



ECPD



European Centre for Peace and Development (ECPD) of the United Nations University for Peace

CONSCIOUSNESS

Scientific Challenge of the 21st Century

Edited by
Dejan Raković
Djuro Koruga

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PREFACE

Consciousness is one of the oldest scientific problems, recognized already in ancient times, both in the civilizations of East and West. However, in contrast to scientific problems related to the structure of matter and physical interactions, and their implications for understanding of macroscopic and microscopic structural levels and phenomena, successfully scientifically resolved during past three centuries of explosive development of natural sciences, the problem of consciousness has remained *scientifically* unresolved to date. The reasons should be sought in extreme complexity of the phenomenon of consciousness, which required development of fundamental theories and methods, conceptually suitable for resolution of the problem.

Although consciousness has been the central theme of philosophical essays for a long time from the very beginning of philosophical thought, or traditional esoteric practices of the East and West which have reached significant level in control of altered states of consciousness with significant philosophical and religious implications - the first scientific attempts to enlighten the phenomenon of consciousness appeared only in psychology of the second half of 19th century (through development of psychophysics and theories of personality), physics of the beginning of 20th century (through development of quantum mechanics and articulation of the problem of the so called wave function reduction, and the role of observer in that process), and computer sciences of the second part of 20th century (through development of artificial intelligence and the conception that the whole cognitive process can be reduced to a computer algorithm). However, due to scientific methodological difficulties the problem of consciousness was afterwards marginalized in these sciences.

A contemporary critical survey of the problem of consciousness can be found in monographs of the eminent theoretical physicists Roger Penrose (*Shadows of the Mind: A Search for the Missing Science of Consciousness*, Oxford Univ. Press, Oxford, 1994), of the molecular biologist and Nobel Prize laureate Francis Crick (*The Astonishing Hypothesis: The Scientific Search for the Soul*, Charles Scribner's Sons, New York, 1994), and of the eminent philosopher Sir Karl Popper and neurophysiologist and Nobel Prize laureate Sir John Eccles (*The Self and Its Brain*, Springer, Berlin, 1977).

The last decade of 20th century has been proclaimed by United Nations as the decade of brain research, which certainly gave a new impulse to investigation of the phenomenon of consciousness, as the most complex brain function. Beside the development of new experimental techniques which enabled physiological investigation of interactions of hierarchically interconnected neighboring brain's neural networks levels, the significant contribution in understanding functions of such a hierarchical structure was given by theoretical breakthroughs in the fields of modeling of bioinformation processes and design of artificial neural networks. Neural networks, as an attempt to model the brain functioning, possess many good properties: parallel functioning, accomplishment of complicated tasks in relatively short time, distributed information, weak sensitivity to local damages, as well as possibility for learning, i.e. adaptation to environmental changes and experience-based improvement of functioning.

Beside brain's hierarchical neural networks, significant role in global distribution and memorizing (over the whole cortex) of hierarchically processed information during the learning process is played by brainwaves. Especially significant role of brainwaves is related to biophysical modeling of consciousness i.e. states of consciousness, characterized by significant acceleration of conscious information processing, which cannot be explained by purely electrochemical processes laying in the basis of synaptic processes in biological neural networks.

Therefore, in the last few years the phenomenon of consciousness comes again in the focus of the world scientific community. In 1994 two international conferences were held in USA (Tucson and San Diego), and in May 1995 a Yugoslav symposium (Belgrade) in organization of European Center for Peace and Development (ECPD) of the United Nations University for Peace - which represented initial impulse for appearance of this book. It is currently estimated that the problem of consciousness belongs to ten most significant scientific problems, although it might soon become one of the most significant owing to its potential implications in many scientific fields.

So, for instance, an understanding of the phenomenon of consciousness in *medicine* might give rise to enlightening of many secrets of the brain functioning, as well as of the role of ionic acupuncture system in cognitive aspects of altered states of consciousness. In *psychology* we could understand mechanisms and roles of altered states of consciousness in the growth of personality, control of creativity, as well as transpersonal phenomena usually accompanying these states. In *biology* it might appear that limits of interactions between individuals are more provisional than widely believed, which would be of significance not only for adaptive mechanisms on the level of the whole biological species, but even for deeper understanding of the very significance of morals in human population. An understanding of the phenomenon of consciousness in *physics* could give rise to a deeper understanding of fundamental problems of the observer's role in quantummechanical act of measurement, which would demonstrate that consciousness, space, time, and matter are more deeply interwoven than widely believed. So, an understanding and controlling of transpersonal interactions would significantly change the field of *communications*, where many traditional barriers might be radically surpassed. In *computer sciences*, an understanding of the nature of consciousness might give rise to computers with artificial consciousness, which would function on deeper quantummechanical principles. Finally, and not accidentally, a deeper understanding of the very nature of consciousness and transpersonal phenomena might radically shift our scientific understanding of some ultimate *philosophical* and *religious* questions, traditionally remaining outside the domain of theoretical and experimental scientific methods of natural sciences, being therefore a subject of deep and painful irrational divisions throughout the whole history of human civilization, which could be finally overcome due to scientific breakthroughs in the field of consciousness.

