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Word, Information, Person as Concepts of Cognitive Psychology

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ABSTRACT

The readers are offered the review of the results of research work performed by science team under the leadership of the author. The results and conclusions in the article reflect the scientific interest of author and his opinion about the research topic. The content of the article is one of the interdisciplinary scientific research and connected with the information theory and cognitive psychology. As a practical application, it is recommended that the results in the article to be used for the correction of person`s addictive behavior. However, the application of the research outcomes is not limited to it. Education, upbringing, and psychoanalytic pedagogy are the areas where the outcomes may be useful.

KEYWORDS

Information; Entropy; Cognitive Psychology; Addictive Behavior; Galvanic Skin Response (GSR).

INTRODUCTION

The material represented in this article relates to the field of interdisciplinary research. On the one hand the theory of information, on the other hand psychology. At first glance, it may seem impossible to combine these two scientific disciplines. But, it is right at the intersection of sciences that you can often find the answers to the questions that cannot be obtained within a single discipline.

Information theory is frequently perceived as belonging to natural sciences and having no relation to the humanitarian sphere. But can this natural science discipline be used, for example, in the field of psychiatry and other mental sciences? To answer this question we will turn to the work of Gregory Bateson: “To the psychiatrists, I presented a challenge in the shape of a small exam paper, telling them that by the end of the course the should understand the questions on it. Question 1 asked for brief definitions of (a) “sacrament” and (b) “entropy.”

The young psychiatrists in the 1950s were, in general, unable to answer either question. Today, a few more could begin to talk about entropy (see Glossary) [1].

In information theory, entropy, which is mentioned in the above quotation by Gregory Bateson, is known to be one of the basic concepts. Entropy is used to calculate the amount of information and, in fact, is the equivalent of the term. Cognition is impossible without information. Therefore, in conjunction with other disciplines the information theory forms interdisciplinary cognitive disciplines where cognitive psychology is easily detected.

Misinterpreted information within oral or written communication is one of the causes of human internal conflicts and conflicts between people. One of my young patients at the time of our conversation noticed that her nervous behavior was the result of the influence of one of her close relatives. This was right the person to be educated.

Maybe right at that moment it was realized that educational conversation, suggestion (information message in the form of speech or text) primarily transmits information. Therefore, it is necessary to focus attention not on the content but on the transmitter of the message, i.e. information. When isolated from the context person`s speech may seem nonsense. Judging on my patient`s face she was most probably perceiving my educational speech right this way.

Issues related to the information and its impact on human, society and nature are acute. Some research outcomes of the

system "word-information-person" got by the research team under the leadership of the author are proposed to the readers in this publication.

MATERIALS AND METHODS

The word is known to be the main instrument of education and upbringing, it can cure or inversely cripple the human. In this case a logical question on how the word affects people arises. At first glance it may seem that the power of the word is in its semantic content. Is it true and what is the sense?

The meaning of "sense" can be formulated as follows: the sense of the information message is the human thought encoded by certain linguistic signs displayed in oral or written form. The following experiment was conducted to answer the question "How does the sense of the information message affect a person?" The person (recipient) was offered to read two texts.

The first text - normal (a fragment of the scientific article), the second - probable (the same text but containing the words redistributed in the random order). In other words, the first text made sense and the latter one was, in fact, "nonsense". When testing the emotional state of the recipient was evaluated alongside with text reading. The method of galvanic skin response (GSR) was used for the evaluation of the emotional state.

GSR method allows quantitative and qualitative assessment of all kinds of emotional manifestations being observed both as a result of special effects and as an index of subjective experiences that occur during mental activity. GSR signal is the most informative for the majority of research tasks and applications.

This signal helps to estimate the variables of the electrocutaneous processes and level-defined parameters characterised by slow tonic changes in the person`s psychophysiological state. The method description and GSR basic parameters are represented, for example, in the following works [2-4].

