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Scientists are studying the problem of modeling the cognitive dissonance phenomenon

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Lobachevsky University (UNN) scientists Alexander Petukhov and Sofya Polevaya are studying the phenomenon of cognitive dissonance. They rely on the theory of information images and a mathematical model developed on the basis of this theory. The proposed theory is based on the idea of a universal cognitive unit of information in the human mind, the so-called "information image," and of the space where it exists, its topology and properties. Accordingly, the theory of information images is a way to describe information interactions of individuals, as well as a number of human cognitive functions.

"We have considered the hierarchy of information images in the mind of an individual, which determines the individual's real and virtual activities. We have also developed algorithms for describing the transmission and distortion of information images by individuals during communication," says Alexander Petukhov.

The theory of information images states that there is a certain limited space filled with a set of information images that are in constant interaction governed by certain laws. Heavier inert information images are in the center of this space, while lighter high-energy images are closer to the edges. From a mathematical point of view, this can be described by means of diffusion equations (for example, the Langevin equation), in which information images are likened to particles intensively interacting in a limited region (the information image space).

For experimental validation of the theory, the researchers used the bilingual Stroop test, a classical test for detecting the effects of cognitive dissonance with several conflicting information disturbances; it was used to compare the results of modeling with experimental results.

In the classical version of the Stroop test, the test subject is given the task of reading the name of a color in accordance with the meaning of the letters of the word that denotes the color and the actual color of the text. The reaction time and the number of errors are measured in four contexts:

- words denoting the color are written in black letters and presented against a light background; the objective function is to name the color in accordance with the meaning of the word;
- the color of the letters and the meaning of the word are equivalent; the objective function is to name the color in accordance with the meaning of the word;
- the color of letters does not match the meaning of the words; the objective function is to name the color in accordance with the meaning of the word;
- the color of letters does not match the meaning of words; the objective function is to name the color in accordance with the color of the letters.

In the third and fourth contexts, a discrepancy arises between the information images activated by verbal and color visual stimuli. Such a cognitive conflict of information images is manifested in an increased time required for decision making (the time interval between the moment when the stimulus is presented and the response of the person being tested). One of the options for modifying the computerized Stroop test is a bilingual test in which the words are presented in both the native language of the person being tested and a foreign language.

According to Sofya Polevaya, the results of the test are interpreted with the help of the proposed theory and compared with the results of computer modeling based on this theory.

"It has been shown that with the help of information images, one can explain a number of cognitive processes in the human mind and also predict their dynamics in some particular cases," Sofya Polevaya notes.

The results of the simulation demonstrate that the general characteristic pattern coincides in the experiment for the native and foreign language, which confirms the adequacy of the model for solving problems of this type and the appropriateness of the interpretation proposed.

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