Psychohygiene
Freiburg i.B., Germany

6.5 Auszeichnungen

D. Lehmann was elected "Honorary Member" of the Swiss Society of Biological Psychiatry (Feb. 2003).

8 Öffentliche Funktionen von Institutsangehörigen

8.2 Organisation von Kongressen, Kolloquien und Tagungen

Organization of a 3-day workshop (Zurich, May 10-12, 2003) on "EEG Neurofeedback Strategies and Results". Main speaker: Prof. Juri Kropotov, St. Petersburg, Russia.

8.4 Weiteres

"Invited lectures" an Kongressen

Gianotti, L.R.R., Künig G., Faber, P. Schreiter Gasser, U., and Lehmann, D. Elektroenzephalogramm bei Alzheimer-Patienten unter Rivastigmin. 4. Ord. Generalversammlung des Alzheimer Forum Schweiz, Zürich, 17 Feb. 2003.

Lehmann, D. Towards the psycho-physiological building blocks of conscious mentation: brain electric microstates. Congress "Toward a Science of Concsiousness", Prague, Czech Republic, July 6-10, 2003.

Pascual-Marqui, R.D., Esslen, M. and Lehmann, D. A new method for the computation of cortical connectivity with sLORETA (standardized low resolution brain electromagnetic tomography). 1st Annual Meeting of the European Society for Neuronal Regulation (eSNR), February 2003, Udune, Italy.

Pascual-Marqui, R.D. Exact Localization with Standardized Low Resolution Brain Electromagnetic Tomography (sLORETA). International Society for Brain Electromagnetic Topography ISBET, World Congress, November 2003, Santa Fe, USA.

Pascual-Marqui, R.D., Esslen, M., Kochi, K. and Lehmann, D. Assessment of functional brain connectivity with high time resolution sLORETA (standardized low resolution brain electromagnetic tomography). Japanese Pharmaco-EEG Group (JPEG), Annual Meeting, July 2003, Awaji Island, Japan.

Pascual-Marqui, R.D. Functional Imaging of the human brain with LORETA (low resolution brain electromagnetic tomography). Kansai Medical University, July 2003, Osaka, Japan.

"Oral presentations" an Kongressen

Gianotti, L.R.R., Faber, P.L., Pascual-Marqui, R.D., Kochi, K., and Lehmann, D. Lesen emotionaler Wörter und ERP-Mikrozustände: Drei Informations-Verarbeitungsschritte der ERP-Kartenserien unterscheiden positive von negativen Emotionen. (48. Jahrestagung der DGKN "Deutsche Gesellschaft fuer Klinische Neurophysiologie und funktionelle Bildgebung", 8-12 Oct. 2003, Freiburg i.B., Germany).

Gianotti, L.R.R., Künig, G., Faber, P.L., Pascual-Marqui, R.D., Kochi, K., Lehmann, D. and Schreiter Gasser, U. (2003). Effects of Rivastigmine medication in Alzheimer patients using frequency-domain dipole modeling and LORETA. (presented at the 12th German EEG EP Mapping Meeting, Giessen, Germany, 19-20 Sept. 2003).

Pascual-Marqui, R.D., Esslen, M., Kochi, K. and Lehmann, D. Functional Brain Connectivity with High Time Resolution sLORETA (Standardized Low Resolution Brain Electromagnetic Tomography). International Society for Brain Electromagnetic Topography ISBET, World Congress, November 2003, Santa Fe, USA.

"Poster presentations" an Kongressen

Gianotti L.R.R., Faber P.L., Pascual-Marqui R.D., Kochi K. and Lehmann D. Very early affect-modulated brain electric microstates (~100 msec) during word processing, and their functional tomography. (9th International conference on Functional Mapping of the Human Brain, New York, NY, 19-22 June 2003).

