

Artificial societies

(The quarterly journal)

Vol 4, No1-4
Quartel II-IV
2009

- scientific articles • discussions • models
- artificial intelligence • scientific software • digest



IN THIS ISSUE:

The Sixth European Conference on Social Simulation

Central Economics and Mathematics Institute of the Russian Academy of Sciences

(Laboratory for experimental economics)

Laboratory for artificial societies

Artificial societies

**The quarterly
Internet-journal
Volume 4, No 1-4, 2009**

ISSN 2077-5180

© Central Economics and Mathematics Institute of the Russian Academy of Sciences

The journal is issued since October, 2006, 4 times per one year.

Editor-in-chief – V.L. Makarov, academician of the Russian Academy of Sciences

Editorial board:

F.I. Shamkhalov, Corresponding member of the Russian Academy of Sciences,
Deputy director of the CEMI RAS

A.R. Bakhtizin, Doctor of Sciences in Economics

G.E. Besstremyannaya, Candidate of Sciences in Economics

A.A. Afanasyev, Candidate of Sciences in Economics

N.V. Bakhtizina, Candidate of Sciences in Economics

H. Deguchi, Dr. of Science, Dr. of Economics (Tokyo Institute of Technology, Japan)

M. Tsvetovat, PhD, (George Mason University, USA)

Computer imposition:

D. Polunina

Address:

47 Nakhimovsky prospect, 117418, Moscow, Russia

Phone (7) (495) 129 07 44

Fax (7) (495) 129 14 00

E-mail: albert@artsoc.ru

Web: www.artsoc.ru

CONTENTS

Volume 4, Issue 1-4, 2009

Scientific articles

Zulkarnai I. U., Gizatov N.R. Agent-based modeling in solving the tasks of economic federalism	5
Bobkova I.A. Developing classification for analyzing social networks in the Internet	28
Lavrov A.A. Providing for reliability and convincingness in computerized scenes introduction	48
Makarov V.L., Bakhtizin A.R., Istratov V.A. The Sixth European Conference on Social Simulation	60
Istratov V.A. A Model for human behavior: preliminary calculations	65
Konkova T.A. Special issues in modeling artificial societies	69
Savelyev A.V. On the possibility of conscious modeling of the unconscious in artificial systems	77
About the authors	84

Agent-based modeling in solving the tasks of economic federalism

© Zulkarnai I. U., Gizatov N.R.(Ufa)

Russia experiences “the maintenance of federalism”: although all groups of the society admit the absence of de facto federalism, the “diagnosis” is still being kept and the country is called a federation. One of the reasons for such state of affairs is likely to be the fact that as a tool of public “construction”, federalism is treated by governing authorities and by society as a progressive phenomenon. However, this attitude is due to feelings rather than to mental analysis. When it comes to practical realization of federalism in the way it has been implemented in other federations, various fears (the threat of separatism and nationalism in regions, the country’s falling apart) arise in Russian governing elite, in society as a whole and in its most educated part – scientific community.

The major problem in public endeavor in Russia is the problem of its moving in direction of centralization and unification after short periods of decentralization.

This matter of course has been strongly criticized by the advocates of market-preserving federalism. The most cited follower of this concept, B.Weingast sees its essence in competition among lower-level jurisdictions combined with restrictions set by the central government. This way excludes monopoly of any government on regulation. Jurisdictions (regions, municipalities within regions) compete for capital, workforce, economic activity, offering a certain menu of public services (tax rates, protection of private property rights, social and communal services, public goods, Weingast, 1995).

Economic agents choose the places for their economic activity on the basis of these “menus”. Such interaction between jurisdictions and economic agents leads to a

large variety of the quality of public goods and the level of tax burden. Moreover, mobility of labor force and capital exerts pressure on jurisdictions limiting them in their possible desire to conduct confiscation policy. Weingast (1995) concludes that in this way federalism softens the level and the prevalence of rent-seeking behavior and formation of redistribution structures. It can be noticed that Russian economy and public system can be most easily described in terms of the very rent-seeking and redistributinal relations.

Along with logical reasoning and mental models of the above mentioned type (e.g. Tiebout, 1956), the same problems, issues and patterns are described by graphical models, the means of game theory, analytical equations (Oates, 1972, Stiglitz, 1997, Musgrave, 1989) and econometric methods (e.g. Martinez and McNab, 1997). Although all the models correspond to the practice of public policy in the developed countries both in view of positive and normative economics, nonetheless, they do not have any impact on the Russian society.

The reason most probably lies in traditions, formed back in the Soviet period of the country's development. Due to ideological reasons, the political science school followed A.Smith and Marx and determined the culture of analysis in the Russian economic science. Fiasco of the large-scale experiment on implementing Marxist model in the 20th century most obviously demonstrated that mental models disregard most crucial details of reality, in particular due to initial assumptions and beliefs of the authors of those models.

“Shock therapy” of 1990s with its catastrophic consequences for Russia and all post-soviet countries was similarly based on mental model of “perfect market”, which had little in common with the centrally planned economy of those times. Normative part of reform concept, called Washington consensus, predicted a negligible recession in economy within only 2-3 years. After that an economic growth due to market interactions of economic agents was expected. However, the actual succession of

events had nothing to do with theoretical predictions and even after two decades since 1990s we still experience the consequences of those hasty decisions.

Unfortunately, the prevalence of mental models, which by their nature simplify the reality, continues to exist in decisions of economic and public policy. Upon regarding one group of factors it is easy to come to a conclusion on necessity of centralization. Similarly, looking at another group of factors in case of the same country in the same period of its development it is easy to come to an opposite conclusion about federalism. Publications in the Russian-language journals “Federalism” and “Regional science” have papers of both kinds.

Complex consideration of a wide range of factors that more adequately reflect the reality is possible only in mathematical models, which unfortunately so far have not taken a due place in decision-making. An exception is Leontyev’s «input-output» model which became the major instrument for decision-making of GOSPLAN in USSR. Using modern terminology the model may be called computable, which allows to think that Russian political elite and scientific circles are ready to accept and trust the results, obtained by the means of this category of models. In this way development of computable models for functioning of the society is regarded to be an urgent and promising task, especially when applied to the issues of federalism and local government.

The boundaries for developing computable models are limited only by productivity of computers, which make emulations. This enables to create models including dozens, hundreds and thousands of equations, which allows describing actual events with more precision. Development of elements of artificial societies led to emergence of neural networks and agent-based modeling (Lyuger, 2005, Bakhtizin, 2008, Makarov, 2006).

Before describing our agent-based model, which was developed for solving certain issues in economic federalism, let us note a number of examples on relevant

issues. We consider that the examples demonstrate the consequences of the absence of reliable forecasting instruments in decision-making.

To raise the revenues of the local budget, in 1980s the mayor of New York decided to increase the rate of property tax. This caused mass movement of rich people in suburban areas, and as a consequence there was a fall in property prices and inhabiting of the city center by poor people. As a results, budgetary revenues decreased (the tax base for property tax in the US is average market price of property in different parts of the city). Another example is tax competition of Spain's provinces for attracting capital, which in similar years led to devastation of local budgets. The phenomenon was called «race to the bottom» and was noticed in different sectors of economy and in competition for investment among countries (Gurtner, 2000). As for Russia, when in 1990s sales tax was used and regions and municipalities could set any rates for this tax up to 5%, this phenomenon was not present, and almost all municipalities set the tax rate at the highest level.

Agent-based model “Territorial competition of regions for investment capital”, which we implemented in Borland Delphi 7, allows solving similar tasks. The model incorporates 4 regions (Bashkortostan, Orenburgskaya oblast, Samarskaya oblast and Tatarstan), and implements the following strategies: decrease in tax rates ($\downarrow T$), increase in tax rates ($\uparrow T$), improvement of institutional environment, worsening of institutional environment ($\downarrow I$) (in reality, it is inaction of authorities, when environment naturally worsens, e.g., there is rise in corruption). Moreover, the following 5 combined strategies are realized: preservation of tax rate and institutional environment ($T=\text{const}$, $I=\text{const}$), increase of taxes and improvement of institutional environment ($\uparrow T \& \uparrow I$), increase of taxes and worsening of institutional environment ($\uparrow T \& \downarrow I$), decrease of taxes and improvement of institutional environment ($\downarrow T \& \uparrow I$), decrease of taxes and worsening of institutional environment ($\downarrow T \& \downarrow I$).

It should be noticed that Weingast (1995) considers it obvious that in reality 2 out of 5 these combined strategies are implemented, stressing that the choice of local jurisdictions and economic agents leads to a variety of public goods, when some jurisdictions lower tax rate and the level of public and other services, and other jurisdictions provide higher level with higher taxes. In our model, however, we implement all five combined strategies. We consider all firms equal in financial parameters. The firms prosper under favorable institutional environment, acceptable taxes and high capacity of market (not very strong competition). We model this prosperity as reproduction of firms as: $N_i = N_{i-1} + \Delta N_i$. Under unfavorable conditions firms start being bankrupt: $N_i = N_{i-1} - \Delta N_i$. The table below presents formulas for calculating regional budgets for each iteration under different strategies:

Table The strategy of territorial competition of regions for investment capital			
Strategy	Change	Territorial budget (B_i) at step i	N
$\downarrow T$	$\Delta T_i < 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i)$	1
$\uparrow T$	$\Delta T_i > 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i)$	2
$\downarrow I$	$\Delta I_i \leq 0$	$B_i = T_i \cdot N_i = T_{i-1} \cdot (N_i + \Delta N_i)$	3
$\uparrow I$	$\Delta I_i > 0$	$B_i = T_i \cdot N_i = T_{i-1} \cdot (N_i + \Delta N_i) - C_i(\Delta I_i)$	4
$\uparrow T \& \uparrow I$	$\Delta T_i > 0 \Delta I_i > 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i) - C_i(\Delta I_i)$	5
$\uparrow T \& \downarrow I$	$\Delta T_i > 0 \Delta I_i \leq 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i)$	6
$\downarrow T \& \uparrow I$	$\Delta T_i < 0 \Delta I_i > 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i) - C_i(\Delta I_i)$	7
$\downarrow T \& \downarrow I$	$\Delta T_i < 0 \Delta I_i \leq 0$	$B_i = T_i \cdot N_i = (T_{i-1} + \Delta T_i) \cdot (N_{i-1} + \Delta N_i)$	8

Here $\Delta N_i = N_i - N_{i-1}$, $\Delta T_i = T_i - T_{i-1}$, and they may have different signs. Apart from reproduction, firms may move from one region to another, creating conditions for tax and institutional competition. Motivation for firm' moving to another region may be

lower tax rate (T) or favorable institutional environment (I), larger market capacity (lower competition). Relocation, however, may occur to the region with higher tax rate, if other two conditions compensate for this drawback. Attractiveness of the market (A) increases due regional efforts to create favorable institutional environment (attracting more solvent citizens), and decreases with rise in firms' competition. Increase in competition is reflected in the model by increase in the number of firms in the region.

With regard to the latter factor, it is logical to consider attractiveness of the region as mixed (club) public good. In this way, with unchangeable institutions attractiveness of market does not change till a certain level N^{xpm} , and when this level is exceeded satiation starts increasing (Fig.1a).

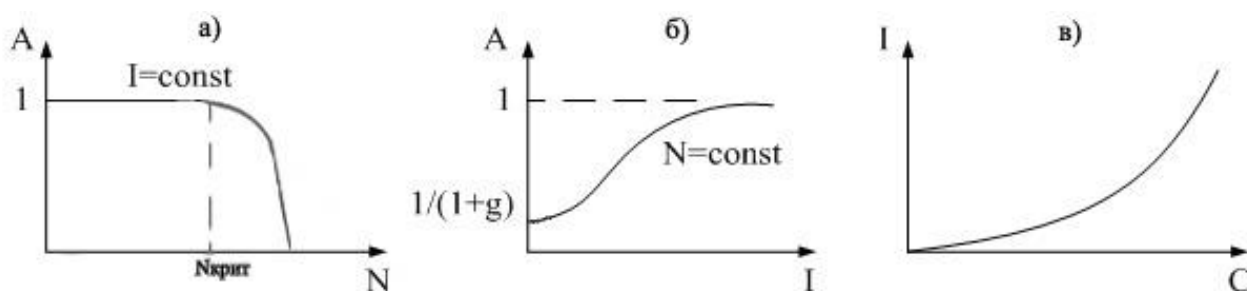


Fig.1. Non-linear dependencies of market attractiveness, quality of institutions, expenditure by the regions and quantity of firms

The dependency of market attractiveness on the quality of institutions is most likely expressed by logistic curve (Fig.1б). With weak institutions market attractiveness remains at low level. With rather strong institutions market attractiveness starts increasing very fast, as firms start feeling high guarantees on the part of state (regions), dealing with business conditions. These guarantees allow giving up private (and rather expensive) ways for ensuring security of transactions. Marginal utility of further increase of institutions starts falling.

This argument (Fig. 2a, 6) allows offering the following equation for attractiveness of region m:

$$A_m = \frac{1}{\left(1 + \gamma e^{-\beta I_m}\right)} \left\{ \begin{array}{l} 1, \\ 2 - e^{\alpha(N_m - N_m^{kpum})}, N_m \geq N_m^{kpum} \end{array} \right\}$$

At the same time, a firm takes into consideration transactional cost C_{km} , related to relocating its activity from region m to region k. In this way, a firm moves from region m to region k, if the two inequalities hold:

$$\Delta A_{km} (\Delta T_{km} - C_{km}) \geq 0$$

$$\Delta A_{km} (\Delta T_{km} - C_{km}) \geq \Delta A_{lm} (\Delta T_{lm} - C_{lm}), \forall l \in N$$

where $\Delta A_{km} = A_k - A_m$, $\Delta T_{km} = T_k - T_m$, N – is the total number of firms in the regions.

T_k – taxes paid by firm in region k;

ΔT_{km} – change of taxes with moving from k to m

C_{km} – cost of firm' moving from region k to region m;

I_k – institutional environment set by region k;

A_k – attractiveness of market, formed in region k.

The cost of institutional development as well as cost for producing any other good increase in a non-linear way (Fig.1B): $I = C^{1+\omega}$, $\omega > 0$.

Block-scheme on Fig. 2 reflects conditions for firms' movement from one region to another. In this way not all firms N_m act in region m, but only their part – μN_m , $0 < \mu < 1$, where μ characterizes information of firms about the regions and is a

parameter, reflecting bounded rationality of firms. In reality firms do not have direct information about regions, but we make this assumption in our model. Fig. 3 demonstrates interface of the model after several iterations with 100% information. Movement of firms is spasmodic, since at each step firms choose the most favorable region. Regions without firms tried to attract firms by improving institutional environment and decreasing tax rate. Finally all regions accepted maximal level for the quality of institutional environment with small tax burden. This is ideal scenario for firms but it can not be implemented in reality.

