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**BIOTECHNICAL SYSTEM OF CAR GAME TRAINING BASED ON USE OF A MULTIPARAMETRICAL FEEDBACK AND SUBSENSITIVITY LIGHT SIGNALS OF CONTROL**

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**Research urgency**

Development of modern hardware promoted creation of the unique medical-rehabilitation technology allowing more effectively to be trained ways of self-control. It is a question of computer game bio-management. The computer game training apparatus includes some the game plots having obvious or latent competitive character. The competition course is regulated by dynamics of the registered physiological parameter: it can be a pulse rate, skin temperature, dermo-galvanic reaction. Win competition the patient can in the event that will learn to operate the physiological function in a situation of virtual competitive stress. The colourful game plots created with use of modern multimedia means, raise motivation training, promote more effective fastening of skills of self-control. In the course of game training the person gets invaluable ability to resist to stress and diseases, studies in a new fashion to react to conflict situations, to reduce excessive internal pressure when the raised working capacity, strong-willed effort, attention mobilisation is required. Working out of structure of biooperated game training for creation of the independent hardware module in which for management of influence use a multiparametrical biological feedback, concerns the actual problems essentially expanding efficiency of treatment by means of computer game technologies of rehabilitation of various diseases of the person.

The work purpose - management optimisation by the virtual game training, directed on overcoming of competitive stress and ability to operate the functional condition by means of the scenarios including visible background and fixing image, and also discrete subsensitivity light signals.

Object of research are neurodynamics brain processes, electrophysiological processes of cardiovascular and respiratory system.

As subject of research information processes serve at recognition of functioning of cardiovascular, respiratory system, and also during carrying out of game biooperated training in real clinical conditions.

**Material and methods of researches**

In biotechnical system of game training the information presentation through an optical communication channel by means of colour impulses is provided. According to a frequency range of electroencephalogrammes, concerning to highly plastic to types, in which alpha rhythm share of essentially more share of a teta-rhythm. The similar structure of light impulses can provide transformation of pattern EEG and, hence, updating of a functional condition of the person [1,7].

We for these purposes had been developed models in a kind the coded colour patterns.

Let's consider an example of change of intensity of light influence at the expense of the directed manipulations with duration of an impulse and a pause at the frequencies corresponding teta and an alpha to a rhythm in the form of a spindle EEG. Only realisation of parametres colourstimulation, having the big coefficient of filling of a colour signal causes sensations of blinking of light.

It is known, that the functional kernel of pattern EEG is made by mutual relations an alpha and teta the rhythms forming 4 basic of type: teta (lf) + alpha (hf); teta (lf) + alpha (lf); teta (hf) + alpha (hf); teta (hf) + alpha (lf), where "lf" is Low frequency and "hf" is high frequency.

Noted types at healthy faces are highly steady against various influences and functional loadings and have correlation communications with that or other psychological profile of the person [2], and also with size pulsation arterial pressure [3]. Therefore, according to the psychological profile, each model of the formula of colour influence should have four formulas of influence of frequencies reflecting combination teta - and an activity alpha.

The real algorithm realising all forms of a combination a teta-alpha of rhythms, is presented in table 1.

Strengthening of parasympathetic influences promotes realisation of a condition of a relaxation of the patient.

One of ways of strengthening cholinergic regulation mechanisms is resonant breath with the period ten seconds.

Features of mechanisms of management of a rhythm the hearts caused by change of respiratory function of the patient, consist that breath with frequency 5-6 in a minute causes the greatest variations of pulse.

It is caused by the maximum stimulation of a wandering nerve as a result of action respiratory arrhythmia heart (RAH) [3,4,6].

In the literature such breath name metronome the similar breath, or more often, as resonant because transfer function of change heart rate at breath has the expressed functional resonance (FR) on frequency about 0,1 Hz.

**Table 1.** Algorithm of realisation of model of alpha spindles in light patterns of  $\theta\alpha$ -rhythms in formulas relaxation colourstimulation

Formula	Formula parametres	Realisation time, s
F-1 $\theta_{hf} \alpha_{hf}$	$\{[(\theta 7 hf \bullet 35 + \alpha 12,5 hf \bullet 25)] * 4\} * 10$	15,00 * 6 = 60 s Transition to F-2
F-2 $\theta_{lf} \alpha_{hf}$	$[(\theta 6 lf \bullet 17 + \alpha 10,0 hf \bullet 40)]$	15,00 * 4 = 60 s Transition to F-3
F-3 $\theta_{hf} \alpha_{lf}$	$[(\theta 7 hf \bullet 22 + \alpha 9,0 hf \bullet 89)]$	15,00 * 4 = 60 s Transition to F-4
F-4 $\theta_{lf} \alpha_{lf}$	$[(\theta 4 lf \bullet 16 + \alpha 9,0 lf \bullet 82)]$	15,00 * 8 = 120 s Transition to F-1
Total time $\Sigma t s$	-	300,00 s
Total time of a session	Repetition of formulas F-1; F-2; F-3; F-4.	2 times=10minutes 3 times=15 minutes 4 times 20 minutes 5 times=25 minutes 6 times = 30 minutes

