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Application of the Reflexive Analysis for Formalization of Situations of the Estimation and the Choice

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Abstract. *Application of the reflexive analysis is considered. An example of process of an ethical estimation of situations and a choice from a set of alternatives is described. Models of V. Lefebvre are used for experiment formalization, and estimation of process by human subjects of activity of other subjects and decision-making in a choice situation.*

Keywords: expert estimation, categorization, human subject, group, interpretation

1 Introduction

Creation of systems of artificial intelligence demands creation and use of the models, capable to reproduce fundamental characteristics of intellectual activity. Such models have to be based on fundamental concepts. On the one hand, concepts have to represent general properties of human mind. On the other hand, they have to correspond to realization opportunities by means of informatics arsenal.

The mathematical apparatus of the reflexive analysis [1-4] has such properties and powerful potential. The author, V.A. Lefebvre, designated it as "contours of fundamental psychology". This approach is based on logic of thermodynamic processes, and has possibility to explain and formalize many phenomena of human behavior.

Properties of fundamental models are complexities of application, formalization and interpretation. The author has his own experience of overcoming difficulties of understanding such models. The first goal of the present article is to represent opportunities and problems of use of the reflexive analysis with use of an example of some research.

The other goal is to represent the project [6] of updating of use of the reflexive analysis. A web site will be created to provide an opportunity to investigate the group decision making process. Feature of the project is organization of humanitarian support of application of the reflexive analysis for a wide range of users [7].

2 Ethical estimation of situations

We used the results of the experiment [5] in which influence of a magnetic field on moral judgments was detected. Experiment was organized as follows. Descriptions of a number of situations of different degree of criminality were offered to respondents. Situations were described by the same schemes, but were different on characters, a situation, etc. So, in Murder option one episode (Jellifish)

the character gives deliberate misinformation about lack of poisonous jellyfishes in this place, and the victim perishes as a result of bathing. In other episode (Tracks) because of negligence of the character railroader there is a train crash therefore 125 people perish.

Respondents had to estimate the guilt of the character of a situation on a scale from 1 (is absolutely innocent) to 7 (is absolutely guilty). Participants of the experimental group (Group E) were exposed to in addition magnetic stimulation of a site of the brain responsible for an assessment and modeling of behavior of other people. Participants of the control group (Group C) made their estimations without additional influence. As a result participants became more strict to estimate the consequences, and more softly to estimate unrealized criminal intentions.

Influence of an external factor on moral judgment was declared in this experiment. Investigation of changes in a picture of the world of the human subject is of a great interest. An effective way of such investigation is application of a certain formal model. We chose as a model "a formula of the person" [1]. The model uses the following formalization.

System representation of any situation consists of the pressure of ***X1*** of the outside world, ***X2*** – perception of this pressure by the human subject, ***X3*** – his intentions , and also of result of his choice – ***X***. All factors of pressure are set in the range [0, 1] where "***0***" value corresponds to a negative pole, and "***1***" – positive. The concepts "negative" and "positive", differently "badly" and "well", "kindly" and "angrily" belong to a universum of the subject.

$$X=X1+(1-X1)*(1-X2)*X3 \qquad (1)$$

We used this model twice: in the first case for the description of behavior of the character of a situation, in the second – for the description of process of assessment of the situation by participants of experiment. The scheme in experiment was formed of the combinations presented in Table 1. The behavior of the character of a situation according to this model is presented in Table 2. Here ***X3*** – the intention realized by the subject, and ***X*** – result of realization of this intention in this situation. The situations distinguished in experiment [5], in Table 2 are in addition supplied with original names.

Table 1. Schematization of the situations in the experiment

		Situation actually is	
		safe ***X1*=1**	**danger** ***X1*=0**
The character is convinced that a situation is	**safe** ***X2***=1	Norm (***Fine***)	Imprudence (***Accident***)
	danger ***X2***=0	Attempt to do a crime (***Attempt***)	Deliberate crime (***Crime***)

Table 2. Formalization of behavior of the character of a situation

№ of option	***X1***	***X2***	***X3***	***X***	**Name of the situation / Name in [5]**
1	0	0	0	0	Deliberate crime / ***Crime***
2	0	0	1	1	Warning
3	0	1	0	0	Negligence / ***Accident***
4	0	1	1	0	Levity ***/Accident***
5	1	0	0	1	Attempt to do a crime /***Attempt***
6	1	0	1	1	False alarm
7	1	1	0	1	Intention without realization
8	1	1	1	1	Norm/ ***Fine***

The model (1) represents a situation in comparison with that which is used by authors [5] in more detail. In particular, in this model and in the Criminal Code (CC) of the Russian Federation options No. 3 and No. 4 differ. It is important to consider option No. 2 as some situations offered in experiment, looked rather strange. For example, in some dangerous situations the character adequately estimated this situation, but didn't interfere though had no criminal intentions (for example, didn't warn the child about danger to jump in water in this place).