Gianotti, L.R.R., Faber, P.L. and Lehmann, D. (2003). Affective information modulates an early ERP microstate of word processing around 100 ms post-stimulus. (presented at the Joint Meeting of the Swiss Society of Neuroscience and the Swiss Society of Psychiatry and Psychotherapy, Fribourg, Switzerland, 18 Jan. 2003).

Gianotti, L.R.R., Lehmann, D., Faber, P.L., Galderisi, S., Hermann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G., and Koenig, T. Syntax of EEG microstates in acute, medication-naïve, first episode schizophrenia. (presented at the Joint Meeting of the Swiss Society of Neuroscience and the Swiss Society of Psychiatry and Psychotherapy, Fribourg, Switzerland, 18 Jan. 2003).

Knoch, D., Gianotti, L., Mohr, C. and Brugger, P. Digit-color synaesthesia: the smaller the digit, the brighter the color. ZNZ Symposium 2003 17 Oct 2003 ETH Zentrum Zurich.

Lehmann, D., Faber, P.L., Galderisi, S., Gianotti, L.R.R., Herrmann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G. and Koenig, T. EEG microstate syntax in medication-naïve, acute, first episode schizophrenia. Poster, Swiss Biol. Psychiatry, Geneva, Feb. 2003.

Lehmann, D., Faber, P.L., Galderisi, S., Gianotti, L.R.R., Herrmann,W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G. and Koenig, T. Syntax of EEG microstates in acute,medication-naïve, first episode schizophrenia. (presented at the Joint Meeting of the Swiss Society of Neuroscience and the Swiss Society of Psychiatry and Psychotherapy, Fribourg, Switzerland, 18 Jan. 2003).

Lehmann, D., Faber, P.L., Galderisi, S., Gianotti, L.R.R., Herrmann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J. , Winterer, G. and Koenig, T. Geänderte Verkettung der Spontan-EEG-Mikro-zustände in akuter, unbehandelter Schizophrenie. (48. Jahrestagung der DGKN "Deutsche Gesellschaft fuer Klinische Neurophysiologie und funktionelle Bildgebung", 8-12 Oct. 2003, Freiburg i.B., Germany).

Pascual-Marqui, R.D., Esslen, M., Kochi, K. and Lehmann, D. Functional imaging of human EEG oscillations. Human Brain Mapping Meeting, June 2003, New York, USA.

10 Publikationen

10.1 In der Berichtsperiode veröffentlichte Arbeiten

- **Aufsätze in wissenschaftlichen Zeitschriften**
  - **Originalarbeiten**

    Anderer P, Saletu B, Semlitsch HV, Pascual-Marqui RD. Non-invasive localization of P300 sources in normal aging and age-associated memory impairment. Neurobiol Aging 24(3): 463-479 (2003).

    Arai M, Tanaka H, Pascual-Marqui RD, Hirata K. Reduced brain electric activities of frontal lobe in cortical cerebellar atrophy. Clin Neurophysiol. 114(4): 740-747 (2003).

Strelets V., Faber P.L., Golikova J., Novototsky-Vlasov V., Koenig T., Gianotti L.R.R., Gruzelier J.H. and Lehmann, D. Chronic schizophrenics with positive symptomatology have shortened EEG microstate durations. Clin. Neurophysiol. 14(11): 2043-2051 (2003).

– **Sonstige Beiträge in wissenschaftlichen Zeitschriften (Abstracts)**

Gianotti L.R.R., Faber P.L., Pascual-Marqui R.D., Kochi K. and Lehmann D. Very early affect-modulated brain electric microstates (~100 msec) during word processing, and their functional tomography. Available on CD-Rom in NeuroImage, Vol. 19, No.2 (2003).

Gianotti, L.R.R., Faber, P.L. and Lehmann, D. Differences and consistencies for valence distinction in ERP microstates when reading emotionally positive and negative words. Brain Topography 15: 269-270 (2003).

Gianotti, L.R.R., Faber, P.L. and Lehmann, D. Electrophysiological and affective correlates of belief in the paranormal. Brain Topography 15: 190 (2003).

