NEURONAL NATURE OF SOME PSYCHOLOGICAL REGULARITIES

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Abstract

There is a step like difference between periods and phases of waves of electroencephalogram (EEG) which reflect coherent activity of many central neurons. Minimal value of the difference is about $R=0.1$ relative to the duration of proper periods. In our opinion the integer $N=1/R-1$ determines the diversity of different brain states. These states constitute an internal world of human being. Their diversity is equal to $C=N**N$, i.e. $(N)$ raised in power $(N)$. Meanwhile the capacity of attention span is about $M=AH/2$, where $(A)$ is an alphabet span of elements which to be processed, for example to be memorized. The short-term memory span $(H)$ and attention span $(M)$ are interrelated like $H=ln(C)/ln(M)=ln(C)/ln(AH/2)$. This formula predicts experimental data much better than known G. Miller's rule "seven plus or minus two". Memory span $(H)$ for stimuli constituted by combinations of different features depends on memory spans $H1, H2, H3..$, for elements constituted by each single feature separately $1/H=1/H1+1/H2+1/H3..$ with high accuracy. The typical frequency of waves in human EEG is about $F=10$ c/s, and the period of alpha waves beating $T=1/F$ determines important parameters of information processing. Among them the variable part of latency of choice reactions $t=T*(1-(1-R)/A)*(1-(1-R)/A)/2$, where symbol $(A)$ is the number of equiprobable alternative stimuli. This formula predicts experimental data much better than known W. Hick's formula. Remarkable, $t=5$ msec, near Geissler's constant, if $A=1$. In case of memory scanning after S. Sternberg (1969) paradigm, other formulas (which are derived from previous ones) predict the value of Cavanaugh's constant, about 250 ms, and Sternberg's estimations for scanning time in ms/symbol. Known reverse relationship between threshold intensity $(I_{max}, I_{min}$) of stimulus and perception delay permits to derive from previous prerequisites the formula to compute the Stevens's exponent $n=log(2R/R)/log(I_{max}/I_{min})$ for stimuli of different modality, and this result coincides with R. Tegtsoonian (1971) finding. Moreover, using multiple regression analysis, we found that small sets of EEG parameters in hundreds subjects permit to predict many personal peculiarities with acceptable accuracy in comparison with well known methods like MMPI's or Raven's testing. This work was supported by the grant N99-06-00134a of the Russian Scientific Fund for the Humanities "Neurophysiological predictors of personal traits"(1999-2001) and the Grant N93-06-10769 of the same Fund " Determination of short-term memory capacity and its temporal characteristics with EEG parameters"(2000-2002) as well as the grant N00-06-80055a of the Russian Fund for Fundamental Investigation "Search of memory codes in single records of electroencephalogram" (2000-2002).