

SOMATOSENSORY AND VISUAL EVOKED POTENTIAL DYNAMICS AS A CORRELATE OF REVERSIBLE STATES OF ALTERED CONSCIOUSNESS

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Interest in phenomena of the human mind such as telepathy, extrasensory activity, bioradiology, meditation, and so on, combined under the general heading of "Paranormal" or "psi" phenomena, has increased greatly in recent years. Many amateur organizations engaged in the study of these phenomena now exist. Unfortunately, however, the people engaged on their study are often remote from science, and their interpretation of these phenomena as a rule is also unscientific and arbitrary. On the other hand, most studies of the "psi-phenomenon" have been mainly philosophical or psychological in character [1, 8], although it is clear that the "psi-phenomenon" is due to brain activity, and the study of the nature of this phenomenon must be undertaken in the first place by objective methods of the neurosciences, and neurophysiology in particular. We could find no extensive list of publications devoted to the study of the neurophysiological mechanisms of altered consciousness, observed during meditation, hypnosis, "extrasensory interactions," and other transcendental manifestations [4, 7].

The study of these "mystic" phenomena of the human mind thus requires, in our view, the closest attention of academic science in order to get rid of the speculative antiscientific explanation of these phenomena.

We accordingly decided to study brain biosignals arising in various states of altered consciousness in persons who, by their subjective criteria, have classed themselves as "sensitives" ("extrasenses"), and some of whom were treating patients in a number of clinical establishments in Russia and elsewhere.

EXPERIMENTAL METHOD

Experiments were carried out on 17 "sensitives" of both sexes aged from 23 to 52 years. Each subject took part in several experiments. Brain evoked potentials (EP) were investigated in a state of rest (background) and during various forms of sensitive activity: purposive action on a recipient ("treatment" of a disease), meditation. A special series of investigations was devoted to the study of control traces of EP of 12 healthy subjects of both sexes, aged from 21 to 49 years, who did not possess the qualities of the subjects of the experimental group, mentioned above.

Somatosensory EP (SSEP) were recorded by a monopolar technique in response to electrodermal stimulation of the median nerve at the wrist and visual EP (VEP) were studied in response to a binocular flash of light. For the recording, surface electrodes were applied above the central (C3, C4) and occipital (O1, O2) regions of the cortex of both hemispheres. Reference electrodes were located on the mastoid processes. Special systems of apparatus ("Medelec Sensor," Great Britain) and ("Polygraph System," Japan) were used to record and average the EP: 64 responses were averaged with an epoch of analysis of 500 msec. Single EP, associated with eye movements, were excluded. Parameters of the averaged EP in the situation studied were then compared. The significance of differences was determined by Student's *t* test.

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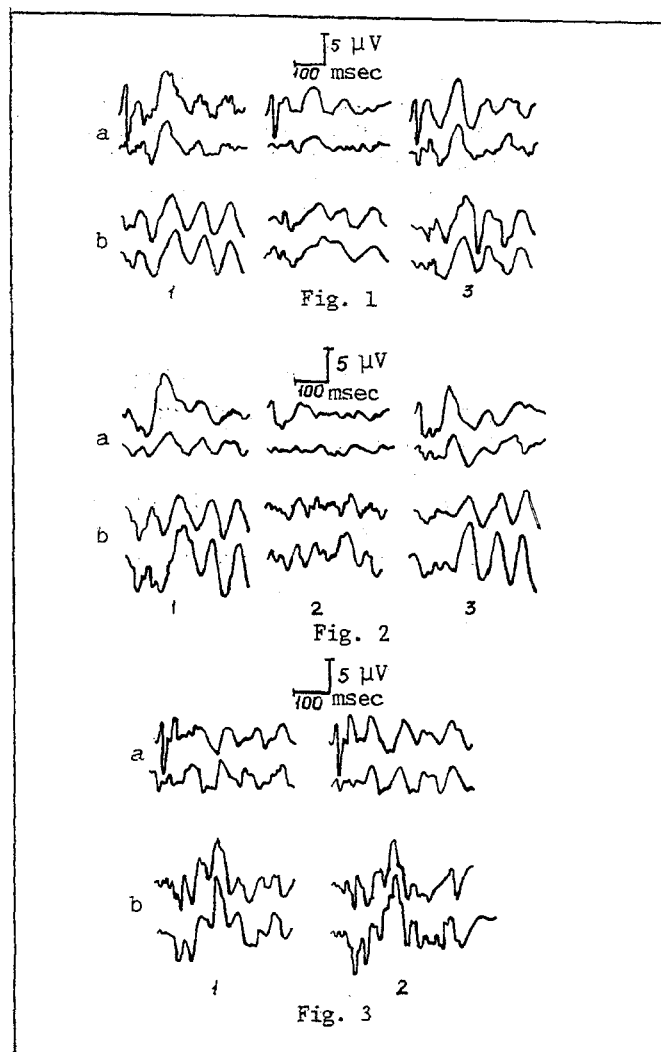


Fig. 1. Character of changes in somatosensory (a) and visual (b) EP of "extrasensitive" subject Yu. A. during direct action on 1) background, 2) direct action, 3) quiet wakefulness after end of action.

Fig. 2. Dynamics of changes in somatosensory (a) and visual (b) EP in "sensitive" subject A.V. during meditation: 1) relative rest, 2) meditation, 3) quiet wakefulness after meditation.

Fig. 3. Somatosensory (a) and visual (b) EP of an ordinary healthy individual: 1) state of quiet wakefulness, 2) attempt to reduce EP voluntarily.

