METHODS OF DETERMINING ATTENTION USING EEG WAVES

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Abstract: *The types of attention studied by the current scientific literature are consistent with the various man-made activities. Because only in the time when attention, regardless of its type, allows for effective interaction with the external environment, it is considered, together with will, a resource. Like any resource, it can be trained and used with efficiency and effectiveness. Because it is an important resource of the human body, attention has to be measured with quantitative indicators. One method used to measure it is the acquisition, processing and interpretation of EEG type waves. The article presents a comparative study between classical methods and those using EEG waves.*

Keywords: *Sustained attention, focused attention; selective attention; alternative attention; distributive attention*

Introduction

In learning activities, the most important feature is attention. It is the process or act of focusing on one or more values of the environmental factors with which the senses come into contact.

To learn how to adapt, understanding the types of attention is a must. The forms of attention are: 1. Suspected attention (vigilance and concentration); 2. Focused attention; 3. Selective attention; 4. Alternative Attention; 5. Distributive Caution.

1. Forms of attention

1. Attentive attention (vigilance and concentration); 2. Selective attention; 3. Alternative Caution; 4. Distributive Caution; 5.Focused attention.

2. Actual results in research attention

From the perspective of psychophysiology, attention has two important components:

1. Focus attention, used in areas within the BCI sphere, corresponding to the ability of the brain to command and control the body's motor activity;
2. Cognitive attention, which manifests itself in the field of learning, which is the ability of the brain to learn to achieve the quality of feedbefore.

3. Psihofisiology of attention

Attention is differentiated on the basis of attributes, depending on the genetic dowry, the structure of the activities carried out predominantly, experience, motivation, valorizing the innate potentials specific to this psychophysiological process, for increasing the efficiency of the activity. The characteristics of attention are: Volume of Attention; Stability of Attention; Mobility of Attention; Distinction of attention; Focusing attention, (Xiao, Zhang, 2015).

The concentration indicator measures the momentary and dynamic concentration and is therefore used to train the concentration of children, adolescents and adults to send remote controls. (Su-Kyoung Kim, et al., 2014).

Throughout its lifetime, alpha activity becomes dominant in the early maturity period reflecting the emergence of an established KS. In childhood, the slower frequencies in the wide range of theta frequencies dominate. They probably reflect the dominance of a WM-based consciousness because these slower frequencies are closely associated with coding and extracting new information (Klimesch W, 2011 & Zauner, 2012).

Another implication is that individual differences in alpha wave activity could reflect differences in the way cognitive (dominant) and personality processing. CF coupling between alpha, theta and gamma oscillations is expected to reflect the interaction between WM and KS. (Klimesch, 2012 & Landau, Fries, 2012).

All available evidence suggests that EEG is not stagnant, but it is a means of studying attention, personality traits, and stress and anxiety. (Nikulin, 2012).

The purpose of the study is to determine, with the help of Neuro Sky, the variation of attention and relaxation, according to gender and age, at one time of the day, for a group of adolescents in the academic education period. In the study, we mean by focus attention to the concentration of attention, which is

fundamental in performance. The opposite of concentrating attention is inattention, relaxation being an independent variable that is not in a causal relation to concentration.

Caution with Neuro Sky is used to focus attention on making moves with great rapidity or focusing on motion control in real or virtual space. Research experiments and results processing were done according to Anita, M. (2007).

4. Objectives and hypotheses

4.1 Objectives

1. Validation of the own mathematical model of determining the degree of attention of adolescents during the academic activity by correlating the results obtained by their own method with the approved ones of the Neuro Sky system;

The Neuro-Sky method is based on a mathematical algorithm based on Fourier transform, modified for EEG waves; His own method results from the psycho-physiological analysis of the EEG waves that I correlate with the two neuro functional states that characterize the attention: the state of wake (learning attention) and the state of vigilance (concentrated focus, focused);

2. Introduction of two quantitative indicators: Focus indicator (correlated with Xiao, Zhang (2015) and Watchtower (learning condition);

3. Verify the validity of their own indicators by correlating them with the level of attention.

4.2 Assumptions

1. Your own model of determining the degree of attention of respondents is valid and consistent;
2. There is a positive correlation between the focus and the focus indicator;

5. Method

5.1 Participants

For the research, 40 students aged 18 to 45, of both genres, who were scanned with the Neuro Sky equipment under the same conditions during the experimental psychology seminar, were selected for the research, the scan time being 1.5 minutes.