Gianotti, L.R.R., Faber, P.L., Pascual-Marqui, R.D., Kochi, K., and Lehmann, D. Lesen emotionaler Wörter und ERP-Mikrozustände: Drei Informations-Verarbeitungsschritte der ERP-Kartenserien unterscheiden positive von negativen Emotionen. Klinische Neurophysiologie 34 (September): A12 (2003).

Gianotti, L.R.R., Künig, G., Faber, P.L., Pascual-Marqui, R.D., Kochi, K., Lehmann, D. and Schreiter Gasser, U. Effects of Rivastigmine medication in Alzheimer patients using frequency-domain dipole modeling and LORETA. Brain Topography 16:126 (2003).

Gianotti, L.R.R., Lehmann, D., Künig, G., Faber, P.L. and Schreiter Gasser U. LORETA analysis of an EEG microstate class affected by rivastigmine in Alzheimer patients. Brain Topography 15: 190 (2003).

Isotani, T., Lehmann, D., Pascual-Marqui, R.D., Gianotti, L.R.R., Kochi, K., Wackermann, J., Saito, A. and Kinoshita, T. Ethanol effects on the spatial configuration of brain electric activity. Brain Topography 15: 192 (2003).

Koenig, T., Prichep, L., Valdes Sosa, P., Braeker, E., Lehmann, D., Isenhart, R. and John, E.R. EEG Microstates, Global Synchronisation and Child Development. Brain Topography 15(4):274-275 (2003).

Lehmann, D., Faber, P.L., Galderisi, S., Gianotti, L.R.R., Hermann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G. and Koenig, T. Geänderte Verkettung der Spontan-EEG-Mikro-zustände in akuter, unbehandelter Schizophrenie. Klinische Neurophysiologie 3: A.24 (2003).

Lehmann, D., Faber, P.L., Galderisi, S., Herrmann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G. and Koenig, T. Syntax of EEG microstate concatenations is altered in acute, medication-naive, first-episode schizophrenics. Brain Topography 15(4):267-268 (2003).

Lehmann, D., Faber, P.L., Strelets, V., Gianotti, L.R.R., Novototsky-Vlasov, V., Gruzelier, J.H. and Koenig, T. Subsecond EEG microstates with different topographies differ in EEG temporal wave frequency. Brain Topography 15(4):271 (2003).

Lehmann, D., Faber, P.L., Strelets, V., Gianotti, L.R.R., Novototsky-Vlasov, V., Gruzelier, J.H. and Koenig, T. (2003). EEG temporal wave frequency differs between topography-defined EEG microstates in subseconds. Brain Topography 15: 194 (2003).

Pascual-Marqui, R.D., Esslen, M., Kochi, K. and Lehmann, D. Functional imaging of human EEG oscillations. NeuroImage (2003)]

Pascual-Marqui, R.D., Esslen, M., Kochi, K. and Lehmann, D. Functional Brain Connectivity with High Time Resolution sLORETA (Standardized Low Resolution Brain Electromagnetic Tomography). Brain Topography (2003)]

- **Bücher**

  – **Dissertationen**

  L.R.R. Gianotti: Brain Electric Fields, Belief in the Paranormal, and Reading of Emotion Words. Thesis presented to the Faculty of Arts of the University of Zurich for the degree of Doctor of Philosophy. Accepted on the recommendation of Prof. Dr. phil. Inge Strauch and Prof. Dr. med. Dr. h.c. Dietrich Lehmann (23 May 2003).

  – **Sammelbände**
    - **Eigene Buchbeiträge in Sammelbänden**

    Koukkou, M. and Lehmann, D. Verkehrte Hirnmodelle und die Hirnmechanismen der Fehlleistung. In: B. Boothe and W. Marx (eds.) Panne – Irrtum – Missgeschick. Die Psychopathologie des Alltagslebens in interdisziplinärer Sicht. [ISBN 3-456-83878-6]. Bern: Huber, pp. 37-51 (2003).