EXPERIMENTAL RESULTS

In the resting (background) state SSEP and VEP of the sensitives were indistinguishable from potentials recorded in ordinary healthy individuals. In the types of "extrasensory activity" tested, a general trend of changes in EP was found in most of them (14 of 17), correlating with a change in functional state of the brain. Both during direct impact and during meditation the "sensitives" showed a marked decrease (by 50-75%) in amplitude of the intermediate and late components of VEP and SSEP in both hemispheres, as well as significant reduction of the early components of SSEP in the hemisphere ipsilateral to the side of stimulation. After the end of "sensitive" activity,

TABLE 1. Dynamics of Amplitude Parameters of Somatosensory EP (in μV) during Different Types of "Sensitive" Activity ($M \pm m$)

Components	Back-ground	Direct action	Meditation
Contralateral hemisphere			
P100	$4,8 \pm 0,7$	$2,1 \pm 0,5^{***}$	$2,5 \pm 0,4^{**}$
N140	$9,6 \pm 1,2$	$3,7 \pm 0,8^{***}$	$2,9 \pm 0,6^{***}$
P190	$8,7 \pm 1,1$	$4,1 \pm 0,6^{***}$	$2,4 \pm 0,5^{***}$
N260	$4,1 \pm 0,5$	$2,3 \pm 0,4^{**}$	$1,2 \pm 0,3^{***}$
P300	$4,8 \pm 0,8$	$2,1 \pm 0,5^{**}$	$0,9 \pm 0,4^{***}$
N360	$3,8 \pm 0,8$	$1,6 \pm 0,4^*$	$1,4 \pm 0,3^*$
Ipsilateral hemisphere			
P25	$2,3 \pm 0,4$	$0,8 \pm 0,3^{***}$	$0,6 \pm 0,2^{***}$
N65	$3,2 \pm 0,6$	$1,0 \pm 0,4^{***}$	$0,7 \pm 0,3^{***}$
P100	$3,9 \pm 0,8$	$1,6 \pm 0,5^*$	$0,8 \pm 0,4^{***}$
N140	$7,2 \pm 1,1$	$2,5 \pm 0,6^{***}$	$0,9 \pm 0,5^{***}$
P190	$5,4 \pm 0,9$	$2,1 \pm 0,7^{**}$	$1,1 \pm 0,6^{***}$
N260	$3,1 \pm 0,6$	$0,6 \pm 0,4^{***}$	$0,8 \pm 0,3^{***}$
P300	$3,7 \pm 0,8$	$0,7 \pm 0,3^{***}$	$0,6 \pm 0,2^{***}$
N360	$2,8 \pm 0,5$	$0,9 \pm 0,4^{**}$	$1,1 \pm 0,4^{**}$

Legend. Here and in Table 2: data for 14 "sensitive" subjects. Only components showing significant changes compared with background state are shown; *p < 0.05; **p < 0.02; ***p < 0.01.

TABLE 2. Changes in Amplitude Parameters of Visual EP (μV) during Different Types of "Sensitive" Activity ($M \pm m$)

Components	Back-ground	Direct action	Meditation
P125	$4,1 \pm 0,6$	$2,3 \pm 0,6$	$2,1 \pm 0,5^*$
N180	$11,1 \pm 1,0$	$3,5 \pm 0,6^{***}$	$3,3 \pm 0,7^{***}$
P240	$8,2 \pm 1,0$	$2,2 \pm 0,5^{***}$	$1,8 \pm 0,5^{***}$
N270	$5,4 \pm 0,7$	$2,3 \pm 0,5^{**}$	$1,9 \pm 0,4^{***}$
P230	$4,3 \pm 0,7$	$2,0 \pm 0,5^*$	$2,1 \pm 0,5^{**}$
N370	$3,9 \pm 0,6$	$2,0 \pm 0,3^{**}$	$1,8 \pm 0,4^{**}$

characteristics of EP of both modalities were restored to their initial values. Typical variants of the changes in SSEP and VEP in response to direct impact and meditation respectively are demonstrated in Figs. 1 and 2. Incidentally, this type of time course of changes in amplitude parameters of EP, recorded during the type of autogenous activity mentioned above, was a stable phenomenon, precisely reproducible in the "sensitives" when retested. Statistical analysis of the results showed a significant decrease (compared with the background) in amplitude of the EP components described above (Tables 1 and 2) and their restoration at the end of "extrasensory activity." In three "sensitives" no evident changes, shown in the Tables, were observed.

To make sure that a reversible decrease in amplitude of the intermediate and late components of VEP and SSEP was a feature only of the "extrasenses" and could not be reproduced by the ordinary subjects during attempts to change their own psychological variables arbitrarily, we undertook a series of control experiments. This was necessary also because of data in the literature indicating that the amplitude of EP depends on the functional state of the subject's brain [3, 5, 6]. Altogether 12 ordinary healthy individuals were tested: in order to reduce the amplitude of their VEP and SSEP they tried their utmost to rest, relax, avoid stimulation, concentrate attention on an abstract pattern, and so on. However, the amplitude of their EP was not reduced during these attempts amplitude of the late components when the subjects concentrated their attention on a stimulus, or when perceiving it at maximal brightness, as well as the absence of changes in EP during voluntary attempts to reduce their amplitude [2].

The investigation thus revealed specific changes in VEP and SSEP correlating with ability, which was confined to the "sensitives," to induce reversible changes of their own consciousness voluntarily. The results suggest that "sensitive" activity is based on the ability of the "extrasenses" to regulate at will the level of activity of their ascending nonspecific brain systems and modify the character of their interhemispheric relations. This probably accounts for some of the features distinguishing these people.

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