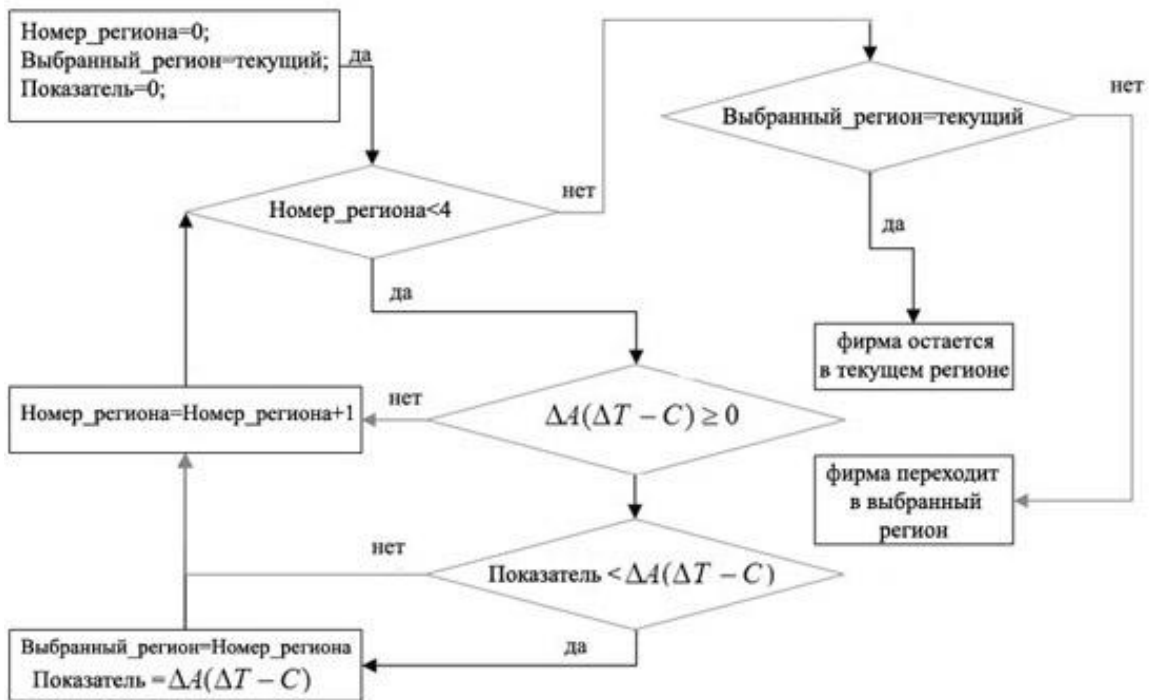


Fig.2. Block-scheme for firm's choosing the region for relocation.

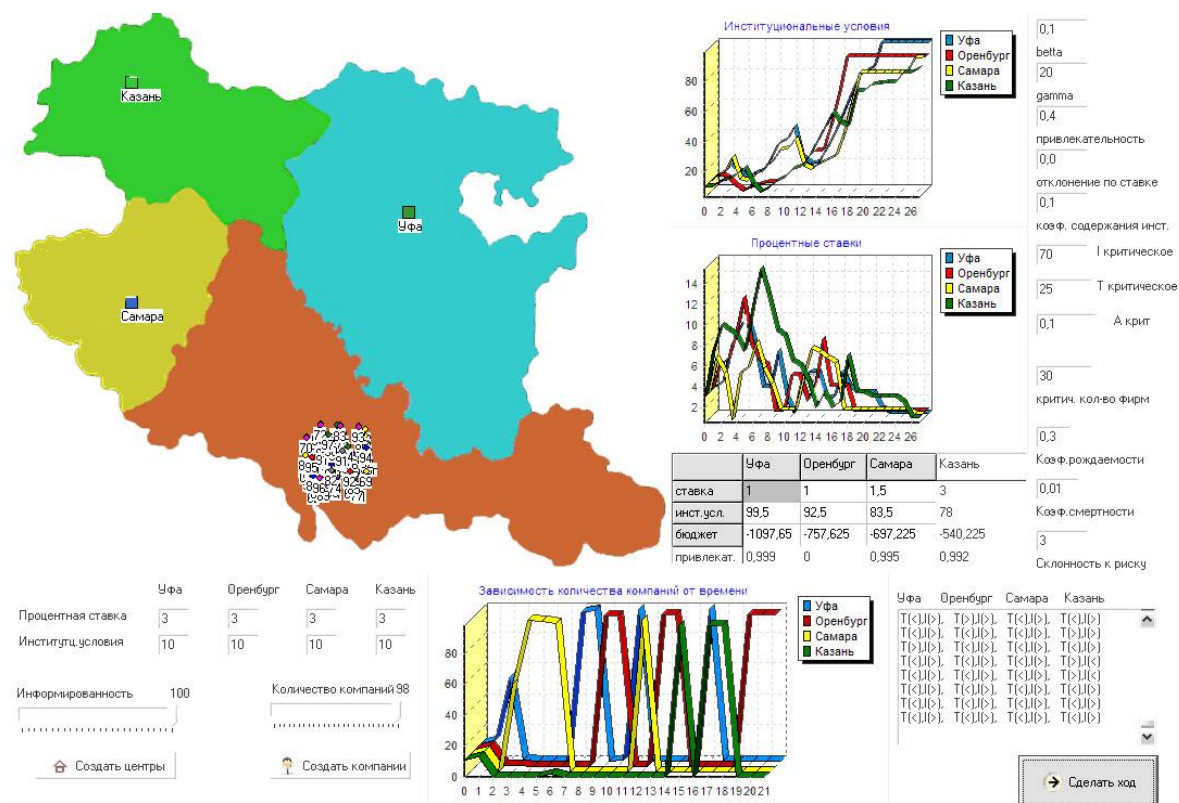


Fig. 3. Interface of the model: full information of firms.

Distribution for firms' information may be set stochastically. The other way is to introduce special regional limitations in modeling the degree of closure of local markets. In this model information is set to be the same for firms in all the regions.

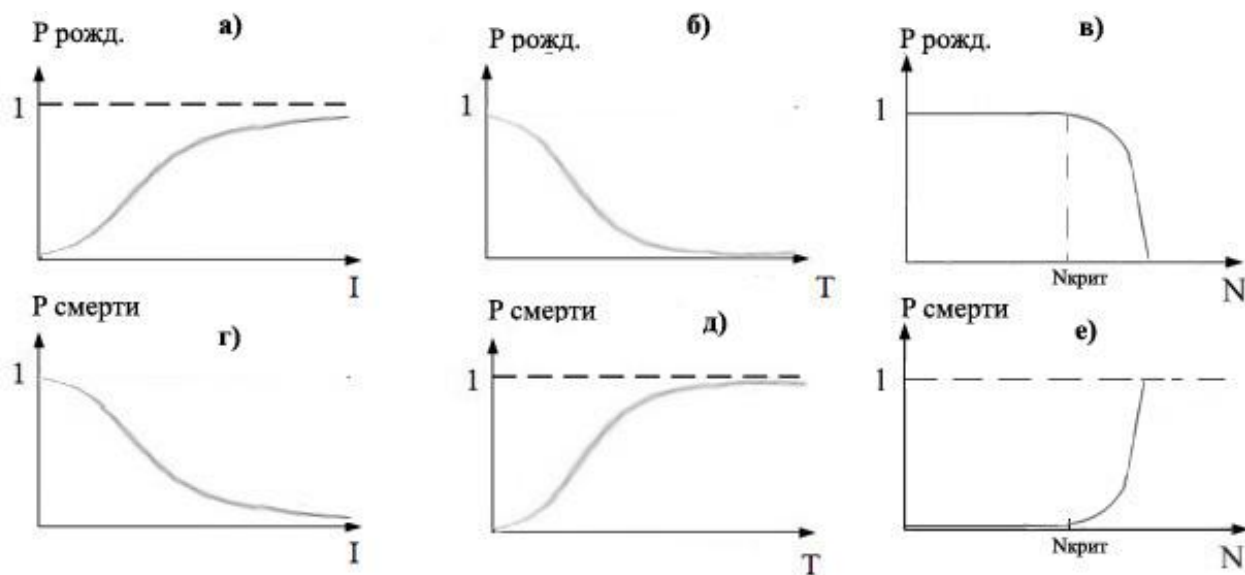


Fig.4. Dependency of emergence (birth) and closure (death) of firms from the quality of institutions (I), tax rates (T) and number of firms (N).

Fig. 4 presents logistic curves, demonstrating how firms births and deaths depend on the quality of institutional environment, tax rates and quantities of firms. With rise in quality of services, there appear favorable conditions for emergence (birth) of new firms. With low development of institutional environment the growth in births is slow, but with increase of institutions and reaching a favorable indicator for firm's creation, the intensity of rise in birth rate increases. With reaching rather high values of institutional environment, the speed for rise in births decreases (Fig.4.a).

Similarly to market attractiveness, it is logical to consider favorable conditions for firms' creation as club public good. In this way, under unchanging institutions and fixed tax rate, the quality of favorable conditions for reproduction does not change till a certain value N^{sum} . With succeeding this value satiation increases, which noticeably decreases attractiveness of a certain region for attracting firms from other regions and for creation of new firms (Fig.4.B). Over-satiation of region by firms noticeably increases the death parameter (Fig.4.e).

Obviously, increase in tax rate has a negative impact on conditions for firms' prosperity. With low tax rates (1%-3%), a gradual increase of tax rate does not strongly decrease the possibility of birth and similarly, very weakly increases the chances for death. However, with significant rise in tax rate (e.g., from 5% to 10% or from 15% to 20%) there should be a facilitation in the speed for changes in births and deaths. What will be the behavior of the birth rate function with high tax rates? In our model we set the upper cap for tax rate at the level of 30%, and taxes can not be raised above this level. Consequently, the behavior of the function over this level would not be reflected in simulations. In our model we suppose that the curve for the relation between birth rate and tax rate has the form as in Fig. 4(б); and the curve for

the relation between death rate and tax rate has the form as in Fig.4(д). Assuming that the speed for changes in the shape of the curves does not increase as much with reaching the rate of 50%, we prolong this non-linear function till the level of 100%. In this way we obtain the curve on Fig.5(б).

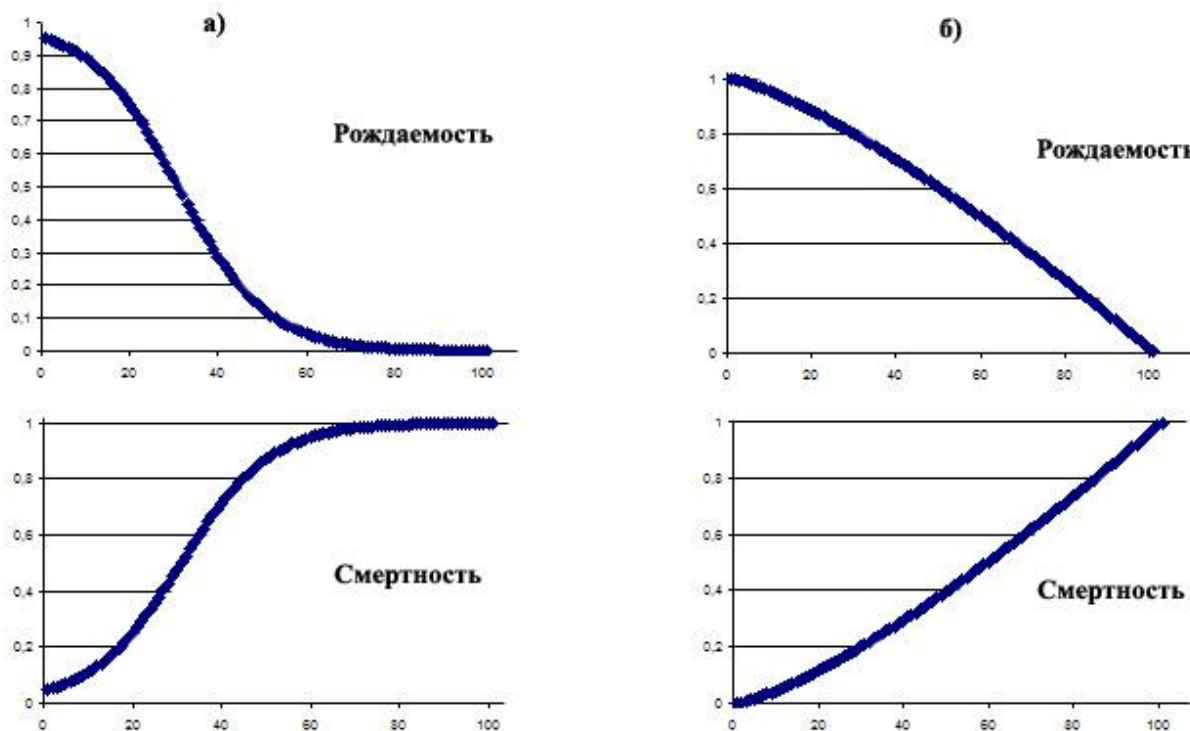


Fig.5. Comparing possible functional forms for dependency of firms' birth and death rates from the size of tax rate.

Let's verify the curves in Figures 5 (a) and 5 (b) on the adequacy of the results in the simulation. To do this we use them in the model in turn. In both cases, the curves of mortality (death) and birth rates are symmetrical, but the increase in Figure 5 (a) when approaching the cap on tax rate is rapid. Consider the death rate of firms in the region, where currently there are 20 companies:

1. We construct the probability function for firms' bankruptcy on the basis of Fig. 5(a). In this case after reaching 50%, tax rate leads mortality to its maximum, and rate of change decreases. Functional dependency on tax rate has the form

$P_{\text{смерт}} = \frac{k}{1 + \gamma e^{-\beta * T}}$. Let us construct average institutional environment in the regions and set tax rates. As a result, under 5% the number of firms-bankrupts is 1 firm, under 9% - 3 firms, 15% - 5 firms, 20% - 10 firms, 30% - 17 firms.

2. Let us construct probability function for bankruptcy on the basis of Fig. 5(б). The function has a form $P_{\text{смерт}} = k * T^{1+\alpha}$. Similarly, let us construct institutional environment and the same number of firms as in the previous case. As a result, the number of bankrupts under 5% is 1 firm, under 9% - is 2 firms, 15% - 5 firms, 20% - 8 firms, 30% - 14 firms.

Comparing the results, we can conclude that with low tax rates both functions give similar results, and with large tax rates, which are close to maximal in the model (30%), differences start emerging. The first simulation is closer to reality, when with maximal tax rate and average institutional environment 17 firms out of 20 become bankrupts, and not 14 as in the second case.

Let us introduce coefficients k_I , k_T u k_N for calibrating institutional parameters, tax rate and the number of firms in the region. The relation between T_m , I_m and N_m in the current period of time m with birth rate ($P_{\text{рожд}_m}$) and death rate ($P_{\text{смерт}_m}$) of firms is the following:

$$P_{\text{рожд}_m} = \frac{k_I}{1 + \gamma e^{-\beta * I}} * \left(1 - \frac{k_T}{1 + \eta e^{-\delta * T}}\right) * \begin{cases} 1, & N_m < N_m^{\text{крум}} \\ 2 - e^{\alpha(N_m - N_m^{\text{крум}})}, & N_m \geq N_m^{\text{крум}} \end{cases};$$

$$P_{\text{смерт}_m} = \left(1 - \frac{k_I}{1 + \gamma e^{-\beta * I}}\right) * \frac{k_T}{1 + \eta e^{-\delta * T}} * \begin{cases} k_N, & N_m < N_m^{\text{крум}} \\ e^{\alpha(N_m - N_m^{\text{крум}})} - 1 + k_N, & N_m \geq N_m^{\text{крум}} \end{cases};$$

Parameters for calibration: $0 < k_I < 1$; $0 < k_T < 1$; $0 < k_N < 1$; $\alpha, \beta, \gamma, \eta, \delta > 0$

Each region may choose out of 5 combined strategies:

$\downarrow T \& \uparrow I$, $\uparrow T \& \uparrow I$, $\downarrow T \& \downarrow I$, $\uparrow T \& \downarrow I$ and base (zero) ($T = \text{const}$ & $I = \text{const}$).

At the current moment, the region evaluates the state of its budget and decides whether to keep or change the strategy. Each region has data on the budget, the number of firms, the quality of the institutional environment and the tax rate in the previous moment of time. If the current situation requires changing the combination, then the choice is 4 variants. Of course, region could choose any of them, but it can lead to chaotic movement of firms and unjustified change in some indicators, because in certain situations, an adequate alternative strategy may remain the only possible one.