**Table 2.** Model an alpha of spindles in a light pattern  $\delta\theta\alpha$  at low frequency of an alpha rhythm of 8 Hz

Structure of a respiratory cycle (Phase)	Parametres of model					
	Rhythm EEG	Hz	Impulse	Pause	Quantity of tics	Time, s
INSPITATION	$\delta$	2	0,30	0,20	1	0,500
	$\theta$	4	0,23	0,02	6	1,500
	$\alpha$	8	0,085	0,04	6	0,750
	$\alpha$	8	0,095	0,03	6	0,750
	$\alpha$	8	0,105	0,02	6	0,750
	$\alpha$	8	0,095	0,03	6	0,750
Total time of the inspiration						5,00
EXPIRATION	$\delta$	2	0,30	0,20	1	0,500
	$\theta$	4	0,23	0,02	6	1,50
	$\alpha$	8	0,065	0,06	6	0,750
	$\alpha$	8	0,075	0,05	6	0,750
	$\alpha$	8	0,095	0,03	6	0,750
	$\alpha$	8	0,085	0,04	6	0,750
Total time of the expiration						5,00

As is known in a pattern EEG the healthy person in shape  $\delta\theta\alpha$  a pattern kernel is highly likelihood communication of  $\theta\alpha$ -rhythms [2,5].

Programs of bioadaptive regulation are usually directed on correction of a functional condition of persons having the raised emotional instability, irritability, irascibility.

In this case strengthening an alpha of activity and its communications with teta and delta components is required. Let's consider models of light spindles which can be shipped in rhythms of a respiratory cycle in a kind metronome the similar breath or resonant breath.

It is visible from the presented data in table 2 the formula of light influence makes invariable a rhythm frequency of 8 Hz, organised in the form of

spindles with changing force of influence on a breath and on an exhalation.

The light pattern is presented by the impulses corresponding to parametres  $\delta\theta\alpha$  EEG.

Delta-teta rhythms are linked with an alpha-a spindle from 25 impulses on a breath and 25 impulses on an exhalation. Time of realisation of the formula makes 10 seconds.

The algorithm of realisation of formulas of influence in the tabular form is presented in table 3.

Hence, transformation neurodynamics activity of the brain, directed on strengthening of its excitability and strengthening of activation of the patient can be provided in addition by share strengthening beta-activity in structure EEG.

**Table 3.** Algorithm of realisation of model an alpha of spindles in light patterns  $\beta\alpha$  rhythms in formulas activating colourstimulation

Formula	Formula parametres	Realisation time
F-5 $\beta_{lf} \alpha_{hf}$	$[(\beta 17 lf \bullet 85 + \alpha 10,0 hf \bullet 107 )]$	15,00 *6 =60 s Transition to F-6
F-6 $\beta_{lf} \alpha_{hf}$	$[(\beta 16 lf \bullet 78 + \alpha 11,0 hf \bullet 95 )]$	15,00 *4 =60 s Transition to F-7
F-7 $\beta_{lf} \alpha_{hf}$	$[(\beta 15 lf \bullet 61 + \alpha 12,5 hf \bullet 118 )]$	15,00 *4 =60 s Transition to F-8
F-8 $\beta_{lf} \alpha_{hf}$	$[(\beta 14 lf \bullet 70 + \alpha 13,0 hf \bullet 112 )]$	15,00 *8 =120 s Transition to F-5
Total time $\Sigma t c$	-	300,00 s
Total time of a session	Repetition of formulas F-1; F-2; F-3; F-4.	2 times =10 min 3 times =15 min 4 times 20 minutes 5 times=25 minutes 6 times = 30 minutes

### Conclusions

The present research is executed according to plans of the problem commission on chronobiology and chronomedecine the Russian Academy of Medical Science, and also with one of basic scientific directions Belgorod state university»: «Working out of universal methodological receptions chronodiagnosics and biocontrol on the basis of biocyclic models and algorithms with use of parametres of a biological feedback», and also at support of the analytical departmental target program «Development of scientific potential of the higher school (2009-2010)» under the project: DSP.2.2.3.3/4307. Program realisation has allowed to receive following conclusions:

1. The determined models of subsensitive signals of a relaxation and activation of the patient in system of biooperated game training are created.

2 The algorithm of management by depth of modulation of a bearing light signal by means of change of its porosity synchronously with frequency of beats heart and breath of the patient, managements of arterial inflow differing by an orientation, or venous outflow is developed.

3. Optimisation of management by intensity of game influence is carried out by means of special algorithm of immersing of formulas of influence in a respiratory cycle.

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