As a result of contemporary scientific trends, here in Belgrade we have decided to unite the existing laboratory and scientific capacities of several eminent institutions of medical, psychological, and engineering profiles on multidisciplinary project "Investigation of Higher Brain Functions, with Biomedical, Technical, and Technological Applications", within the *Joint Laboratory for Cognitive Neurosciences and Neuroengineering*. The Joint Laboratory will also represent a center of excellency and scientific basis of European Center for Peace and Development (ECPD) of the United Nations University for Peace, through organization of symposiums and specialistic educational courses in the field of neurosciences and neuroengineering.

The Belgrade symposium *Consciousness: Scientific and Technological Challenge of the 21st Century*, held during 29-30 May 1995, as well as this book appearing several months later, represent first significant activities of Joint Laboratory, demonstrating competence of Belgrade scientific community to cope with so complex multidisciplinary scientific problem.

This book consists of four parts. In the first one, related to *Phenomenology of Consciousness*, after anthropological and philosophical essay devoted to archetypal selfconsciousness of paleolithic-neolithic civilization of the "divine Pelasgians" from the Balkans and its influence on Pythagoras (Lj.Kljakić), a survey of different conceptions of consciousness through history of philosophy is given, with argumentation for necessity of a new scientific synthesis (V.Abramović). Then follows a survey of investigation of consciousness in experimental psychology, with original approaches to analysis of the composition of dreams, and effects of hypoxia on cognition (P.Ognjenović), and, finally, a detailed presentation of biological bases and neurophysiological correlates of free will, attention, conscious intention and perception, and selfconsciousness and emotions (V.Desimirović).

The second part, related to *Altered States of Consciousness*, starts with a detailed comparative survey of the structure of Universe, the structure of human selfhood, human bodies, human states of consciousness, psychic powers, as well as precise techniques for expansion and attainment of higher states of consciousness in esoteric practices of ancient Indian Upanishads and teaching of the contemporary Christian mystic Daskalos, with striking correspondences between these two traditions (P.Vujićin). Then follow the application of psychotherapeutic ritual in Amazon tribal societies, with shamanistic control and interpretation of hallucinogenic altered states of consciousness (Č.Hadži-Nikolić, B.Petković-Medved), as well as a survey of contemporary methods of neurolinguistic programming, including original integrative model for efficient hypnotherapeutic reprogramming of old behavioral models (G.Stanojević-Vitaliano).

The third part encompasses *Electroencephalographic Correlates of States of Consciousness*. It starts with a broad survey of pharmacoencephalography (PEEG), i.e. electroencephalographic study of drug effects, with significant clinical implications (Ž.Martinović), and followed by a detailed relationship between clinical neurophysiological polysomnographic data and different sleep disorders (N.Ilanković, A.Ilanković). Out of the new methods of EEG signal analysis, the application of the theory of deterministic chaos is given, illustrated in the cases of normal and pathological EEG (V.Radivojević, M.Rajković, D.Timotijević, M.Car), as well as original methodology and software environment for quantitative analysis of EEG activity in altered states of consciousness, with particular application on the monitoring of the healing process (E.Jovanov).

The fourth part, *In Search for a New Paradigm*, consists of original scientific approaches to the problem of consciousness, which mostly bear characteristics of a new scientific synthesis. It starts with the conception of information physics, as a synergetic theory of classical mechanics, quantum mechanics, and theory of information, which relates consciousness with biology and physics, and finds the roots of biological form of consciousness in biophysical cytoskeletal processes (Đ.Koruga). The second approach points out a universal Mind/Matter code starting from the unity of chemical and genetic codes, unifying global-integral introspective method of the East and single-partial empirical method of the West (M.Rakočević). The original triunism concept is then presented, offering new possibilities for formulation of the scientific basis of "thought", and seeking for resolution of the brain-mind problem through relationship of three hierarchical levels: neurobiological, neurological, and behavioral ones (Lj.Rakić). Finally, a new biophysical model of altered states of consciousness is given, which - starting from the only hypothesis that consciousness is related to electromagnetic field of brainwaves, and using methodology of fundamental relativistic and quantum physics - accounts for the dynamics of psychological processes in altered states of consciousness as well as numerous bizarre transpersonal phenomena in transitional states of consciousness, necessarily implying some experimental tests of the model (D.Raković).