Let us consider certain situations:

1. If the budget increases, the strategy is kept.
2. If the budget does not change, the base (zero) strategy is chosen (no change in tax rate and institutional environment).
3. Consider the situation, when popularity of market (A) in the region fell below certain critical value, which caused unbearable conditions for firms' existence. Consequently, it is necessary to promptly improve the variable A, improving the quality of institutional environment. As a result there remains a choice only between two strategies: $[\downarrow T \& \uparrow I]$ and $[\uparrow T \& \uparrow I]$.

a) Strategy $[\downarrow T \& \uparrow I]$ is aimed at attracting as much companies as possible, as it decreases tax rate and improves institutional environment. The strategy will be most efficient if there are no firms in the region at current moment.

b) Strategy $[\uparrow T \& \uparrow I]$ is very universal and efficient for many modeled situations. To keep existing companies and increase the amount of gathered taxes, the region constantly improves institutional conditions. As long as the quantity of firms does not reach the critical number, attractiveness of the local market will increase. This will cause the inflow of firms from other regions and will encourage the emergence of new firms. However, the long period of growth of tax rate may cause

firms to move to a region with more adequate tax rate and will lead to loss in the budget.

4. Strategies $[\downarrow T \& \downarrow I]$ and $[\uparrow T \& \downarrow I]$ provide for worsening of institutional environment. Obviously, this will cause the fall in popularity of the local market, but a reasonable decrease of costs for maintaining institutional environment may lead to revenues coming to local budget.

a) Strategy $[\downarrow T \& \downarrow I]$ is universal, as well as its opposite one $[\uparrow T \& \uparrow I]$. Decrease of tax rate is accompanied by worsening of institutional environment which keeps competitiveness of region in attracting firms. It is most efficient if in current period of time region has a rather high indicator of institutional environment and inadequately high tax rate.

b) Strategy $[\uparrow T \& \downarrow I]$ provides for gradual increase in tax rate with simultaneous worsening of the quality of institutional environment. Obviously, this strategy does not bring good perspectives to the region, as popularity of local market falls sharply due to low quality of the services provided. Together with high taxes this makes the region uninteresting to firms. However, $[\uparrow T \& \downarrow I]$ may be used for short-term increase of budget in prospering region, which can not meet costs of keeping high indicator of institutional environment. How can tax rate be increased? When the current number of firms N_{i+1} increases relative to the previous number N_i , but the balance indicator B_{i+1} falls relative to B_i . This happens in case of fall in tax rate or growth of costs for improving and maintaining institutions.

The most prevalent situations and strategies used by regions for solving these situations are represented at block-scheme (Fig.6). We assume that each agent-region decides how it increases or decreases tax rate or improves institutions. To make this process deterministic, we relate ΔT and ΔI with the current number of firms in the region. The more firms there are in the regions. The smaller is the change of ΔT and ΔI , in order to avoid extra risks. T_{cp} – is the average value of tax rate in the model,

which can be changed in the course of simulations. $I_{кр}$ – is a critical indicator of institutional environment, under which further improvement of institutions does not give noticeable increase in market attractiveness. $A_{кр}$ – is the critically low attractiveness of market.

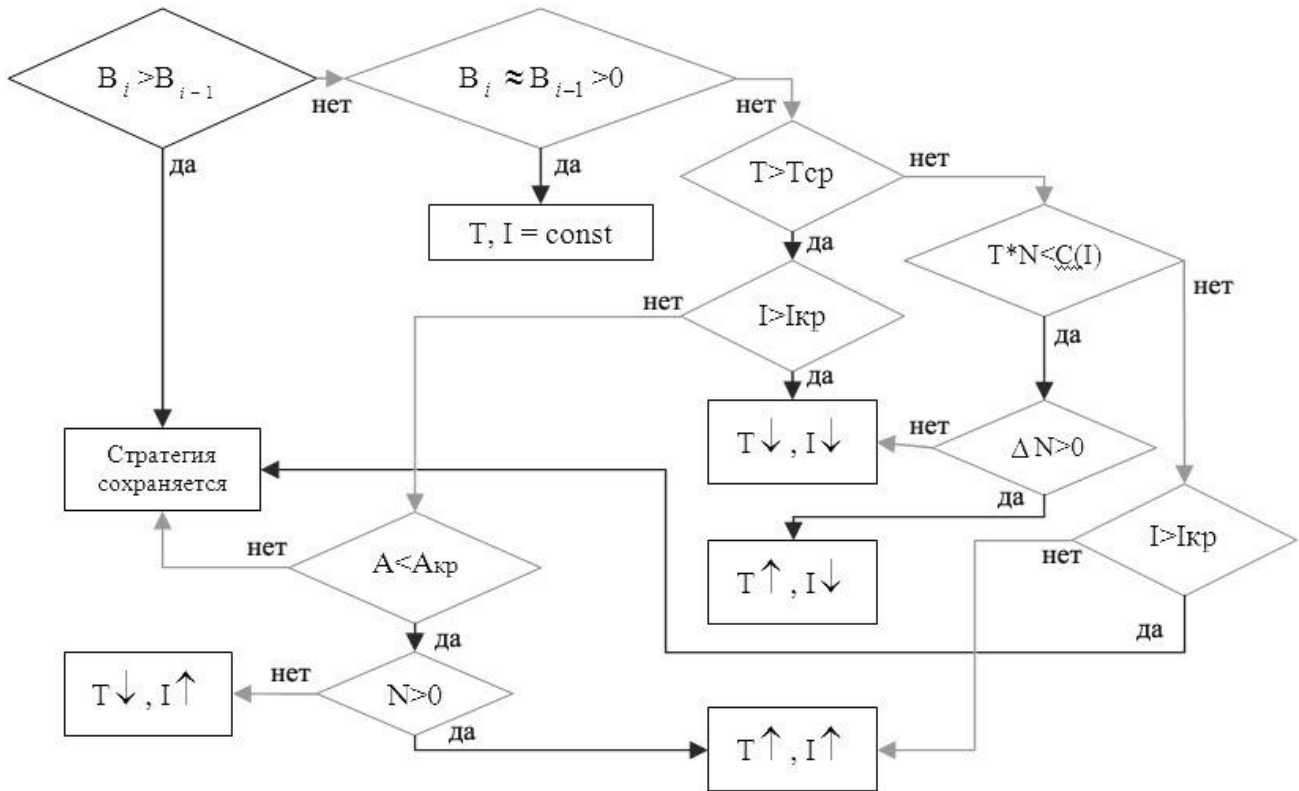


Fig.6. Block-scheme for using different strategies by the regions.

Let us model the situation, when the number of firms reaches its maximum, oversaturating market capacities in the regions:

1. As the critical number of firms is reached, further increase in their number leads to higher competition, decrease in attractiveness of markets and absence of favorable conditions for emergence of new firms.

2. Under institutional environment sufficient for firms' existence and with low mortality coefficient (a correlated parameter) regions choose different strategies for increasing the budget. As indicators for market attractiveness are lowered by large

competition, when a region increases tax rate, all firms start to leave this region for regions with lower tax rates. Improving institutional environment will have a negligible effect on attractiveness of oversaturated market. Consequently, to keep firms and to sustain positive budget, each region gradually approaches the strategy with relatively low tax rate and low level of institutions. This to a certain extent reflects current situation in Russian regions.

3. The state of equilibrium emerges when a region does not attract firms from other regions and does not let its own firm go. As long as regional budget does not demonstrate negative dynamics, tax rates will remain at equally low level, and the quality of institutional environment will oscillate around the minimal value to prevent closure of firms.

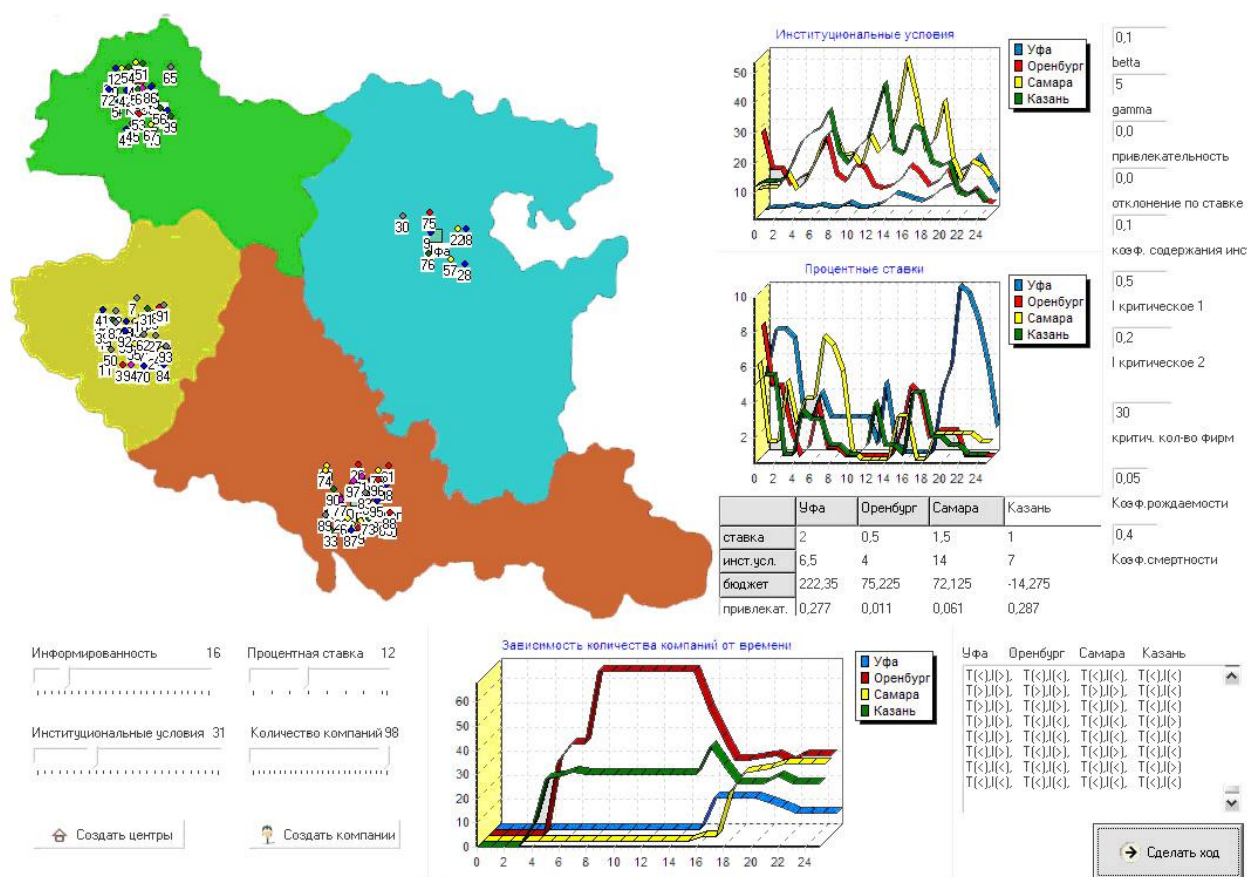


Fig.7. Interface of the model: equalizing the number of firms in regions.

Will regions always aim at changing their strategy? Indeed, upon reaching the necessary number of firms, that bear the tax burden in due course, regions can maintain current indicators of tax rates and institutional environment. This could lead to stability in distribution of firms-competitors. Suppose that the leaders of regions in our model like risk (they are risk lovers or risk seekers). That is, the higher is the risk seeking indicator, the higher the probability that strategy will be changed at current iteration. The low risk seeking indicator, the more cautiously the decision on changing strategy will be made; and this decision will be taken only with noticeable worsening of regional budget.

Risk aversion (risk seeking) may be included in the model as parameter R , $\Delta B_{i+1} = B_{i+1} - B_i + \frac{1}{R}$. That is, at each iteration we calculate not the change between current and previous budgets, but the change compensated by a positive parameter $\frac{1}{R}$. Then with decrease of budget by the value lower than $\frac{1}{R}$, region will not risk to change strategy, and will simply choose base strategy [$T=\text{const}$ & $I=\text{const}$].

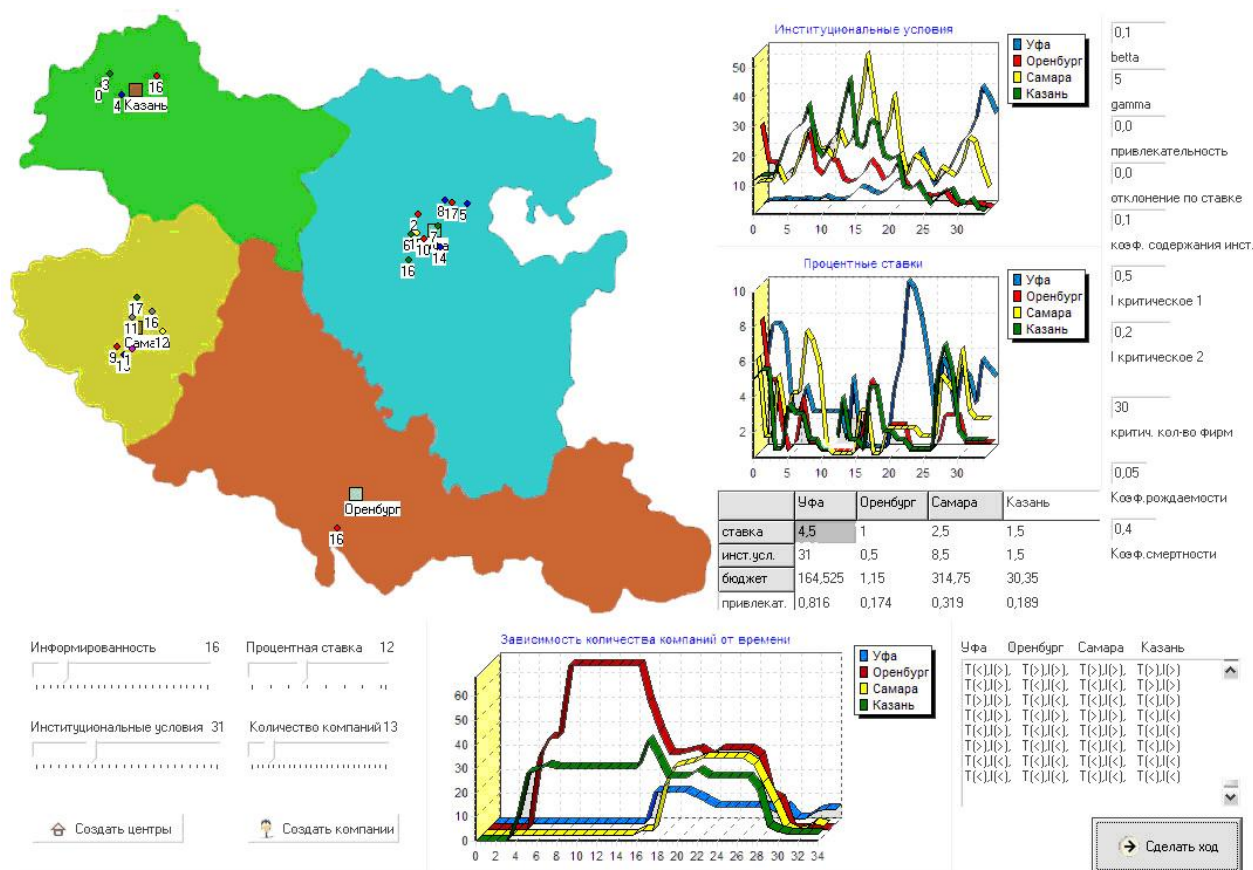


Fig.8. Interface of the model: bankruptcy of firms, caused by violation of equilibrium conditions in one of the regions.

Let us continue the previous simulation:

4. In region with the smallest number of firms in the model (in the model it is Bashkortostan Republic), we increase risk indicator till $R=10$.

