PARAMETRIZATION OF AN EXPERIMENTAL MODEL OF RECOGNITION OF RHYTHMIC STIMULATION IN THE RITMOTEST DEVICE

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Qualitative and quantitative assessment of central nervous system characteristics can be implemented in specially arranged experimental media [2, 8]. An experimental model of spatial-temporal prognosis of an event (EMSTPE) [10] is an example of such a medium. A series of devices have been developed on the basis of this technology for testing the normal and pathological characteristics of the human central nervous system [7]. Ritmotest is one of such devices. This device is designed to measure objective characteristics of the higher nervous system activity from the results of psychophysiological tests. The Ritmotest device uses the method of qualitative and quantitative evaluation of characteristics of learning and reproduction of rhythmic stimulation of various tempo and modality.

There is a considerable literature on rhythmic and temporal characteristics of the human central nervous system [3]. The studies devoted to qualitative and quantitative analysis of rhythmic activity and its changes in patients with neurological and mental diseases or under unfavorable environmental conditions are of particular interest [5]. These works demonstrated that parameters of rhythmic activity can be used as indicators of normal and pathological states of the human central nervous system. A specific feature of these models is that they are based on empirical clinical data. In contrast to that, the Ritmotest device was developed on the basis of comprehensive systemic approach to various forms of rhythmic activity [1, 8].

The goal of this work is to describe the principle of operation of the Ritmotest device, its operating modes, parameters, and characteristics essential for qualitative and quantitative assessment of higher nervous activity.

In addition to a number of accessory signals indicating the start and the end of the procedure [7], the control panel of the Ritmotest device contains the fields of presentation of stimulus and detected signal. According to classification given in [10], these fields correspond to zero-dimensional space of stimulation/reaction presentation. Therefore, spatial reaction coordinate is absent, and rhythmic depression of control key with a probe is the only available behavioral response.

The Ritmotest automatic microprocessor device was designed for monitoring human higher nervous system in the norm and pathology. The Ritmotest device has three operating modes:
- generation of rhythmic reactions (tapping test, TT), in which the tapping rhythm generated by the subject tested does not coincide with the stimulation rhythm;
- tracing of stimulation rhythm (rhythm mode, R), in which the tapping rhythm generated by the subject tested coincides with the stimulation rhythm;
- mode of reproduction of rhythmic stimulation (tapping state, T), in which the tapping rhythm generated by the subject tested should match the stimulation rhythm previously presented and memorized.

Qualitative and quantitative evaluation of characteristics of learning and reproduction of rhythmic stimulation implemented in the Ritmotest device allows indication of every behavioral event of the tested person and its temporal deviation from the moment of rhythmic stimulation.

The following models implement the generation mode.

1. Model of absolutely regular rhythm. All intervals between reactions are constant and equal to \( T_i \) (Fig. 1, 1a). Actual implementation of this mode is the model of regular temp with natural fluctuation (Fig. 1, 1b), which is distinguished from the ideal case by a pseudorandom type of the interval duration \( (T_i \pm S_{n}) \), where \( S_{n} \) is the mean square deviation.

In further discussion, two types of models will be discussed: absolutely ideal (without natural fluctuation) and real (with natural fluctuation \( S_{n} \)). In Fig. 1, ideal and real models are denoted as (a) and (b), respectively.
Fig. 1. Processes of generation, tracing, and reproduction of rhythmic stimuli in various model presentations.

2. Model of absolutely regular rhythm with an arbitrary shift (Fig. 1, 4). This model is distinguished from Model 1 by different instruction for determining the mean interval between reactions ($T_{min} \neq T_i$).

3. Model of ideal trend. Values of intervals between responses gradually increase/decrease ranging between $T_{min} + T_{max}$ (Fig. 1, 7).