One of important properties of model (1) is the explanation with its help of effect of distortion of estimates at a categorization [1]. This effect may be described in such a way. Magnitude estimates of object for example, length of a metal rod in inches, linearly depend on the actual length of the rod. Categorial estimates (for example, to category 1 belongs the shortest objects, to category N belongs the longest objects) has systematic shift.

For example, at an assessment of length of rods or level of knowledge of students the positive pole associates with the maximum value of category. Estimates are thus overestimated. Extent of distortion increases with increase in relative frequency of presentation of the objects close to the minimum category. Discussion of the hyperbolic law of a categorization at an estimation of psychophysical incentives contains in [4].

When modeling procedure of an assessment by the participant of experiment of degree of guilt of the character we made the assumptions which are listed below.

1) In each situation the pressure of X1 corresponds to the punishment measure, defined by some official documents, and practice of their application as well. As respondents were students and weren't lawyers, we decided to neglect some distinctions of the legislation of the USA, Israel and the Russian Federation. Such specification can be rather interesting. In particular may be differed four forms of guilt: on purpose; with consciousness; with levity; with negligence.
2) The perception of X2 was interpreted as operation of the filter created on the basis of experience of the participant of experiment concerning similar estimates. Such estimates are caused, in particular, by influence of mass media. Actually it is result of the answer to a question of guilt of the abstract participant (subject) of a crime, i.e. it is a question according to the situation scheme, instead of a concrete situation.
3) Intention of the respondent was accepted adequate to his perception: X3=X2.

For an objective scale we took the values corresponding to imprisonment terms in the criminal code of Russian Federation and rated them to a scale, used in the experiment. These values together with experimental estimates are given in Table 3.

Table 3. Conditions and results of experiments

	Name of the situation		
	Imprudence ***Accident***	Attempt to do a crime ***Attempt***	Deliberate murder ***Crime***
Criminal code of Russia Federation (1997)	**Article № 109.** Causing death on imprudence	**Article № 30.** Attempt to do a crime	**Article № 105.** Murder
Punishment measure (imprisonment term, years)	**3** years or **5** years if this is inadequate execution of official duties	No more than **3/4** from the maximum term for a crime	From **6** to **15** years in the absence of aggravating circumstances
Basic estimation (points)	**3**	**5,4**	**7**
Estimation of group C	**3**	**6**	**7**
Estimation of group E	**4**	**5**	**7**

There is the certain arbitrariness connected with a choice of a maximum penalty, and a value or an interval for intermediate values. We took the minimum value equal to zero. The following operation is transformation of an interval of terms of punishment to an interval in points.

At least two options of necessary reduction of the "objective scale" to an interval **[*0, 1*]** are possible. In the first option it is possible to consider that the maximum degree of guilt of 7 points corresponds to value ***0***, and absence of fault (1 point) corresponds to ***1***. The second option is that the severe punishment is considered by the expert as force manifestation, i.e. is considered as a positive pole. Our analysis showed that the inverse scale describes experimental data better. It indirectly confirms the hypothesis that for respondents the severity of punishment was the positive pole. It is curious to note that in situations, where the character formally could be considered absolutely innocent (1 point), the experimental assessment equaled on the average to 2 points, and this effect also is present at model (the second case).

The similar experiment was made by us in 2012 with students of Omsk state institute of service. Differences in the organization of experiment consisted in the following. Instead of the real magnetic device the simulator was used, and students had to confirm in writing that they agree to contactless magnetic influence, or refuse to make it (this right used 4 persons from 21.

At a briefing it was recommended indirectly to students to consider consequences more important than an intention. Recommendations were rational (links to the Criminal code of the Russian Federation), and irrational (the corresponding literary precedents were mentioned). Results confirmed known effect, that change of an estimation can be achieved without physical impact at the expense of impact on consciousness and subconsciousness of respondents by means of the organization of the corresponding procedure. Absence of "purely kind" and "purely angry" respondents, otherwise, absence of correlation of the estimates made by the specific respondents concerning a various type of crimes was of some surprise for us.

The model (1) was used here in two options. In the first case it was supposed that every respondent precisely estimate a situation (X2=X1), and have intention to implement his estimation (X3=X2). The second hypothesis was that impact on experimental group had brought the respondents into a stable condition of an average estimation by default (X2=X3=0,5).