The Editors are grateful to all authors for their great efforts to present, in a very short time, the results of Belgrade scientific community in exploration of this extremely significant and complex scientific problem. We believe that forthcoming time will multiply repay for efforts invested.

Finally, Editors and Publisher greatly acknowledge sponsorships of Yugoslav Ministry for Development, Science and Ecology, ITM Company, and Railway Health Center Belgrade.

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Belgrade,
May-November 1995

Dejan Raković
Đuro Koruga

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Car, M. (b. 1969, Belgrade) Bioengineer at the Institute for Mental Health, in Belgrade. Graduated with B.S. degree in computer engineering (1994) from the Faculty of Electrical Engineering in Belgrade, where he is now postgraduate student. Published several scientific papers and communications. Works in the fields of design of computer applications, digital processing of biological signals, and applications of neural networks and chaos theory in EEG signal processing.

Desimirović, V. (b. 1933, Belgrade) Professor of medical psychology and mental hygiene at the Higher Medical School in Belgrade, and psychopharmacology at postgraduate studies at the Medical Faculty in Belgrade. Formerly the Chief of Department for Psychoses at the Psychiatric Hospital in Vršac, and at the Institute of Psychiatry in KBC Zvezdara-Belgrade. Received M.D. from the Medical Faculty in Belgrade (1960), where he also completed specialization in neurology and psychiatry (1968), and got his M.S. (1976) and Ph.D. (1979) degrees in neurophysiology and psychopharmacology. During 1974 he spent one-year subspecialization in EEG and clinical neurophysiology, in Holland. Published over 70 scientific papers and communications, as well as two books, "Biological Bases of Psychiatry" (as a co-author with Prof. S.Jakulić, 1990) and "Contemporary Medical Psychology" (1994). He is currently investigating psychopharmacologically induced sister chromatide exchange.

Hadži-Nikolić, Č. (b. 1941, Valjevo) Chief of Department for Mental Health, of the Railway Health Center in Belgrade. Graduated and received M.D. degree (1966) from the Medical Faculty in Belgrade, while he completed his specialization in neuropsychiatry (1974) at the Medical Faculty in Zagreb. Got his postgraduate education in application of acupuncture for drug addiction (1978-80), in China, Hong Kong, and Thailand. Received two Ph.D. theses: first, from the United Nations Open International University for Complementary Medicine, Colombo-Athens, in Athens (1987), and second, from the Department of Ethnology of the Philosophical Faculty in Belgrade (1991). Working in the field of transcultural psychiatry, related particularly to shamanism and hallucinogens, completed his empirical research (1980-85) in South America (Peru, Ecuador) and India. Published over 70 scientific papers and communications, the book "Scalp Acupuncture" (1983, in Serbian), as well as audio cassettes for relaxation (with Lj.Mirković, M.D., 1985,1995). He is currently applying meditative techniques in psychotherapy.

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Vujićin, P. (b. 1943, Novi Sad) Free lance journalist and translator; working for many years in sales and marketing department of a computer company. Graduated English language and literature (1967) from the Faculty of Philology in Belgrade. Specialized in phonetics and taught English as a second language (1968-70) at the Institute of Foreign Languages in Belgrade. From 1970 to 1975 lived and worked in London, and completed a course in anthropology at the ILEA. In 1975 spent half a year in East Africa (Kenya, Tanzania) studying local history, culture, and politics. From 1975 to 1978 lived in Sudan. Travels extensively in the East (India, Sri Lanka, Nepal, Burma, Thailand, Malaysia, Singapore, Indonesia, Hong Kong, Japan, etc.) and West (Europe, Mexico, USA). As a frequent visitor to Indian ashrams and holy men (Sai Baba, Shivabalayogi, Niranjana, Satyananda), initiated in various Eastern practices of meditation; a pupil of the Cypriot Christian mystic Daskalos (1990-94). Writing for esoteric and New Age magazines and free lance publisher and translator of books on yoga, meditation, kabala, mysticism, chromotherapy, and psychology.

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PHENOMENOLOGY OF CONSCIOUSNESS

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