5. With $[B_{i+1} - B_i < -0.1]$ Bashkortostan does not keep the tax rate at the low level and chooses other strategy. In this case the strategy is to compensate losses of budget by raising tax rate. A combination $[\uparrow T \& \uparrow I]$ is chosen, which corresponds to American model of territorial competition. However, coefficient for inclination to improve institutional environment in this simulation remains small. Consequently, this simulation may not be extended to other Russian regions.

6. The growth in the quality of institutional environment with relatively low competition causes the inflow of firms from other regions. In attempt to change

situation, Samarskaya oblast changes its strategy as well. As a result, with high competition and relatively weak institutional environment, companies face the problem of increase in tax rates. Firms start being bankrupts, and regions which did not haste to change strategy, bear considerable losses in budgets. In this case the system was taken out of equilibrium by the change of the only parameter for inclination to risk (R) in the only region.

Can inclination to risk be one of major regional characteristics and be set as a fixed parameter? We think that making a decision about the change of strategy depends on current circumstances, and unfavorable matter of things in the region may lead to risk seeking. Hence, in our model with regional competition for firms the most unfavorable situation will be absence of firms. In this case inclination to risk must be maximal. Upon reaching a critical number of firms, inclination to risk becomes close to zero, and region stops changing strategies (Fig.9.)

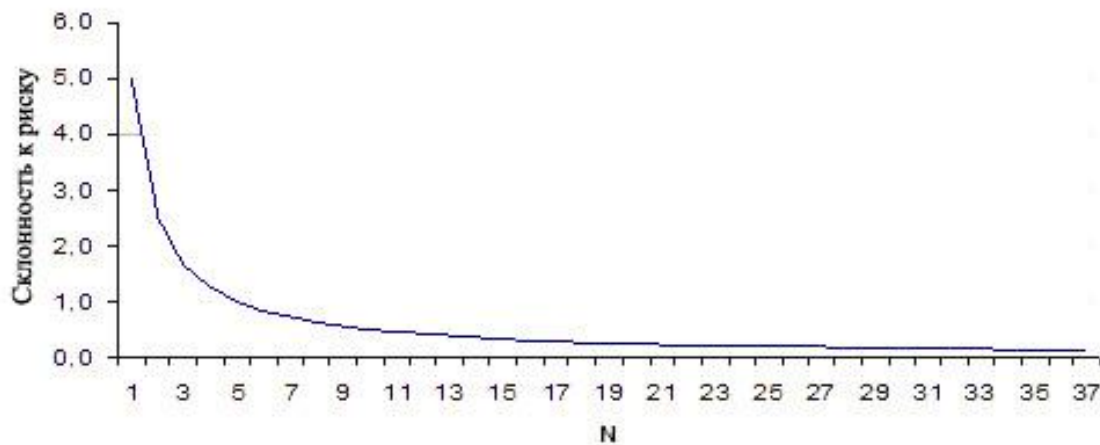


Fig.9. Dependency of inclination to risk from the number of firms with $k_{\text{риск}}=5$.

Let us express inclination to risk R through the number of firms N: $R = \frac{k_{\text{риск}}}{N_{\text{фирм}}}$,

where $k_{\text{риск}}$ - is a correlated parameter.

As was previously noticed, the increase in the number of firms in the region decreases changes in tax rates and institutions. Inclination to risk, in this way, influences not only the moment of decision-making about the change in strategy, but also dynamics of changes in ΔT and ΔI . The growth in tax rate and institutional environment will equal the inclination to risk multiplied by the corresponding correlation coefficient.

Fig. 10 models the situation when each region when each region improves institutional environment. Initial data were different values of tax rates (22%, 6%, 5% and 21% corresponding to the number of a region in the model) and of institutional environment (30, 20, 22 и 10), and 10 firms in each region were created. Information of firms about situations in the regions was 20%, and the value for inclination to improve institutional environment was set at a high level for all regions. Inclination to changes in institutional environment in the model is a calibrated parameter, which influences growth: the larger the inclination, the faster is the speed for improvement of institutions in case of strategies $[\downarrow T \& \uparrow I]$, $[\uparrow T \& \uparrow I]$ and the slower is worsening of institutions in case of strategies $[\downarrow T \& \downarrow I]$, $[\uparrow T \& \downarrow I]$.

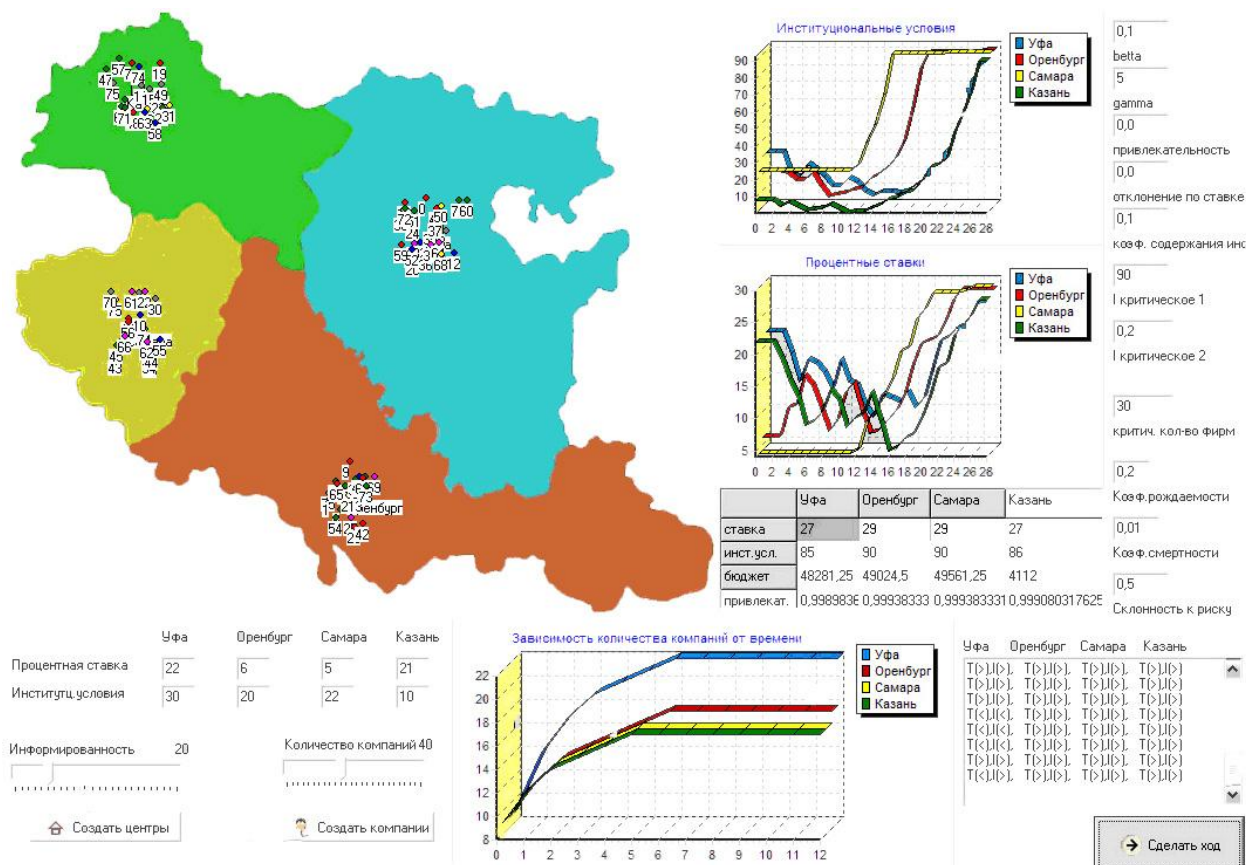


Fig.10. Interface of the model: equilibrium with high values for institutional environment and different tax rates in the regions.

Let study the following actions of the regions step by step:

1. One of the regions (Bashkortostan) has more favorable institutional environment than other regions. Several firms move to Bashkortostan from other regions but at the same time there is reproduction of firms in all the regions.

2. The region where firms move sees gradual decrease in inclination to risk and with time the changes of tax rate and institutional environment become negligible. However, the region whose budget decreases due to outflow of firms has to look for ways to improve the situation; it has to risk and change strategies.

3. Strategies differ in each region, since initial conditions also differ. Loosing firms due to their movements and bankruptcy, regions discover that tax flows do not compensate costs of maintaining institutions. Therefore, regions attempt to lower the

quality of institutional environment. In this case 2 regions with high tax rates choose the strategy $[\downarrow T \& \downarrow I]$, and 2 other regions with lower tax rates choose the strategy $[\uparrow T \& \downarrow I]$.

4. Worsening institutional environment, regions meet increase in mortality and decrease in birth rate of firms. Risk seeking increases with necessity to attract firms. In this case the optimal strategy is $[\uparrow T \& \uparrow I]$, and all regions start using it.

5. As inclination to improve institutional environment was rather high for all regions, and as with emergence of a necessary number of firms risk seeking decreases and strategies stop changing, the growth in institutional environment becomes galloping and then institutions remain at high level. In this case the budgets of all the 4 regions increase considerably (around the value of 4000 units, which is an order higher than in case of Russian model of competition), and regions keep their strategies. Large costs of maintaining due institutional environment are compensated by high tax burden. Firm are being attracted and reproduction occurs.

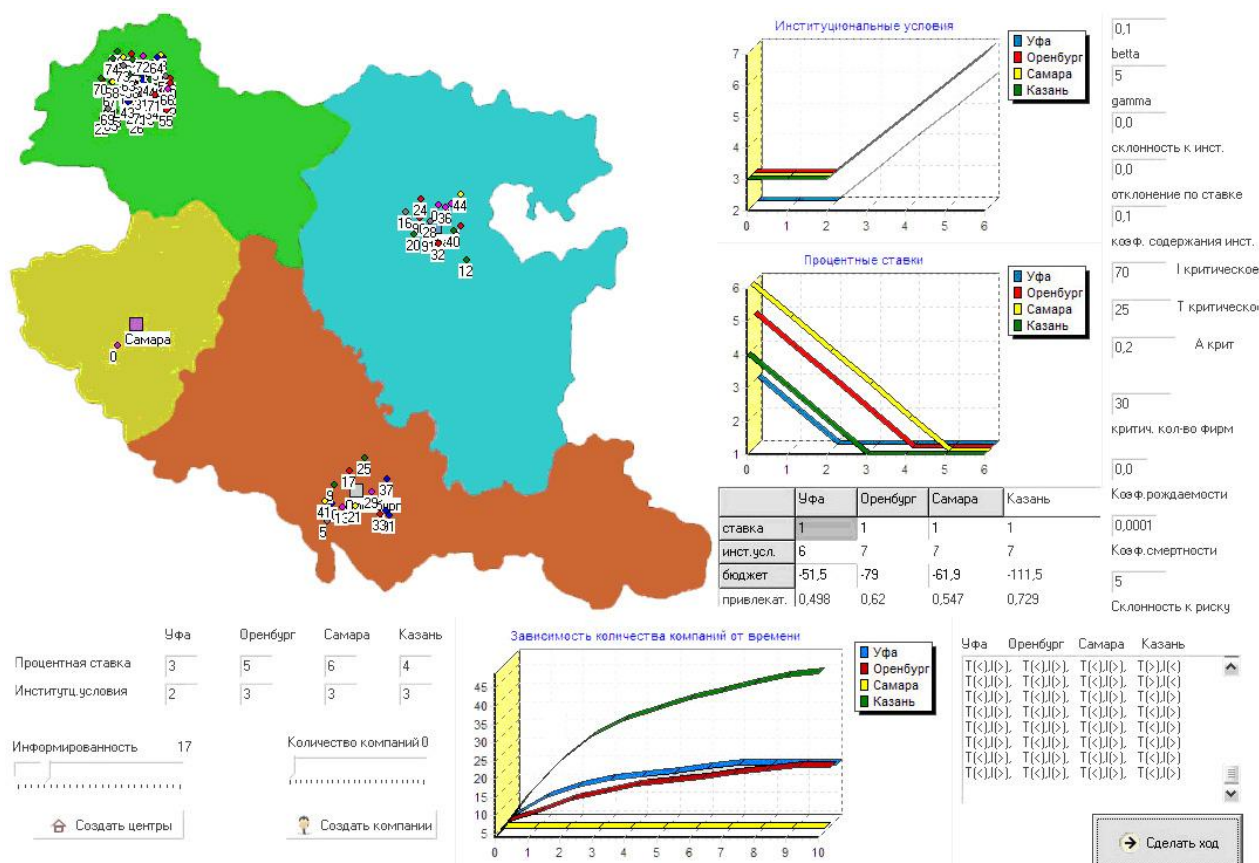


Fig.11. Interface of the model: model of competition in Spain.

Let us conduct another computational experiment (Fig.11), in order to answer the question: "How will equally non-developed regions conduct competition?" As initial data, let us set low values of institutional environment (2-3 units in the model) and low variation in tax rates of 3-6 percent. There are 4 artificial regions in the model. If there are unfavorable conditions in each of them, firms will become bankrupts. However, in reality firms may move to a more remote region with better conditions instead of become a bankrupt in one of the analyzed regions. Let us set mortality coefficient at a low level, not to cause bankruptcy of firms right after the start of the model. We set inclination to improving institutional conditions low for all regions. We distribute 5 firms in each region and start simulations.

1. Each region attempts to improve institutions to attract firms.

As inclination to improve institutions was set low, there are no noticeable changes in rise of market attractiveness.

2. Even a slight increase of institutions leads to decrease of budget, as institutional environment improves with rise of costs of this measure.

3. As improvement of institutions is unprofitable, to continue competitive activity and to attract a larger number of firms, the region has to decrease tax rate.

4. Decrease in tax rate and improvement of institutional environment leads to high birth rate of firms and lowers risk seeking. Strategies are maintained by regions.

5. All 4 regions reach the lowest tax rate (in the model it equals 1%), budget deficit and increase in poverty. Competitive activity of regions for investment by the firms has a negative effect for each region due to low tax rates. This simulation imitates tax competition “race to the bottom”.

Variations of combinations of strategies and their parameters in case of the above described non-linear dependencies cause a large number of stable and non-stable equilibria, some of which describe actual federations in real world. Not to «drown» in the sea of computational simulations, it is necessary to set the boundaries for search and introduce most realistic mechanisms for firm and regions' behavior in the model. Therefore, initial values of tax rates and institutional environment, risk seeking, improvement of the quality of institutions, correlated coefficients and the level of information may be changed before each experiment. This helps imitate conditions close to reality and enables increase credibility of results.

References

1. Bakhtizin A.R. (2008) Agent-based models of economy. Moscow, Ekonomika (In Russian)
2. Lyuger D.F. (2005) Artificial intellect. Moscow, “Williams” (In Russian)

3. Makarov V.L., Bakhtizin A.R., Bakhtizina N.V. (2006) CGE model of Russian socio-economic system with built-in neural networks. Moscow, CEMI. (In Russian)
4. Makarov V.L. (2007) Collective goods in agent-based models. Artificial Societies. Vol. 2, No. 1. (In Russian)
5. Stiglitz J. (1997) Ekonomika gosudarstvennogo sektora. IRFRA-M. (In Russian)
6. Oates W.E. (1972) Fiscal Federalism. New York,
7. Gurtner B. (2000). The race to the bottom: incentives for investment?
http://www.taxjustice.net/cms/upload/pdf/Bruno-John_0810_Tax_Comp.pdf
8. Gimenez J.J. Tax competition in Europe: Spanish national report.
<http://www.eatlp.org/uploads/Members/Spain02.pdf>
9. Martinez-Vazquez J., McNab R. (1997) Fiscal Decentralization, Economic Growth, and Democratic Governance. Georgia State University, Atlanta, Georgia
10. Makarov V. How public goods can generate regional structure: simulation on the agent-based model. Power Point Presentation:
<http://www.artsoc.ru/html/WCSS2.htm>
11. Musgrave, Richard A. & Peggy B. Musgrave (1989) Public Finance in theory and practice. McGraw-Hill International Editions
12. Tiebout Charles. A pure theory of local expenditures. Journal of political economy, LXIV (1956), 416-24.
13. Weingast B.R. (1995) "The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development", Law, Economic and Organization, Vol.11, No.1, 3-31.