Available data don't allow to confirm, or to disprove these hypotheses, however, in our opinion, they find the plausibility status. A fragment corresponding to experimental data is represented in Table 4 and are accompanied by fig. 1 schedule.

Table 4. Experimental and calculated values

Value of ***X1***	**Group *E***	**Model (1)** ***X1=X2=X3***	**Group EM**
1	**2**	**3**	**4**
0	0,17	0	0,17
0,3	0,33	0,447	0,5
0,7	0,83	0,763	0,67

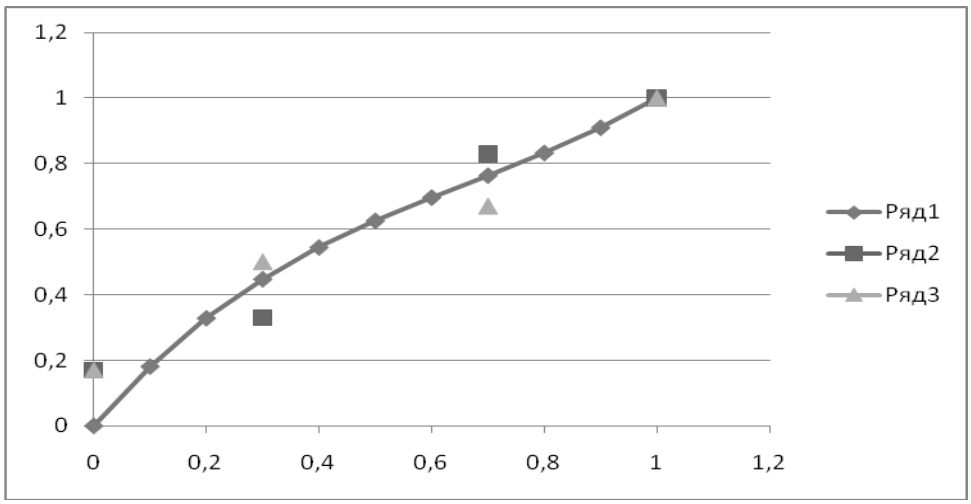

Fig. 1. The schedule to Table 4. Ranks 1, 2, 3 correspond to columns 3, 2, 4

Thus, the model allows to describe the main trend of estimations of this experiment. The explanation of shift of the estimations caused by influence of a magnetic field, demands more investigations.

3 The reflexive analysis of decisions in group of human subjects

The general scheme of the reflexive analysis [1, 2] can be described as follows. Operands (variables, entrances and exits) models can be interpreted as influence, pressure, coercion, intention, etc. Values of the operands of the model are, as a rule, the Boolean "***0***" and "***1***". These values may be interpreted as "bad" and "good" respectively. In some cases ("golden ratio", a categorization) the values may belong to a discrete or continuous interval of numbers, and to a discrete set of symbolical values as well. Operators of model are the operations "addition/subtraction" (±), "multiplication" (•) "negation" (¯). The equality symbol (=) is used also.

The conceptual scheme of the theory of reflexive games [3] may be described as follows. Under consideration there is a group of human subjects. The structure of such a group is set by the graph where knots are subjects, and edges are the relations between subjects. The relations between the subjects can be presented in terms "union" and "conflict". Qualification of the relations is made from the point of view of the external observer. Subjects may have their own interpretation of these relations.

Each subject potentially can make an alternative choice of actions from the set of actions attributed to the group or make the decision to postpone a choice or appear in a situation of impossibility of a choice.

Data set consists of lists of subjects, their possible actions, the relations of subjects and their influences to each other. Result is the list of possible actions of each subject.

The web site will be developed for these calculations. We will create an interactive version of model of behavior of group on the basis of the theory of reflexive games of V.A. Lefebvre with use of cross-technologies. For realization of humanitarian support it is planned to place calculation examples, including educational video movies. Creation of such materials is carried out within the scientific direction "Reflexive Theatre of the Situational Center" [7].

4 Conclusion

It was shown that the results of a pilot study may be used as resource for some sort of data mining. The reviewed example can be used for formalization of similar researches. Results form also the basis for carrying out large-scale experiment by a categorial estimation of situations. Such work is planned to carry out within the next annual conference "Reflexive Theatre of the Situational Center-2013".

Further researches are connected with creation of interactive means of use of reflexive models in analytical activity, and also their realization in a robotics. It is supposed to unite "a formula of the person" with models of reflexive games [8]. In such a case we will have an opportunity to investigate multistep processes including dynamic change of number of members of group. It will be possible to observe change of an estimation of the type of relation "union" and "conflict".

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