In our research, the following GSR parameters were used as evaluative ones:

- GSR-activity TA, cNp/min. The GSR-activity value is obtained as the average of amplitudes of single phase GSR signals over the test time expressed in centiNapiers (cNp) per one reaction.
- Time of activation phase t_i, sec. It characterizes the instantaneous speed of the GSR signal in the activation phase.
- Time of relaxation phase t_i, sec. It characterizes the instantaneous speed of the GSR signal in the relaxation phase.
- Activation amplitude a_i, cNp. Increment of activation in i-th reaction.
- Relaxation amplitude $-a_i$, cNp. Decrement of activation after relaxation in i-th reaction.
- Average activation speed V_i, cNp/min. It characterizes the "strength" of response in i-th reaction.
- Average relaxation speed $-V_i$, cNp/min. It characterizes the intensity of reduction processes in the skin.

The works of Sukhodoev can be referred to for a more detailed description of the listed parameters [3, 4].

For registration of GSR and measurement of evaluation parameters, two-channel hardware and software complex "DIANEL 11S-iON" was used, its description being available in [5]. This device is designed for measuring the electrical conductivity of skin (electrodermal conductivity). It employs a modification of Fere method – a technique of relaxation and activation test based on original developments of the Russian scientists.

During testing, sensors of "DIANEL 11S-iON" hardware and software complex were attached to the recipient's fingers, ring and little fingers of the right and left hands (right and left channels, respectively). Then the test message was read for the recipient and simultaneously his galvanic skin response was recorded. The emotional condition of the recipient was determined according to change of electrodermal resistance signals amplitude and evaluated according to GSR parameters.

As a result of the conducted experiment a connection between the sense of the message and person`s emotional condition in the form of the inverse relationship was revealed. It is obvious that the meaningful text is understandable for the person and does not cause emotional stress. The senseless text makes the person catching the sense that leads to the increased emotional tension. It allows to conclude that the definition of the "sense" does not reveal all the secrets of the word power and therefore is of little use for the substantiation of the word effect on the man. However, it is clear that the sense has a supreme importance as an element of connectedness and logic of the information message.

The following hypothesis was set up taking into account the outcomes of the conducted experiment: the emotional state of the person perceiving an information message by hearing or reading depends on the level of information richness of this message. The level of information richness is equivalent to the amount of information, i.e. as it has been already mentioned to the amount of entropy. According to C. Shannon "The entropy is a statistical parameter which measures, in a certain sense, how much information is produced on the average for

each letter of a text in the language" [6].

Entropy in the sense of the above quotation is a key concept of our study. Typically, information messages (texts) contain about 80% of redundant information. The remaining 20% is this very entropy due to which the information message may serve as a source of unpredictable energy. If text or oral messages were deprived of entropy, they would not bring news to the recipient and thus would not cause the change of their emotional state.

To test the stated hypothesis several experiments were carried out. The outcomes can be found in [7-12]. Test texts of different types were used as information messages: the sequence of alphabet letters, the news from the website, the fragments of scientific and publicistic articles. The emotional state of the recipient was assessed by GSR parameters. To eliminate the influence of external interference pilot testing was conducted in two human conditions:

wakefulness - a state of awareness;

hypnosis - a state from relaxation to moderate trance.

RESULTS AND DISCUSSION

During the research study it was stated that human emotional responses occur when perceiving some words or word groups - text constructions of the information message with a distinctive level of entropy. Obviously, these word forms carry an element of novelty and uncertainty for the recipient and cause emotional reactions. In fact, these are special, different from linguistic "entropy language constructs".

The work [7] can be referred to for a more detailed description of the obtained results. Some of the results of test are represented in Table 1 and graphically in Figures 1 and 2.

Table 1: Results of test in conditions of the recipient's wakefulness and hypnosis.

Evaluative parameter of GSR	Wakefulness condition		Hypnosis condition	
	Left channel	Right channel	Left channel	Right channel
GSR-activity TA, cNp/min	17,13	10,47	7,72	0,71
Activation time t_i, sec	10,12	7,59	6,76	5,42
Relaxation time t_i, sec	27,32	43,30	24,06	69,78
Activation amplitude a_i, cNp	15,63	12,74	4,72	1,30
Relaxation amplitude $-a_i$, cNp	83,78	103,80	12,53	29,62
Activation speed V_i, cNp/min	1,52	1,26	0,64	0,23
Relaxation speed $-V_i$, cNp/min	2,02	1,63	0,47	0,34

Figure 1 shows a fragment of GSR graph obtained during the recipient's listening of the test text in condition of wakefulness.