Developing classification for analyzing social networks in the Internet

© Bobkova I.A. (Moscow)

Recently social networks are occupying more space in the Internet. Having appeared only in 1990s, social networks became an integral part of the world and regional Internet, covering over 50% of Internet audience. Social networks are particularly prevalent in the last 5-7 years. By the number of visits a day and by audience coverage, the largest networks are comparable to best searching sites, and in the 2 recent years they enter top-10 in revenues from advertisement.

1. Development of communication services

The first form of message exchange, allowing communication between two subscribers – email – appeared in 1971. Online communication service (Internet Relation Chat), developed in 1988, allowed making communication of users more free, and as a result groups of people with the same interests and with established personal relations (user communities) started to form. Conquest of the planet by the Internet began in 1991. Guest books (a list of messages, where any visitor may leave a message), blogs (web protocols, where each user keeps a journal of notes, often in the form of a diary), forums (further development of teleconferences and guest books, in which participants are grouped by the topics of analyzed questions, and mediation is done by site administrators) appear on various sites. Back in 1995 emerges the first network – Classmates.com, which helps users find classmates and keep in touch with them. Social network in the Internet is a social structure, consisting of a group of nodes – social objects, encompassing people (clients of network) or groups of people (communities), and links among them. The first original network in Runet – Moi Krug – dates back to 2005 (*Appendix 1*). Since 2006 social network enter top-10 most visited sites.

II Qualitative analysis of social networks

In the end of 2008 most popular sites were (*Source: <http://www.alexa.com/>*)
(social networks are marked with bold)

1. Yahoo! - www.yahoo.com
2. Google - www.google.com
3. YouTube - www.youtube.com
4. Windows Live Search from Microsoft.- www.live.com
5. **Facebook**.www.facebook.com
6. Microsoft Network (MSN)- .www.msn.com
7. **Myspace** -. www.myspace.com
8. Wikipedia - wikipedia.org
9. Blogger - www.blogger.com
10. Yahoo! - www.yahoo.co.jp

Russian networks enter top-500 world sites: **23. V Kontakte** - www.vkontakte.ru, 40. **Одноклассники**.- www.odnoklassniki.ru, 331. **LiveInternet.ru** - www.liveinternet.ru

Table 1. Frequency of visiting large international social networks: million people a year according to methodology by ComScore Inc. (total unique visitors)

	June 2008	2007	Growth in half a year	%
Internet – total	860.514	815.797	44.717	5.20
Social networks – total	580.510	516.318	64.192	11.06
Facebook	132.105	97.792	34.313	25.97
MySpace	117.582	107.167	10.415	8.86
Hi5	56.367	31.428	24.939	44.24
Friendster	37.080	29.735	7.345	19.81
Orkut	34.028	25.138	8.89	26.13
Bebo	24.017	21.282	2.735	11.39
Others	179.330	203.776	-24.446	-13.63

Source: ComScore Inc

Daily frequency (million people) at the end of 2008 was: Facebook – 34, MySpace – 28,8, Hi5 – 4,7, Friendster – 6, Orkut – 9,6, Bebo – 4,8.

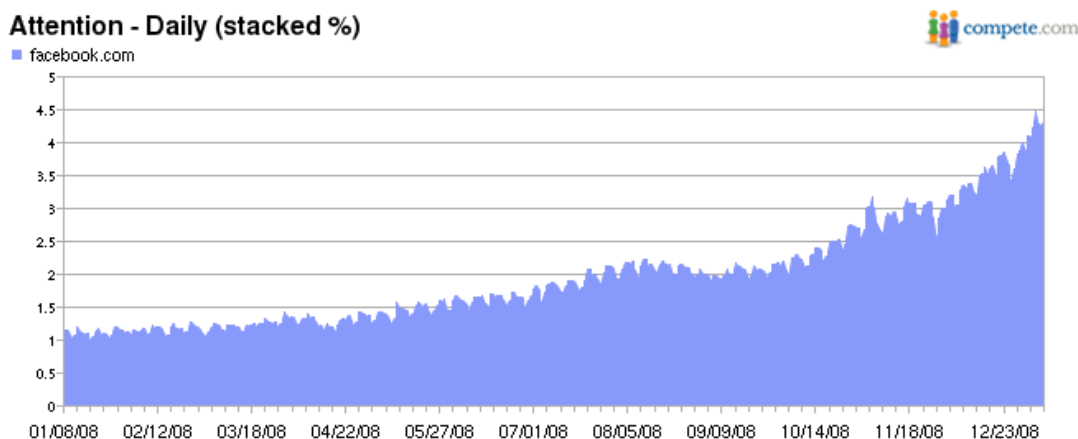


Fig. 1. Growth of time, spent by American users of Facebook, in the total time spent for using the Internet, in 2008.

The first social network in Runet appeared in 2005 (Moikrug.ru). Recently several networks appear each day. All of them are of different level, some are of “one day”-type and disappear soon. Yet, social networks are the most dynamically developing segment in Internet as a whole and in Runet in particular. In 2008 for the first time social network Vkontakte became top-1, outrunning search and mail sites.

Top-10 sites in Russia by the number of visits as of the end of 2008. (Source: <http://www.alexa.com/>)

1. **V Kontakte** – www.vkontakte.ru
2. Yandex – www.yandex.ru
3. Mail@Mail.ru - www.mail.ru
4. **Odnoklassniki.ru** - www.odnoklassniki.ru
5. Rambler - www.rambler.ru
6. Google Russian language version of a search server www.google.ru

7. Narod.ru – www.narod.ru
8. Google - www.google.com
9. YouTube – www.youtube.com
10. **LiveJournal** – www.livejournal.com

At the end of 2008 «Voice of Runet» conducted a poll of its visitors about the amount of time Runet users spend at the sites of social networks in working days and on holidays (hours a day). The poll was taken among 2000 respondents in Russia and abroad.

Table 2. Time, spent by Internet users in social networks (*Source* «Voice of Runet» <http://www.voxru.net/online/stat/86.html>).

How much time respondents spend at the sites of social networks
(% of all repondents)

Hours a day

	Holidays	Working days
Less than 1 hour	14	52.6
1-3 hours	67	21.8
More than 3 hours	13	6.9
Hard to say	6	9.4

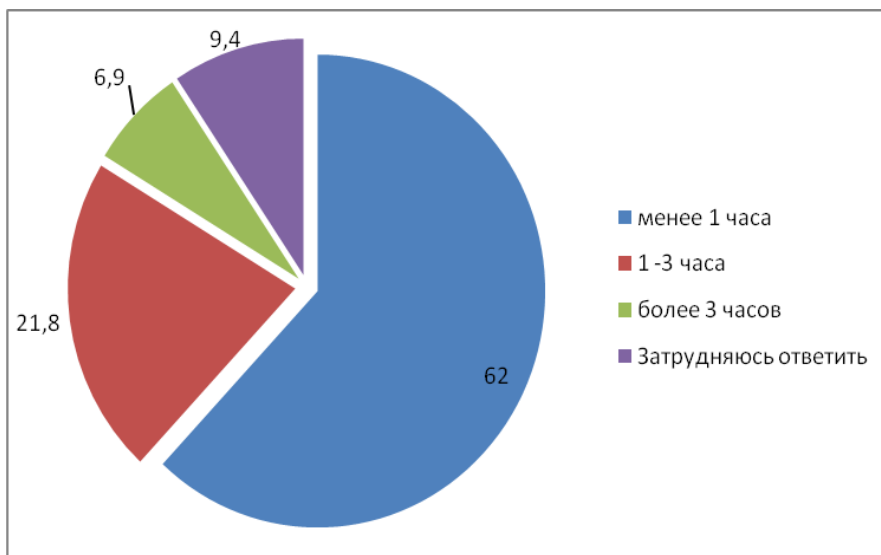


Fig.2. Number of hours, spent by users in social networks on working days

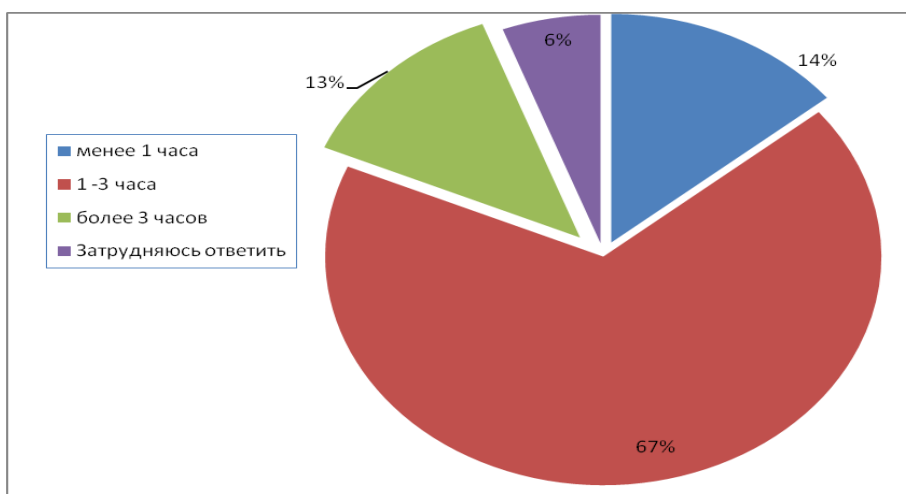


Fig.3. Number of hours, spent by users in social networks on holidays

In spring the company comScore Int. Conducted a survey among users of social networks, which reveals that on average each Russian users spends 6,6 hours a month in networks, looking through 1307 pages. This is the highest indicator in 40 countries, described in the review. The second place is occupied by Brazil - 6,3 hours a month and 1220 pages. Then follow Canada (5,6 hours), Puerto Rico (5,3 hours) and Spain (5,3 hours). Surprisingly, USA are only at the 9th place with the figure of

Developing classification for analyzing social networks in the Internet

4,2 hours a month. Out of 31,9 million Russian users who accessed Internet in April, 2009, 18,9 million visited social network at least once (*Appendix 3*).

III. Gender ratios of social network users

The results of research conducted by RapLeaf company in 2008 demonstrate gender differences among 49,3 million people above 14 years old in 7 age groups: in all largest networks the number of women exceeds the number of men, especially in the age group 18-24 (Table 3, Fig. 4-5, Appendix 2).

Table 3. Gender ratios for users of social networks (Source <http://ablohin.ru>).

Sex	Users of social networks		Users of social network Vkontakte.ru	
	Number	% of total	Number	% of total
Men	20559526	42	6550700	43
Women	24821901	50	6502710	42
Non specified	3887623	8	2262320	15

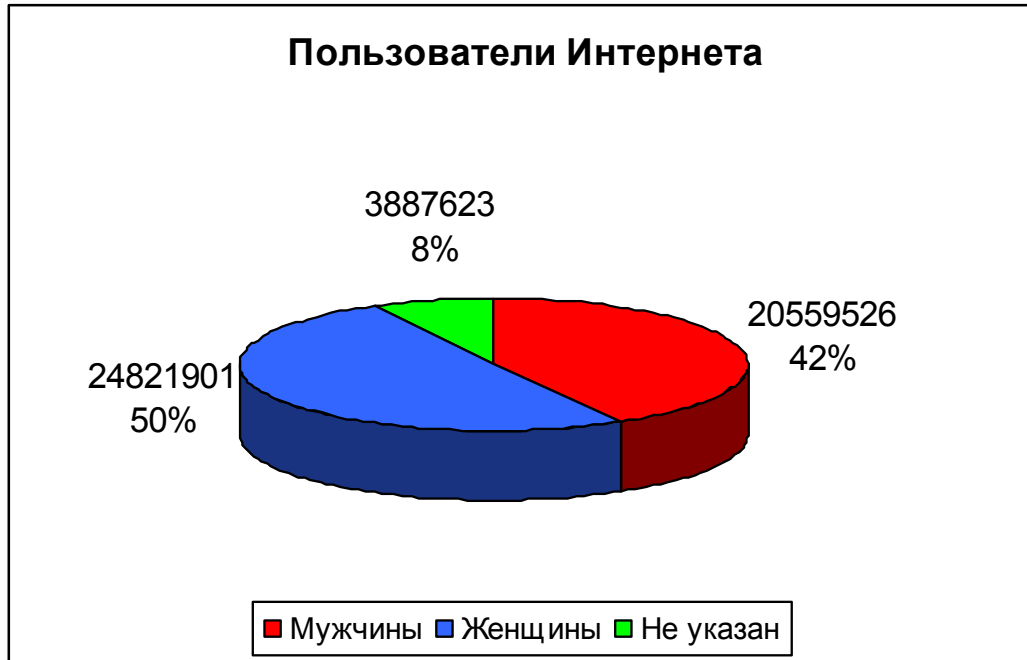


Fig.4. Gender ratios for users of social networks above 14

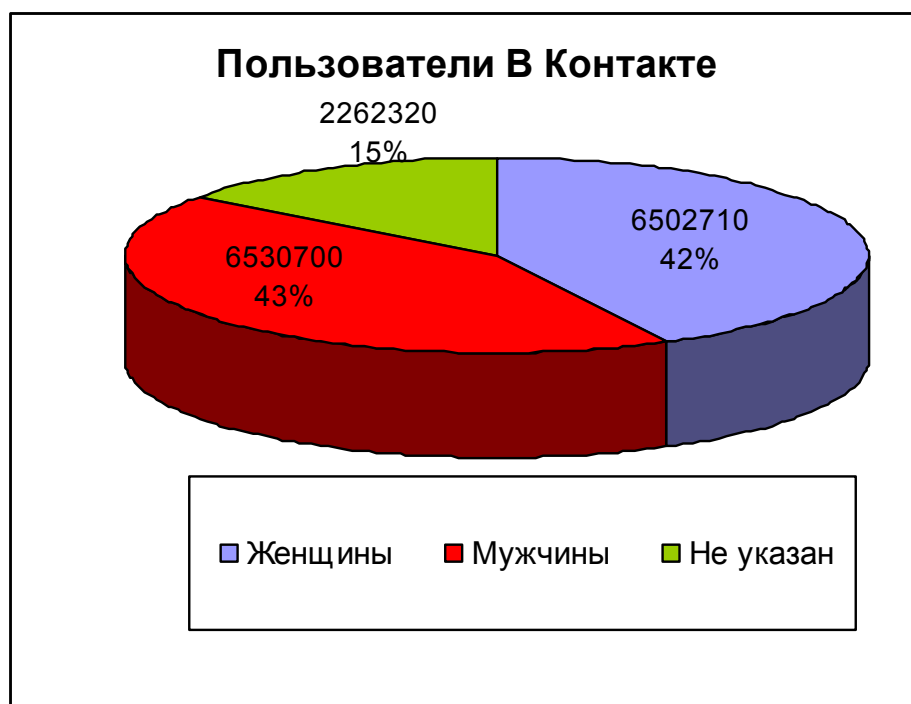


Fig.5. Gender ratios for users of Vkontakte.ru aged 12-70

IV. National peculiarities for popularity of social networks

Social networks are most popular in USA, Canada, Netherlands, Great Britain, South Korea, Taiwan, and Hong Kong (over 20% of population are users of social networks). In such large countries as Russia, China, India, Brazil etc. the share of population using these resources is small (less than 10%), which is explained by non-accessibility of Internet for a part of population and lag in development of computerization of 5-7 years relative to other countries.

However, Russia, China, Latin America and Arab countries are a most developing market for these services, and one might be sure that the situation will change completely in the nearest future. Especially, since state programs of Internet'ization are adopted in a number of these countries, including Russia.

