Biophysical aspects of neurocognitive modeling with long-term sustained temperature variations

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***Abstract*—Long-term focused attention with visualization and breathing exercises is at the core of various Eastern traditions. Neurocognitive and psychosomatic phenomena demonstrated during such exercises were instrumentally explored with EEG and other sensors. Neurocognitive modeling in the form of meditative visualization produced persistent temperature effects in the body long after the exercise finished; this raises the question about their psychosomatic or biophysical origin. The work explores this question by comparing experiments with focusing attention inside and outside the body. EEG, temperature, heart and breathing sensors monitor internal body conditions, high resolution differential calorimetric sensors are used to detect thermal effects outside the body. Experiments with 159 attempts (2427 operator-sensor sessions) were carried over five months, control measurements run in the same conditions in parallel to experimental series. Increase of body temperature up to moderate fever zone 38.5 °C and intentional control of up and down trend of core temperature by 1.6 °C are demonstrated. Persistent temperature variations last >60 min. Experiments also demonstrated induced thermal fluctuations at 10^{-3} °C level in external calorimetric systems with 15 ml of water for 60-90 min. Repeatability of these attempts is over 90%, statistical Chi-square and Mann-Whitney tests reject the null hypotheses about random character of outcomes. Thus, the obtained data confirm the persistent thermal effects reported in previous publications and indicate their biophysical dimension. To explain these results we refer to a new model in neuroscience that involves spin phenomena in biochemical and physical systems. These experiments demonstrate complex biophysical mechanisms of altered states of consciousness; their function in the body's neurohumoral regulation and non-classical brain functions is discussed.**

***Keywords*—Biophysics, psychosomatic phenomena, neurohumoral regulation, non-classical brain functions.**

I. Introduction

Neurocognitive and psychosomatic mechanisms of altered states of consciousness (ASC) in several Eastern traditions, such as Reiki [1], Tai chi [2], Qigong [3], Johrei [4] and others have been studied in academic publications. For instance, the focused attention on the body (abdominal region near the navel) in yoga Tummo has been shown to increase core temperature up to 38.3°C [5]. Authors demonstrated that a neurocognitive modeling in the form of meditative visualization in ASC is responsible for two effects: (a) increasing temperature far beyond the range of normal body temperature; (b) persistent, step-wise temperature increase long after the exercises finished. Similar effects were described in other publications [6], [7].

Persistent effects were also reported for techniques targeting environmental objects and processes, such as exposure of external Qi [8]–[10] and focused attention [11], [12] to aqueous solutions and properties of materials [13], bacterial cultures and laboratory animals [14]. The practice of these techniques causes instrumentally recorded persistent changes in both the internal metabolism of human meditator and the properties of materials and processes. Comparing both results, the question arises about only psychosomatic or also biophysical origin of such phenomena. The work explorers this question in relation to long-term sustained temperature variations in two cases, when the attention is focused inside and outside the body.

This experimental study replicates and extends the methodologies of previous works [5], [6], [13] with practitioners of the six yogas of Naropa [15], [16] and the Dhammakaya meditation [17]. Skin surface and core temperature are measured with IR camera (wavelength 8-14μm) and contact sensors. External effects are measured by high resolution differential calorimeters with 6 temperature sensors and 2x15 ml of water. Such calorimeters are able to measure extremely small t changes as a symmetry breaking effect. A separate laboratory was prepared for measurements, three calorimetric setups served as control systems and three others used in experiments, all systems running in parallel. Additionally, the power supply, electromagnetic emissions, magnetic fields, air pressure and mechanical impacts are recorded by corresponding sensors. Meditators use the real-time biofeedback with sensors of EEG, heart and respiratory rate, and muscle activity.

The obtained results confirm the persistent effects reported in [5], [6], [13]. In particular, increase of body temperature up to moderate fever zone 38.5 °C and intentional control of up and down trend of core temperature by 1.6 °C are demonstrated for >60 min. Experiments have also shown the induced thermal fluctuations in external calorimetric systems at 10^{-3} °C level for 60-90 min, which point to biophysical dimension of such phenomena. To explain these results, the biophysical hypothesis consists in the spin conversion of water isomers [18]. The spin configuration affects chemical reactivity [19], [20], behavior in electric field [21], magnetic moment [22], evaporation [23], surface tension [24] and other properties, in particular, the heat capacity of water isomers [25]. As a hypothesis, it is assumed that such a spin conversion induced through ASC, as recently proposed in neuroscience [26], [27] e.g. via non-classical brain functions [28], can cause the observed thermal effects.

II. Setup and methodology of experiments

A. Description of the setup

The experimental setup includes biofeedback equipment for monitoring body-internal conditions and differential calorimeters for experiments with external thermal phenomena. Meditators use the Muse-2 EEG, heart and breathing sensor, see Fig. 1, for real-time auditory control of ASC. Experiments in