    Lehmann, D. and Koukkou, M. All brain work - including recall - is state-dependent. In: E. F. Pace-Schott, M. Solms, M. Blagrove and S. Harnad (eds.): Sleep and Dreaming: Scientific Advances and Reconsiderations. [ISBN 0-521-81044-2 & 0-521-00869-7]. New York: Cambridge University Press, pp. 176-177 (2003).

– **Sonstige Buchveröffentlichungen**

"Abstrakte in Abstrakt-Büchern"

Gianotti L.R.R., Faber P.L., Pascual-Marqui R.D., Kochi K. and Lehmann D. (2003). Very early affect-modulated brain electric microstates (~100 msec) during word processing, and their functional tomography. (presented at the 9th International conference on functional Mapping of the Human Brain, New York, NY, 19-22 June 2003) Abstract Booklet, p. 20 (2003).

Gianotti, L.R.R., Faber, P.L. and Lehmann, D. (2003). Affective information modulates an early ERP microstate of word processing around 100 ms post-stimulus. (presented at the Joint Meeting of the Swiss Society of Neuroscience and the Swiss Society of Psychiatry and Psychotherapy, Fribourg, Switzerland, 18 Jan. 2003). Abstract Book, p. 28 (2003).

Gianotti, L.R.R., Künig, G., Faber, P.L., Pascual-Marqui, R.D., Kochi, K., Lehmann D. and Schreiter Gasser, U.. Effects of Rivastigmine medication in Alzheimer patients using frequency-domain dipole modeling and LORETA. 12th DMM 2003 – German EEG/EP Mapping Meeting, Giessen, Germany, Sept. 19-20, 2003, Abstract Booklet p. 27, (2003).

Gianotti, L.R.R., Lehmann, D., Faber, P.L., Galderisi, S., Hermann, W.M., Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G., and Koenig, T. Syntax of EEG microstates in acute, medication-naïve, first episode schizophrenia. (presented at the Joint Meeting of the Swiss Society of Neuroscience and the Swiss Society of Psychiatry and Psychotherapy, Fribourg, Switzerland, 18 Jan. 2003). Abstract Booklet, p. 21 (2003).

Knoch, D., Gianotti, L., Mohr, C. and Brugger, P. Digit-color synaesthesia: the smaller the digit, the brighter the color. ZNZ Symposium 2003 17 Oct 2003 ETH Zentrum Zurich Abstract #134, Abstract Booklet p. 88 (2003).

Lehmann, D., Faber, P.L, Galderisi, S., Gianotti, L.R.R., Herrmann, W.M, Kinoshita, T., Koukkou, M., Mucci, A., Saito, N., Wackermann, J., Winterer, G. and Koenig, T. EEG microstate syntax in medication-naïve, acute, first episode schizophrenia. Swiss Society for Biological Psychiatry, Geneva (2003).

10.2 Arbeiten im Druck

- **Aufsätze in wissenschaftlichen Zeitschriften**
  - **Originalarbeiten**

Esslen, M., Pascual-Marqui, R.D., Hell, D., Kochi, K. and Lehmann, D. Brain areas and time course of emotional processing. NeuroImage (in press 2003)

Gamma, A., Lehmann, D., Frei, E., Iwata, K., Pascual-Marqui, R.D. and Vollenweider, F.X. Comparison of simultanously recorded [H215O]-Positron Emission Tomography (PET) and Low Resolution Brain Electromagnetic Tomography (LORETA) during cognitive and pharmacological activation. Human Brain Mapping (in press 2003)

- **Bücher**
  - **Sammelbände**
    - **Eigene Buchbeiträge in Sammelbänden**

Lehmann, D. Zustandsabhängige Hirnarbeit in Makro- und Mikrozuständen während Wachheit und Traum. In: P. Giampieri-Deutsch (ed.) Psychoanalyse im Dialog der Wissenschaften, Bd. 2. Anglo-Amerikanische Perspektiven. Stuttgart: Kohlhammer (in press 2003)

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