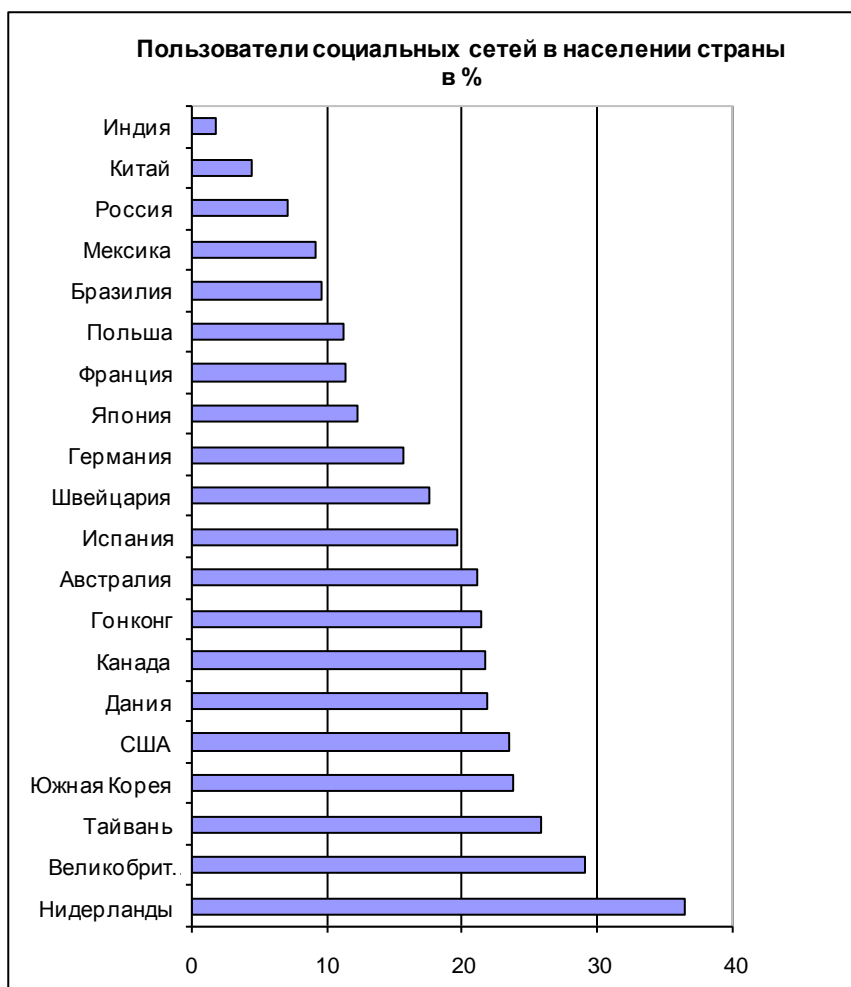


Fig.6. The share of social network users in population aged over 15 in certain countries (%) (according to Universal McCann)

Serious differences in using networks exist among the countries. These differences are often explained by the time of country's integration into world communication space, technological level, mentality of population. If in such eastern countries as China or Japan users are very cautious in their sayings, in Russia users actively comment events, diaries (blogs) and comments of other users, share information with friends and unknown people. Moreover, crucial changes may be seen in use of various networks widespread over the world. This is well demonstrated on world map where leading social networks in various countries are presented. This information is provided by Oxyweb.co.uk (Fig. 7). Yet, despite existing differences,

in all the countries there is the process of rapid growth in the number of social network users and in quality of services

The following most popular world networks could be singled out as of the end of 2008.

1. Facebook – absolute leader in many countries, number 1 in Canada, Scandinavia, Argentine, European countries, Africa, Asia – over 130 million users.

2. MySpace – social network, which remained the leader for a long time and which was the most popular network for Americans till May 2009.

3. Hi5 – in a number of countries, such as Mexico, Peru, Angola, Mozambique, Mongolia, Thailand, Syria, Portugal – network is an absolute leader.

4. V Kontakte – Russian Kontakt is number four social network in the world and the most popular network among Russian language population.

5. Orkut Brazil – a part of social network Orkut, created in Google, - number one in Brazil.

6. Skyrock – French blog platform of social network.

7. Odnoklassniki – the analogue of Classmates, number two popular Russian language network.

8. Friendster – one of the first social networks, now it is mainly presented by Asian countries.

9. Orkut India.

10. Netlog – European social network for young people (25 languages).

11. Mixi – the most popular social network project in Japan.

12. Nasza klasa – Polish Classmates.

13. Tagged – network which grew out of a special project for American school students, popular among teenagers.

14. Bebo – abbreviation from Blog early, blog often.

15. Kaixin001 – Chinese social network, which demonstrates phenomenal growth. Created in April 2008, in several months network acquired 8 million of active users.

Less popular networks: 16. PerfSpot, 17. Studiverzeichnis, 18. Xiaonei, 19. Multiply, 20. Hyves, 21. Tianya, 22. Sonico, 23. LinkedIn, 24. Ning, 25. Badoo.

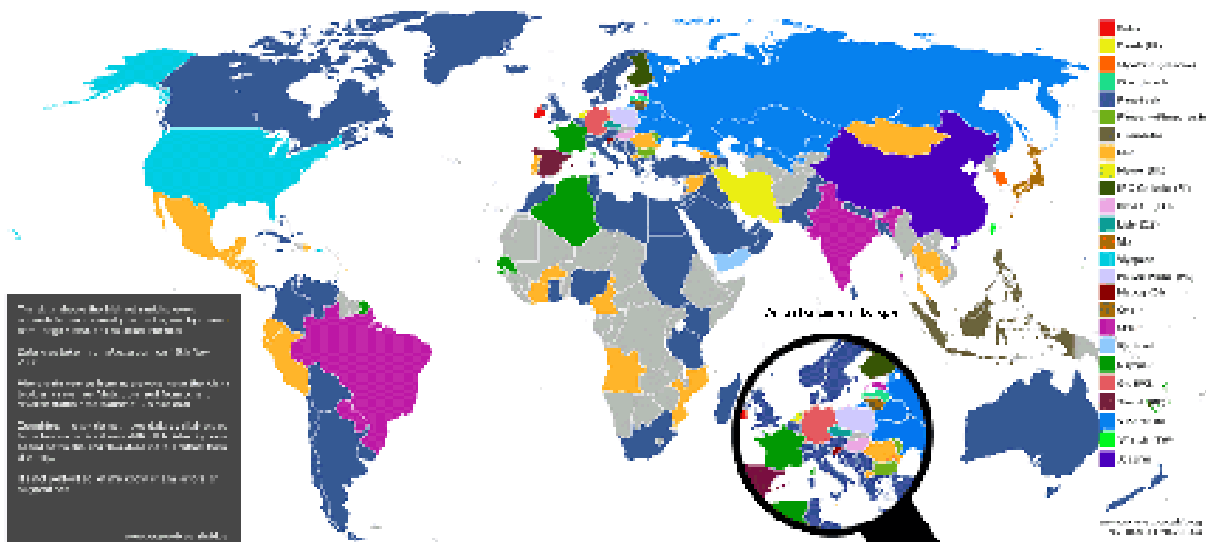


Fig.7. The map for popularity of social networks in the world as of December 2008 (*Source: <http://socseti.com/img/>*)

Spring of 2009 introduced certain changes in the picture. According to the data on largest countries (by Alexa and Google Analytics) the most popular (top-3) networks had the following ranks:

Australia: Facebook, MySpace, Twitter

Canada: Facebook, MySpace, Flickr

India: Facebook, Orkut, Hi5

France: Facebook, Skyrock, MySpace,

China: QQ, Xiaonei, 51

Germany: Facebook, StudiVZ, MySpace

Italy: Facebook, Netlog, Badoo

Russia: V Kontakte, Odnoklassniki, LiveJournal

Spain: Facebook, Tuenti, Fotolog

Great Britain: Facebook, Bebo, MySpace

USA: Facebook, MySpace, Twitter (in May 2009 Facebook outran MySpace in popularity).

Last year witnesses rapid growth in popularity of Facebook and Twitter. However, in countries with vivid national specific features (CIS, China, Japan, Brazil etc.) national social networks remain leaders.

V. Most discussed problems in social networks

In general the range of topics discussed in social networks is very wide:

- 1) music and cinema;
- 2) entertainment;
- 3) hobbies;
- 4) family, house, children and family relations;
- 5) health;
- 6) politics, world and regional problems;
- 7) business and finance;
- 8) science and technology;
- 9) Internet, computers, software;
- 10) art and culture;
- 11) love and human relations;
- 12) education;
- 13) work and career;
- 14) automobiles and other means of transportation, problems in transportation;

- 15) sport;
- 16) pets;
- 17) nature and ecology;
- 18) travel;
- 19) religion and mystics;
- 20) various other issues.

For Runet users, however, the following topics turned out to be the most preferred:

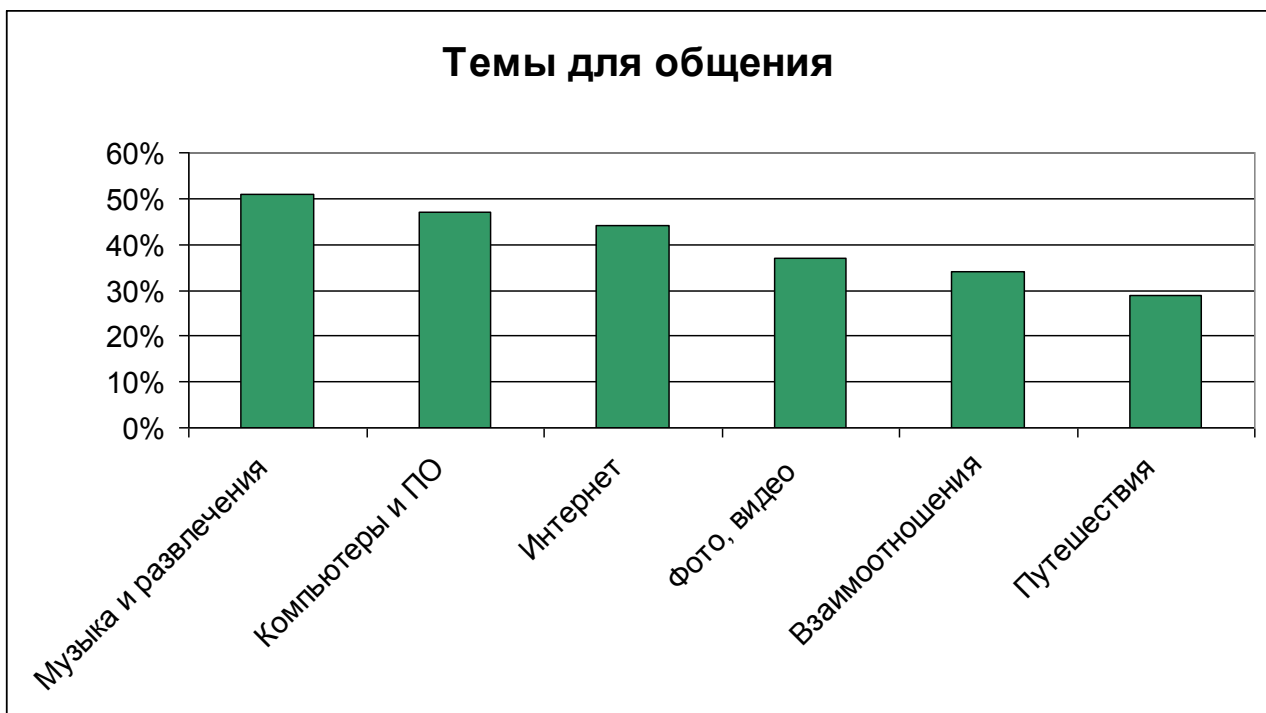


Fig.8. Most frequently discussed topics in Runet (*Source*: data of research by Rumetrika.ru)

VI. How much does it cost?

The growth of social networks makes them attractive for Internet advertisement. Below are certain figures from Internet business world (*Sources* – sites webplanet.ru, liveidea, social-networking), .

In July 2005 media magnate Rupert Murdoch bought network MySpace.com for the sum over \$600 million.

In 2006 the profits of LinkedIn were \$10 million.

In February 2007 media holding "RBC Informational systems" reported the desire to invest up to \$120 million in buying and developing Internet projects in Russia, CIS and eastern Europe. The company expects that by the year 2010 it will earn \$70-100 million a year in Internet business.

In March 2007 Moikrug.ru was bought by Internet holding "Yandex" for \$2,5 million.

In September 2007 Latvian Forticom bought 30% of authorized capital stock of the company, which runs Odnoklassniki.ru. At that time experts assessed the purchase as \$10 million, and the whole company as about \$30 million. Now one daily visitor cost on average \$100, although the sum may change depending on a particular asset. According to open statistics, Odnoklassniki.ru are visited by more than 2 million people a day. Therefore, the site might cost up to \$200 million.

At the end of 2007 «Finam management» announced that it bought 10% of Badoo Ltd for \$30 million.

LiveJournal had 18 million of registered users in 2007. 1,3 million of them were Russians – this is the second national diaspora of live journal. In December 2007 Russian company «SUP» bought the whole LiveJournal from SixApart. Financial conditions of the purchase were not allowed, but analytics assumed that the price was about \$30 million. Some said that in 2006 "SUP" was about to offer \$1,2-1,3 billion for YouTube, which was finally bought by Google for \$1,5 billion.

In 2007 Microsoft bought 1,6% of social network Facebook for \$240 million. The whole Facebook was assessed as \$15 billion, which is 10 times larger than video service YouTube of Google. The deal demonstrated that investors consider social networks the most promising communication segment of Internet.

Jason&Partners assessed market for interactive communication services (social networks, introduction services, network and mobile services) in 2007 as \$47 million, including direct revenues from services and advertisement revenues.

Facebook revenues from advertisement were in the range of \$100 million in 2006, and \$210 million in 2008 in USA only. The total expenditure on advertisement in USA social networks are recently 820-900 million according to different estimates. By the year 2011 they may reach \$2,5 billion, if the figure is not considerably influenced by the crisis.

The earnings of social sites on one visitor in 2008 were: Google: \$65.55 Yahoo!: \$31.25, Microsoft (MSN): \$17.74, MySpace: \$12.85, Facebook: \$11.79 (according to *eMarketer*).

VII. Classification of social networks

The process of Internet socialization demands serious socio-economic research and analysis. The variety of networks in different countries, changing preferences of consumers, the growth in the number of consumers, appearance of new groups of users in communities – all these issues lead to necessity to introduce classification of networks. Due to large variety and intersection of the properties of networks, it is impossible to create a unified vertical classification; therefore, it seems reasonable to apply classification on the basis of different parameters.

The following parameters may be used for classification:

- 1) location

Developing classification for analyzing social networks in the Internet

- international networks (e.g., FaceBook, MySpace)
- national (Kaixin001, Odnoklassniki.ru)
- regional (Moskva.ru),
- local (Sosedi-online.ru, Smolyane.ru)
- global (forming projects such as SocialStream, OpenSocial);

2) type

- universal (MySpace, Bebo, Tagged, Orkut),
- thematic – several further layers for classification (i.e., by the search topic) may be suggested:
 - i. to search people (Classmates, Odnoklassniki, MoiMir)
 - ii. work (LinkedIn, MoiKrug)
 - iii. news (Digg.com, news2.ru),
 - iv. video (YouTube.com),
 - v. foto (Fixx.ru)
 - vi. entertainment (FaceBook, Tagged, VKontakte)
- other – so called niche networks (networks created for a special group of people, yet, these networks may encompass large audience), e.g.:
 - i. young mothers (MommyBuzz.com, Youmama.ru),
 - ii. car owners (Boompa.com, Dovezu, ZaBarankoi),
 - iii. fishermen (Fion.ru),
 - iv. bibliophiles (Bookcrossing.com, X-libris.ru, LiveLib.ru),
 - v. glider pilots (Rusikar.ning.com),
 - vi. those caring about their health (DrugMe.ru) etc.