5.2 Tools and Materials

For the proposed determinations we used:

- Neuro Sky equipment and its own EEG waveform application and attention-determining;
- Wi-Fi connection with the storage and processing computer;
- Continuous EEG wave transformation program in digital EEG waves;
- EEG wave filtering program to transform them to the requirements of psychophysiology;
- Calculate the degree of attention by two methods:
- A mathematical method embedded in the Neuro Sky filtering software;
- An original method of statistical processing.

5.3 Procedure

The participants were informed of the objectives, procedure, equipment used and how to conduct the experiment. The experiment began after the agreement of each participant. They were informed about the results of the experiment as well as the outcome of the processing.

5.4 Experimental design and variables

The independent variables are the densities of the power spectra of the EEG waves. DSP values of EEG waves categorized into 8 categories through the computational processes, as follows:

- Analog filtering, which has the effect of eliminating the artifacts generated by the movements of the facial muscles, blinking, etc;
- Transformation of analogue waves, continue in digital signals, ie in number lines;
- Determining the spectral power density to allow us to compare different wave frequencies and to perform mathematical and atatic calculations, being converted into a single unit of measurement;
- Apply the digital filter that divides the EEG waves into 8 categories, depending on the DSP;
- Record the recordings in the ME as shown in Table 1.

Which, after processing, takes the form from the following table.

Atentie	Relax	Delta	Theta	Low Alpha	High Alpha	Low Beta	High Beta	Low Gama	Mid Gama
58.23	57.054	337949	62691	14854	16197	12905	9441	5848	18883
27	14	1602	3827	815	1396	1994	1997	1202	1652
88	93	2077313	362143	58994	115846	63245	18828	18891	85780
4	4	2	2	2	2	2	4	3	2

Dependent variables are attention and relaxation.

I have chosen as the research standard the one-sided design consisting of 40 participants.

The results were recorded with the Neurosky MindWave Headset and via a Wi-Fi connection they were stored and processed in the computer after an original processing program. The scanning time was 1.5 minutes.

The focusing index is a quantitative indicator used to draw attention to the fact that, after a period of 5-6 training sessions of 15-20 minutes each, the participant can order different equipment after two categories of orders:

- On-off commands, ie: opens and shuts the TV, opens and closes the door, gas, water;
- Calibrated commands: increases or decreases the sound level on the TV or radio, opens or closes the door halfway, etc; To accomplish these things, Xiao, Zhang. (2015) introduces the Focus or Concentration Index: $I_f = \frac{DSP(Beta)}{DSP(Theta)}$, and I will call it IFXZ.

Because of the studies I have made, I have come to the conclusion that Low beta waves are determinant for the value of attention, I will calculate the Focus Index and the relationship: $I_f = \frac{DSP(LowBeta)}{DSP(Theta)}$ which I call IFRP and will compare the results.

5.5 Discussions

Neuro Sky's attention and meditation results are checked by psychophysiologists who have participated in product validation. No documentation provides details of how the system calculates. To validate our own results, we used the Pearson, Kendall and Spearmen correlations in SPSS and obtained the following results:

1. The correlation coefficients Pearson, Kendall and Spearman, for the relationship between IFRP and attention have a significant correlation with the correlation index of 0.01;

2. The correlation coefficients Pearson, Kendall and Spearman, for the relationship between IFXZ and attention have a significant correlation with the correlation index of 0.01;

3. The correlation coefficients Pearson, Kendall and Spearman, for the relationship between IFRP and attention and attention indicator, calculated by its own method, have a significant correlation with the correlation index of 0.05, which means a significant correlation with the index correlation framing of 0.01;

4. The correlation coefficients Pearson, Kendall and Spearman for the relationship between IFXZ and IFRP have a significant correlation with the correlation index of 0.01;

Conclusions

1. The model for determining the attention indicator is valid and consistent, which validates hypothesis 1;

2. We calculated the focus index with the Xiao relationship, Zhang. (2015), and correlated positively and significantly with attention;

3. We have introduced a new relationship for the coefficient of focus, which I have noted IFRP, which correlates with the Xiao, Zhang focusing coefficient. (2015), and which has a better correlation than that:

Comparison between the careful correlation of IFRP and IFXZ:

Coefficients	IFRP	IFXZ
K_P	0.565	0.501
K_K	0.467	0.410
K_S	0.644	0.533

4. This method can be introduced in a synchronous pattern that will determine the degree of attention on-line, which will allow the organization of the training program and its structure over time, depending on the participants' dynamic of attention;

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