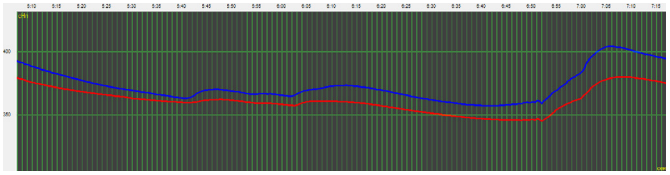

Figure 1: Fragment of GSR graph in the recipient's wakefulness condition.

The data of Table 1 and Figure 1 demonstrate clearly that the recipient responded to the message transmitted rather emotionally, which is confirmed by significant change of GSR signal amplitude.

Figure 2 shows a fragment of GSR graph obtained during the recipient's listening of the test text in condition of hypnosis which appears smoother rather than one given in Figure 1.

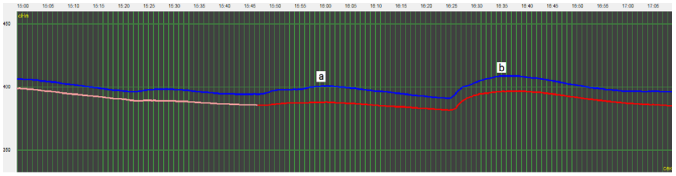

Figure 2: Fragment of GSR graph in the recipient's hypnosis condition.

Comparing of data represented in the table and in figures shows that the emotional perception of text information by man decreases in hypnosis condition. Meanwhile, the emotional reactions, as shown in Figure 2, arise at perception of individual words or word groups. After calculations, it has turned out that text structures to which the recipient had an emotional reaction in hypnosis condition differ from the structures located next to them in the value of entropy.

Let us compare the results of entropy calculations with text structures of the test message. In Figure 2, the emotional reaction in point a is correlated to reading of the word "It" which is used here in meaning of Freud. Entropy of this word makes 0,918 bits per symbol. Meanwhile, entropy is 3,169 bits per symbol in the word located to the left, and it amounts to 3,095 bits per symbol in the combination of words located to the right. The following example shows that the recipient developed the emotional reaction (Figure 2, point b) at the point of reading the sentence "Perhaps, it is then that one starts to understand that one learns independently what one needs and you cannot teach him everything you deem necessary to give him". Entropy of this sentence amounts to 4,131 bits per

symbol. For comparison, in the sentence coming before, entropy makes 4,423 bits per symbol.

The obtained research outcome leads to the formulation of the basic principle for the developing methodology of the psychological correction of addictive human behavior: the word forms of corrective information message should have a distinctive level of entropy. According to the methodology, GSR method helps to detect person`s problematic emotions and, accordingly, problematic areas of the psyche. Specially created texts containing "entropy language constructs" are used to correct the identified mental disorders. The content of the texts is transmitted to the patient in the form of suggestions as an information message.

The experimental texts aimed at the correction of addictive human behavior in relation to the excessive use of alcohol and tobacco smoking were worked out for the approbation of the obtained research outcomes. These texts consist of separate text constructs with a different level of entropy. The words, composing the text structure ("desire", "calmness", "well-being", "overcoming", etc.) were chosen using the method of free association by Jung [12] and were combined in the text on the level of entropy. Thus, in fact, correcting texts are themselves the maps of neurolinguistics programming and their distinctive feature lies in considering the entropy of the words that constitute them. The developed methodology and experimental texts are in the state of approbation.

CONCLUSION

Most probably Gregory Bateson was right when focusing his students-psychiatrists attention on the meaning of the word "entropy". Entropy carries a charge of energy that can change the person's emotional state. Directing this energy into a positive direction, the power of word can correct, for example, person`s dependent behavior. In this context, the word entropy emerges as one of the addictive behavior correction factors.

However, application of the obtained outcomes is not limited only to this. Education, upbringing, psychoanalytic pedagogy - this is not a complete list of those areas where the obtained outcomes can not only be used but also find future development. We hope that eventually our efforts will help to establish an interdisciplinary scientific discipline - cognitive psychology.

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