3) level of using Web

- Web 1.0 – the first types of networks ICQ, Evite, SixDegrees,
- Web 2.0 – most modern networks,

Developing classification for analyzing social networks in the Internet

- Web 3.0 – social networks of future – work instrument (to a certain degree these are MySpace, LiveJournal, LinkedIn).
- 4) accessibility of information
- open (FaceBook, MySpace etc.),
 - closed (PlayboyU.com, aSmallWorld, for millioners etc.),
 - mixed (Pro2, Yahoo!360),
- 5) membership with internal classification
- the number of visitors per day, month, year,
 - the number of registered users,
 - the number of permanent users (more than a certain number of visits a day),
- 6) audience
- age
 - i. adults (PeopleAggregator, LinkedIn, FamilySpace),
 - ii. young people (Orkut, Panjea, Facebook),
 - iii. teenagers (Tagged, Friendster),
 - iv. children (Stardoll, Imbee),
 - profession
 - i. medicine (Acustic.ru),
 - ii. design (Revision.ru),
 - iii. scientists (LiveJournal – project i-future),
- 7) technology – e.g., use of mobile technologies
- mobile social networks (Dodgeball.com, CatchUp.ru),
 - mobile instruments of interaction with networks (Odnoklassniki, MoiMir, VKontakte etc.).

By the number of social networks the market is close to satiation point, which may be seen from the slowdown in dynamics of growth of such western networks as classmates.com, with their analogues of Odnoklassniki, MoiKrug, VKontakte, SchoolLife etc. (Russian and Asian countries demonstrate lag in 5-8 years). The growth of total unique users largely occurs due to East European countries, Latin America and Asia. Therefore, one might expect that soon social networks will reach a new level of development, will be more professional and more suitable for everyday use due to new services. The owners and developers of social networks keep looking for new directions of development. For example, one of the most popular social networks – Facebook – announced the start of a new strategy, dealing with opening the platform of the project to outside developers (<http://www.social-networking.ru/news/30/>). It will help developers create new services for the project, sell and distribute them. Up till now all social networks were based on closed platforms. Facebook had already attracted 65 companies (one of them is Amazon) to the process of creating Facebook Platform. Recently the strategy of Facebook is very close to the strategy of Microsoft in 1980s. At that time the success and profitability of Microsoft was due to the large-scale program of attracting outside developers, who created a large number of computers on the basis of Microsoft operation system.

Very soon we will see new global networks, accumulation of network sources, creation of 3D world, and in future – incorporation of intellectual robots-androids in social networks.

REFERENCES

1. Voice of Runet <http://www.voxru.net/online/stat/> (In Russian)
2. Social networks from A to Z <http://www.social-networking.ru/> (In Russian)

3. Webplanet <http://www.webplanet.ru> (In Russian)
4. Galleo. Papers on social networks <http://galleo.ru/articles> (In Russian)
5. Alive idea <http://www.liveidea.ru/content/> (In Russian)
6. Social networks <http://socseti.com> (In Russian)
7. Alexa Internet <http://www.alexa.com>
8. Compete.com <http://www.compete.com>
9. Blog of Alexander Blokhin <http://ablohin.ru> (In Russian)
10. Rumetrika. Figures in Internet <http://rumetrika.rambler.ru> (In Russian)

APPENDIX 1.

Chronological table for the history of social networks

- 1995** The first network - [Classmates](#)
- 1996** SixDegrees (bought by YouthStream Media Networks in 2000, since 2001 does not exist as separate project); PlanetAll
- 1997** AsianAvenue – online – network for contacts, address book, later amended by services of social network
- 1998** PlanetAll is bought by Amazon.com
- 1999** Cyworld is launched as forum;
QQ starts as a tool for instantaneous messages;
Blackplanet is launched as online community
- 2000** [MiGente](#)
- 2001** [Ryze](#)
- 2002** [Friendster](#) launches beta-version as a private network
- 2003** [LinkedIn](#), [Hi5](#), [MySpace](#), OpenBC, [Tribe](#)
- 2004** aSmallWorld – a closed private network with access by invitation;
Dogster, [Orkut](#), [Facebook](#);
Mixi – the first user creates a note Multiply Dodgeball
- 2005** [Bebo](#) [Yahoo! 360°](#) , [Bebo](#) restarted as a full social network;
AsianAvenue is restarted with functional features of social network;
BlackPlanet is restarted with functional features of social network;
MoiKrug.ru, [Tagworld](#), [Zaadz](#)
- 2006** [MiGente](#) is restarted with new possibilities of a social network;
[Odnoklassniki.ru](#)
- 2007** Moikrug.ru was bought by Internet-holding "Yandex", Forticom bought part of authorized capital stock of the company which controls website Odnoklassniki.ru.
- 2008** Kaixin001 – a rapidly growing Chinese social network;
[Facebook](#) is translated into 20 world languages, including Russian.
- 2009** In July Russian users of social networks came out on top in the time they spend in social networks – 6,6 hours a day, leaving behind Brazil (6,3) and Canada (5,6 hours).

Social networks: sex and age in different social networks

Социальная сеть	Пол	Возрастная группа						
		14-17	18-24	25-34	35-44	45-54	55-64	65+
Bebo	Женщины	1 207 833	1 373 653	735 666	197 297	84 106	33 693	12 950
	Мужчины	569 510	802 474	488 944	162 689	63 119	27 058	10 775
	Не указан	15 532	15 865	3 977	1 197	406	101	22
Blackplanet	Женщины	120 981	346 629	164 383	47 500	13 660	3 361	1 814
	Мужчины	55 856	212 479	140 077	52 483	16 099	4 309	1 781
	Не указан	3 114	9 027	4 870	2 152	843	240	29
Classmates	Женщины	142 757	599 895	724 253	240 863	117 584	41 578	10 152
	Мужчины	62 885	278 908	435 742	211 079	100 527	41 874	12 527
	Не указан	2 532	9 355	9 363	5 346	2 811	1 323	407
Facebook	Женщины	784 214	1 685 029	767 619	184 057	72 743	21 441	10 270
	Мужчины	357 017	977 753	609 655	177 662	62 033	22 024	8 545
	Не указан	29 495	82 958	47 769	13 403	4 595	1 549	405
Flickr	Женщины	87 720	303 941	363 220	139 090	60 707	19 871	5 113
	Мужчины	44 170	235 015	398 061	205 631	89 587	33 994	8 998
	Не указан	5 163	23 806	25 753	10 982	4 825	1 926	524
Flixster	Женщины	2 221 835	3 258 823	1 841 543	658 189	297 477	93 020	27 204
	Мужчины	1 146 532	2 583 675	1 840 241	671 368	271 350	90 236	26 387
	Не указан	439 005	936 040	728 514	309 983	132 917	56 386	16 674
Friendster	Женщины	341 386	1 165 896	890 380	210 887	61 603	18 889	8 364
	Мужчины	225 834	975 965	904 600	279 728	85 178	27 573	11 975
	Не указан	5 856	21 879	19 569	3 998	597	141	82
Hi5	Женщины	1 382 273	3 078 898	1 475 824	412 150	175 018	52 250	16 800
	Мужчины	724 153	2 610 316	1 927 297	612 917	231 727	76 374	22 358
	Не указан	374 960	833 937	453 346	143 102	55 487	16 872	3 556
LinkedIn	Женщины	3 697	39 594	178 550	69 197	24 368	7 726	1 355
	Мужчины	4 618	42 642	222 431	124 759	45 310	16 083	3 379
	Не указан	610	7 905	27 858	13 456	5 264	2 005	40
Multiply	Женщины	115 117	352 590	194 957	51 304	19 488	5 829	2 270
	Мужчины	55 054	261 803	194 818	63 000	25 247	8 846	3 042
	Не указан	184	536	389	112	44	17	0
Myspace	Женщины	5 158 453	7 091 214	3 800 542	1 252 287	542 694	167 087	71 531
	Мужчины	3 365 442	5 226 788	3 238 471	1 209 510	475 566	167 101	66 852
	Не указан	3 147	4 726	2 540	1 137	548	251	67
MyYearbook	Женщины	637 510	578 018	239 646	91 832	37 531	10 871	5 345
	Мужчины	280 131	292 263	127 999	55 766	23 582	7 503	3 145
	Не указан	20 524	20 980	9 300	4 507	1 837	729	232
Perfspot	Женщины	84 840	158 003	91 200	31 375	14 192	4 033	1 077
	Мужчины	66 643	317 958	260 641	86 707	29 974	9 494	2 790
	Не указан	30	181	264	95	36	6	0
Tickle	Женщины	743 111	1 491 975	887 369	318 578	151 490	44 742	12 876
	Мужчины	309 858	939 737	739 932	268 239	118 031	41 130	12 042
	Не указан	70 562	177 297	100 108	34 037	14 204	5 048	1 235
Itoro	Женщины	6 322 060	9 651 584	5 683 422	1 929 328	857 965	279 684	97 858
	Мужчины	4 050 429	7 546 654	5 543 729	2 113 597	873 135	323 251	108 731
	Не указан	682 756	1 456 780	1 045 381	428 357	181 913	72 196	20 240

Source <http://ablohin.ru>

APPENDIX 3.

Top-20 countries, most actively using social networks, as of May 2009

Country	Hours per visitor *	Pages per visitor
The whole world	3,7	525
Russia	6,6	1307
Brazil	6,3	1220
Canada	5,6	649
Puerto Rico	5,3	587
Spain	5,3	968
Finland	4,7	919
Great Britain	4,6	487
Germany	4,5	793
USA	4,2	477
Columbia	4,1	473
Mexico	4	488
Chile	4	418
Ireland	3,8	462
Turkey	3,7	427
Venezuela	3,7	454
France	3,6	526
Australia	3,4	374
New Zealand	3,4	386
Switzerland	3,2	430
Italy	3,2	399

Source: comScore World Metrix

*Visitors aged over 15. Traffic from public Internet access places and mobile phones is not included.

Providing for reliability and convincingness in computerized scenes introduction

©Lavrov A.A. (*Moscow*)

Rapid formation of world information space on the basis of modern computer technologies becomes one of the dominants for global science and technology revolution. As a result cutting-edge technologies enter various spheres of society's activity and introduce crucial changes to understanding future developments in these spheres.

Cinema production is one of these fields where computer technologies offer new possibilities. The purpose of this paper is to develop an effective programming approach for automatic information systems in computer modeling of mass scenes and for their reconstruction in cinema production. This work has a complex character and is based on such disciplines as cinema theory, sociology and computer programming.

The idea of modern computerized cinematograph consists in creating artificial (virtual) objects, which are placed in real world [1]. The ratio of virtual and real components may be in a large range of 0 to 100%. One of the major requirements to new technologies is reliability and convincingness for a spectator in his/her viewing of the final material. The importance of this statement lies in the fact that introducing knowingly artificial elements demands creation of new adaptive technologies and methods. At the same time, technologies of computerized cinematograph open new revolutionary opportunities and perspectives in cinema art and cinema industry.

Technology of creating artificial mass scenes implies using special tools and techniques in order to make these scenes reliable and convincing [2-4]. Obviously, the shift from traditional to computerized cinema should rest upon understanding of how a spectator perceives cinema. These issues are studies in such a discipline as the theory of cinema art. The phenomenon of collective perception of cinema demands thorough investigation, as well, since it is closely linked to psychology of society's members and to the system of collective perception and utility.

Providing for reliability and convincingsness in computerized scenes introduction

Another important point in the problem of providing for reliability and convincingsness in artificial mass scenes is sociological aspect. It deals with the fact that human mass behavior, beliefs about the degree of ordering of masses, and social psychology become of a particular meaning in this context. It is impossible to adequately reflect mass scenes in cinema without deep knowledge in the above mentioned fields.

Finally, the third component of the process for creating mass scenes in cinema production is the very technologic regulations in computer software for automatic information systems.

The concept: masses – cinema - masses

Due to the above described argument, this paper treats masses both as an object for modeling and as a consumer for cinema products. Consequently, masses become the major object for investigation in this research. The simplified description of the order of action in computerized cinema may consist of the following sequential steps:

- the research of behavioral regularities and creating models for masses;
- the development of highly effective software of automatic information systems for computerized modeling of mass scenes;
- the study of phenomenon of collective perception of cinema.

In this way the elementary initial cycle: M (masses) - K (cinema) - M (masses) – is created. Each consecutive cycle sees reproduction of the same sequence at a new level, taking into consideration the results of the previous cycle. As a result, the formula for progress in a modern computerized cinema looks as:

$$[\mathbf{M} - \mathbf{K} - \mathbf{M}] * \mathbf{N} \quad (1),$$

where **N** is the number of cycles.

It should be noted that notations **M** to the left at right of **K** in equation (1) are not identical. They reflect notions that do having a large degree of kinship, yet are different. Let us call them correspondingly M1 and M2. M1 is a modeled reflection

Providing for reliability and convincingsness in computerized scenes introduction of a mass, created on the basis of requirements for future development of a programming software.

M2 is generalized representation of a mass reaction to cinema products.

Consequently, a correct form of (1) becomes:

$$[M1 - K - M2] * N \quad (2).$$

Types of human associations: general ideas, definitions and classification.

Mass and crowd

Sociology has many ways for naming human associations as a multitude of people situated in a certain place within a certain period of time [5-10]. The terms mass, crowd, gathering etc. may be used. In this context we believe that from a psychological point of view a crowd should imply an initially or eventually non-organized gathering of people, which does not have (or has lost) a common conscious goal and usually is in a state of emotional exultation.

The belief about “human mass” as a weekly organized amorphous gathering was formed analogous to beliefs about physical masses which do not have any form: “a mass of walking people flew from the town center to the riverside and the park.” The word “crowd” is synonymous to “human mass” as a vividly represented multitude of people. Although crowd consists of a multitude of individuals, it can be physically overviewed and be described as a unified object. In practice, however, words “crowd” and “mass” are often used very non-strictly, and sometimes are treated as simple synonyms. Strictly saying, this is not necessarily correct. The term “mass” may be regarded as a generalization, determining a certain abstract social group of people. In this sense one may talk about “working masses”. The term “crowd” reflects situationally definite sample of human mass representatives. In this sense we can say that each crowd is a mass, but not each mass of people gathered in the same place at the same time is a crowd. For example, a “mass of people” at a large flea-

Providing for reliability and convincingsness in computerized scenes introduction market is not necessarily a crowd. Big gatherings of fans or spectators on the stands of stadiums remain “mass” with a possibility of transforming into a “crowd”.

A crowd is a collectively psychological phenomenon, i.e. a definite group of agents directly interacting with each other. The scale of crowd’s activity is limited by the number of its members (from several persons to several hundred thousand people), by the space (street, stadium, field etc.). A crowd may be furiously aggressive, may be in ecstasy or in panic.

The time for existence of each particular crowd is short. Yet, as a form of a social group the crowd is eternal and may act in the framework (or in periods) of various socio-historic structures.

This paper treats definition “mass” as more general than “crowd”.

Classification of a mass (crowd)

A special feature of a mass (crowd) is a particular difficulty of its study. Suddenness of emergence and disappearance of mass, uncertainty of qualitative and quantitative parameters and many other aspects complicate execution of correct and reproducible experiments. At the same time reproducing masses in certain modeled laboratory conditions also becomes implausible. Consequently, specialists have to gather the required information from printed media, video materials and other sources.

Nonetheless, the attempts to determine and research certain aspects of mass behavior have been repeatedly made. International science has accumulated a certain experience which on the whole corresponds to the frameworks of well-known methodological approaches in social psychology [11,12]. These methods can mostly give a meaningful results only with their wide applications, which would enable reproduction of the results.

1) A questionnaire method

Providing for reliability and convincingness in computerized scenes introduction

This is one of the most feasible methods for studying mass phenomena. Its effectiveness depends on how clearly the main conditions for conducting statistically reliable surveys are fulfilled.

2) Data of systematic observations

The issue of mass disorder has a long history in various countries, and corresponding experience has been generalized and analyzed.

3) Experimental methods

There groups of methods, useful in studying the problems of mass (crowd) psychology, may be singled out. The first group accumulates methods widely used in experimental social psychology in studying behavior of groups and individuals in groups. The second group of experimental methods contains modeling of crowd behavior. Although it is extremely difficult to create natural conditions in laboratory, such attempts have been continuously made. Field experiments are the third group of experimental methods. Many experiments deal with behavior of actual groups, and their data are partially applicable to studying crowds. Consequently, possibilities of these methods are constrained, as well.

As any other social phenomenon, a crowd may be classified according to different foundations. In literature there exists is a huge number of crowd classifications [13,14].

External and internal characteristics of crowd

The matter of scientific interest is to study external and internal characteristics of mass (crowd). These characteristics reflect internal socio-psychological processes in a crowd. In this regard, a number of general characteristics of different types of mass (crowd) may be distinguished.

The size of mass (crowd)

Providing for reliability and convincingness in computerized scenes introduction

The number of participants may vary in a large range: from several persons to tens and hundreds thousand people. This parameter is extremely important as the following characteristics of a crowd depend on its size:

- the way of implementing internal and external communication;
- the internal subculture;
- the character and ways of interacting with outside world;
- the safety level of its members in case on non-standard situation;
- the level of external dangerousness.

Geometric and time parameters

The size of space occupied by mass has a particular importance. Conditions dangerous for human life appear when mass density exceeds a certain critical level. As gatherings of people normally appear in busy places: on the streets, squares, highways, the presence of mass in these areas may disturb usual rhythm of life and may cause emergence of critical situations.

There are several classifications of crowd in social psychology

According to the degree of organization:

Spontaneous crowd

It appears spontaneously and is not organized by anybody. Crowds of people in the subway or in cinema lobby belong to this type. Although people have gathered on a special occasion, the crowd does not have instigators.

Driven crowd

Crowd, organized by leaders. This crowd has instigators. An interesting type of such crowd is flash mob – a crowd of people, which suddenly appears in one plays and then suddenly disappears. Flash mobs are usually organized through Internet.

Organized crowd

Crowd which has a clear organization and order. The term was introduced by Gustave Le Bon, who considered such formations as soldiers company and as a

Providing for reliability and convincingness in computerized scenes introduction session of parliament to be a type of crowd. Le Bon used the term spiritual crowd, underlying the fact that crowd has its own spirit. Many researchers, however, do not agree to such extended interpretation and believe that crowd indicates only a non-organized mass of people.

According to the type of human behavior:

Occasional crowd – gathering of curious people (idlers), who gathered, for example, on the case of car accident.

Conventional crowd – gathering on an occasion known beforehand (e.g. festival, carnival etc.)

Expressive crowd – crowd expressing common emotions (e.g. protest, exultation etc.).

Ecstatic crowd – crowd in ecstasy.

Acting crowd – crowd conducting physical actions. It includes subtypes:

- Aggressive crowd – mass of people, conducting destructive actions.
- Crowd in panic – crowd, escaping something or from somebody.
- Acquisitive crowd – crowd fighting for valuables.
- Insurgent crowd – crowd opposing the authority.

It is necessary to note that the above ways of crowd classification are of exclusively descriptive nature and are based on observation of real events. We believe it is necessary to study this problem on more general grounds. In this context major features of crowd (mass) may be subdivided into the following categories:

- external: scale (number of members, the size of occupied territory);
- internal: reflecting links between members: homogeneity of composition; presence of common goals; pre-history of crowd's creation; presence of leaders etc.;
- emotionally-energetic: readiness of crowd for coordinated actions; emotional outbursts and spontaneous actions with unpredictable consequences.

Psychological features of mass (crowd)

The founder of research related to phenomenon of a crowd is French sociologist Gustave Le Bon, the author of the book “Psychologie de foules” [10]. He made a considerable contribution to the development of many socio-politic theories.

The views of Le Bon, and in particular racial elements of his theory, have been widely criticized in the middle of 20th century. Yet, Le Bon singled out certain features which lay into foundation of further studies of crowd phenomenon.

Social psychologists note a number of psychological characteristics of a crowd [13,15]. They are peculiar to the whole psychological structure of this formation and are reflected in various spheres:

- cognitive;
- emotionally volitional;
- temper ;
- moral.

In cognitive sphere crowd demonstrates various special features of its psychology.

Infection

Psychological infection contributes to creation of special features in crowd and determines their direction. A person tends to imitate. Opinions and beliefs disseminate in crowd through infection.

Inability of awareness

Important characteristics of crowd include its non-awareness, instinctive and impulsive features.

Peculiarities of mass reflection

It does not seem reasonable to talk about thinking of crowd as of an absolutely ordered mass. In this state crowd does not feel itself as one unified formation, does not see its goals and does not actively interact with outside world. At higher stages of organization a component of internal interaction increases in mass (crowd); there

Providing for reliability and convincingsness in computerized scenes introduction emerges a flexible internal structure with leaders, core, active and passive parts. In this period mass transforms into a unified body, realizes its goals and demonstrates signs of thinking.

Peculiarities of imagination

The ability for imagination is strongly developed in a crowd. A crowd is very perceptive to impressions.

Peculiarities of thinking

Crowd thinks in images. An image arises in its imagination, and in its turn leads to other images, that may be logically non-connected to the original one. Crowd does not separate subjective from objective. It treats as real images which arise in its mind and usually have very little relation to facts, observed by crowd. Crowd may think only in images and is perceptive only to images.

Categorical attitude

Having no doubts about what is truth and what is delusion, crowd demonstrates authority and intolerance in its actions.

Conservatism

Being extremely conservative in its essence, crowd feels deep aversion towards all novelties and feels deep respect for tradition.

Suggestibility

Freud proposed a productive idea for describing the phenomenon of crowd. He considered crowd as human mass being under hypnosis. The most dangerous and the most essential in the psychology of crowd is its susceptibility for suggestion.

On relations between individual and mass psychology

With development of civilization of the society, culture leaves traces on each individual by imposing existing norms and bans. Society forms its rules (rules for individual's existing in civilized world), and disobeying these rules implies exposure to punishment. In a crowd, however, each individual is depersonalized and can

Providing for reliability and convincingness in computerized scenes introduction commit any illegal actions without thinking about punishment. While thinking is a prerogative of consciousness, unconscious instincts prevail in a crowd. It is also that being in a crowd, any individual should obey its internal rules, i.e. to do what other members of crowd (mass) do. As a result, mass subdues individual blocking his/her will and consciousness. Therefore, from a point of view of psychophysiology crowd actualized instincts of the right hemisphere of mind (right hemisphere thinks in images and feelings, while the left hemisphere uses mind in its logic). Consequently, consciousness of individual is blocked. For a certain time this person stops thinking logically and stops being aware of his/her own actions. In this way subconscious, lower instincts prevail, and a person starts following the commands of the right hemisphere.

It should be noted that almost any crowd at a certain time experiences collective exultation, resulting in lower sustainability of its members towards any pressure. This leads to increase of irresponsibility and therefore, to subconscious desire to be led by emotions and immediate desires, rather than by sensible testing of reality in committing any actions. It is also that heightened emotional exultation of certain members causes chain spread in crowd, and penetrates in its energy by an indescribable way. Joint collective exultation in masses increases. For certain members this collective exultation may suppress individual behavioral mechanisms and may lead to creation of new, possible non-characteristic forms of behavior. Then, as a consequence, there is a change in habits and demands to oneself as a personality. This may witness for general decrease of censorship threshold for personal psychics. It can also demonstrate elimination of critical attitude towards outside information, and altogether considerably increases susceptibility of individual and mass towards suggestive action.

In other words it is necessary to mention that emotional exultation, causing a feeling of irresponsibility, which, in its turn, is due to belonging to a certain common

Providing for reliability and convincingsness in computerized scenes introduction idea, forms in every individual in a crowd. As a result, a person in a crowd automatically and subconsciously commits actions of other members, as if being hypnotized by identical character of these actions. Sometimes, actions are committed with maniac satisfaction and cruelty common to such cases. Actions are committed since being in a crowd allows to liberate consciousness, and to do what has been previously prohibited by law (with law being in fact the only restrictive factor for the priority of lower instincts). It is not only consciousness but the fear of further punishment that prevents people from implementing in life their lower instincts.

Considering the issue of aggressiveness in crowd, Academician and Doctor of political sciences D.V.Olshansky distinguishes such types of aggressive behavior as expressive, impulsive, affective, alien and instrumental.

Description of mass (crowd) as objects with different degree of order

Let us pay attention to an important aspect in major characteristics of masses, which deals with the degree of their order. Imagine a fully disordered mass, consisting of individuals, who are simultaneously situated in the same place; yet, there are no any links between them. Crowd satisfies this definition. Passersby in the street ex facto satisfy also this description, yet under a more attentive investigation this thesis becomes unfounded. Indeed, rules of mutual politeness, ethical norms etc. are present inside this group. Therefore, a certain order must be present in any mass.

Another extreme case is a maximum level of order. Military units or members of enterprises fulfilling their duties may be attributed to this category. Let us examine the case of military units. How the character of links between elements of mass in this community may be described? Suppose that this is subdivision equipped with modern weapons. In certain situations it is supposed to act with utmost speed and coordination. Obviously, many years of training procedures, the highest level of interaction and mutual understanding is necessary for this structure. Moreover, mass-structure should have the noise proof features and noise immunity in the period of

Providing for reliability and convincingsness in computerized scenes introduction active opposition to the enemy. This structure is aimed at maintaining these internal links in circumstances when there is a danger for physical existence of elements of the system (human life). Hence, the degree of order may change in a wide range and is determined by the character of links between elements of mass.

Coming to the basics of modeling, we may conclude that modeling principle may include a component of physical reflection of elements and a system of internal and external relations, determining the order of interaction and outside factors.

Conclusions

1. Important features of mass (crowd), which may be modeled by computerized methods, may be divided into the following categories:

- external: scale (number of members, size of occupied territory);
- internal: reflecting links between members (uniformity of contents; presence of common goals; pre-history of crowd's formation; presence of leaders etc.;
- emotional and energetic: readiness of crowd for coordinated actions; emotional outbursts and spontaneous reactions with non-predictable consequences.

2. Psychological features of crowd (mass) – incapability for consciousness, categorical behavior and suggestibility – create the basis for our views on the character of crowd (mass) action depending on internal and external factors. And this can be also modeled with the use of computer.

References

1. Landay, L.(2007) Representing the crowd: From silent film to digital cinema / L. Landay // Media in Transition 5: Creativity, Ownership and Collaboration in the Digital Age.
2. A. Watson, J. Hu, J. McGowan III, and J. Mulligan.(1999) Design and performance of a digital video quality metric. In Human Vision and Electronic Imaging IV, pages 168–174. Proceedings of SPIE Vol. 3644.
3. Woodcock, S. Game ai: The state of the industry / S. Woodcock // Game Developer Magazine.

4. DeLoura, M.(2000) Game Programming Gems (Game Programming Gems Series) / M. DeLoura.— Book & cd edition.— Charles River Media
5. А. Б. Ковельман (1994) Рождение толпы: от ветхого к новому завету. Человек в истории. Образ "другого" в культуре. М., с. 123-137
6. Московичи С.(1996) Век толп / Пер. с франц. М.: «Центр психологии и психотерапии»
7. Левада Ю.(1997) Человек, толпа и масса в общественном мнении. Мониторинг общественного мнения: Экономические и социальные перемены, № 5.
8. Лебон Г.(1995) Психология народов и масс. СПб.: Макет
9. Тард Д.(1903) Личность и толпа. СПб.
10. Le Bon G.(1895) Psychologie de foules. P.
11. Шихирев П.Н.(1999) Современная социальная психология. М.
12. Minguzzi G. F.(1975) Dinamica psicologica dei gruppi sociali. Bologna.
13. С. К. Рощин (1990) Психология толпы: анализ прошлых исследований и проблемы сегодняшнего дня. Психологический журнал. Том 11, № 5. Стр. 3-16.
14. French J.R.P.(1944) Organized and unorganized groups under fear and frustration. Iowa City: Univ.of Iowa Press.
15. Freud S. (1922) Group psychology and analysis of the ego. L.

The Sixth European Conference on Social Simulation

© *Makarov V.L., Bakhtizin A.R., Istratov V.A. (Moscow)*

The Sixth European Conference on Social Simulation, organized by European Social Simulation Association (ESSA), was held in the University of Surrey (Guildford, UK) on September 14-18, 2009. The conference analyzed a wide range of issues: social conflicts, cognitive agents, methodology for modeling humans, animals and artificial intelligence.



17 plenary talks (including 2 keynote speakers), 49 presentations and 11 poster presentations were made during the conference. The conference included 4 tutorials, and 4 seminars and demonstrations, with details provided below.

Keynote speakers



1. Jim Doran (University of Essex, UK) devoted his talk “Does ABSS need Cognitive Agents that are Multiple Agent Systems?” to outlining the developments in artificial intelligence in the past 50 years. In particular, he described agent-based modeling in creating intelligent cognitive agents.



2. The talk "Generative Archaeology: How Even Really Simple Models can help in Understanding the Past" by Tim Kohler (Washington University, USA) dealt with applying an agent-based model for studying one of the riddles of the American history – depopulation of Mesa Verde in the South West. Various ways of inhabitants' relocations were calculated with the use of the data on the sources of food and on the social groups in the

proximity.

Tutorials

1. Tutorial “Social Simulation on the Grid” (the author is Gary Polhill from Macaulay Land Use Research Institute) demonstrated methodology for visualizing applications, requiring plenty of resources (e.g., Swarm, RePast и MASON).

2. Tutorial by Shu-Heng Chen (National Chengchi University, Taiwan) “Heterogeneous and multi-agent modeling” was devoted to general issues of developing agent-based models with heterogeneous agents. The first part of the

tutorial provided a literature review in the field of experimental economics and application of neural networks for economic studies. The second part described construction of agent-based models with heterogeneous agents, using the example of financial markets.

3. Tutorial by Jim Duggan (National University of Ireland, Galway) “Agent-Based Simulation: A Differential Equation Approach” described similarities and differences between two approaches in computer simulations. Namely, these were system dynamics and agent-based modeling applied to market models and the spread of epidemics.

4. Tutorial by Gerd Wagner (Brandenburg University of Technology at Cottbus, Germany) “From Basic Discrete Event Simulation via Object-oriented to Agent-based Discrete Event Simulation” dealt with conceptual foundations of the new programming language, aimed at technical implementation of agent-based systems in the most natural way. The major issues discussed were 1) the problems of processing events on the levels of agents and the whole system, and 2) the formalization of switches between different states of the agents in different moments of time.

Seminars and Demonstrations

1. Ken Kahn (Oxford University, UK) conducted the seminar “Modelling4All: Supporting non-programmers in composing agent-based models in a Web 2.0 community”. An online constructor, which enables creating, running, modifying and disseminating agent-based models, was demonstrated in the course of the seminar. The major attention was given to the issues of using the constructor for educational purposes in teaching a wide range of disciplines.

2. Ulf Lotzmann (University of Koblenz-Landau, Germany) demonstrated EMIL project (<http://emil.istc.cnr.it>). The project is aimed at modeling social processes, where social norms are considered in the course of individual interactions and in the course of studying (educational norms). The project offers theoretical structure

(EMIL-A) and programming environment (EMIL-S), allowing to create new models and expand the existing ones.

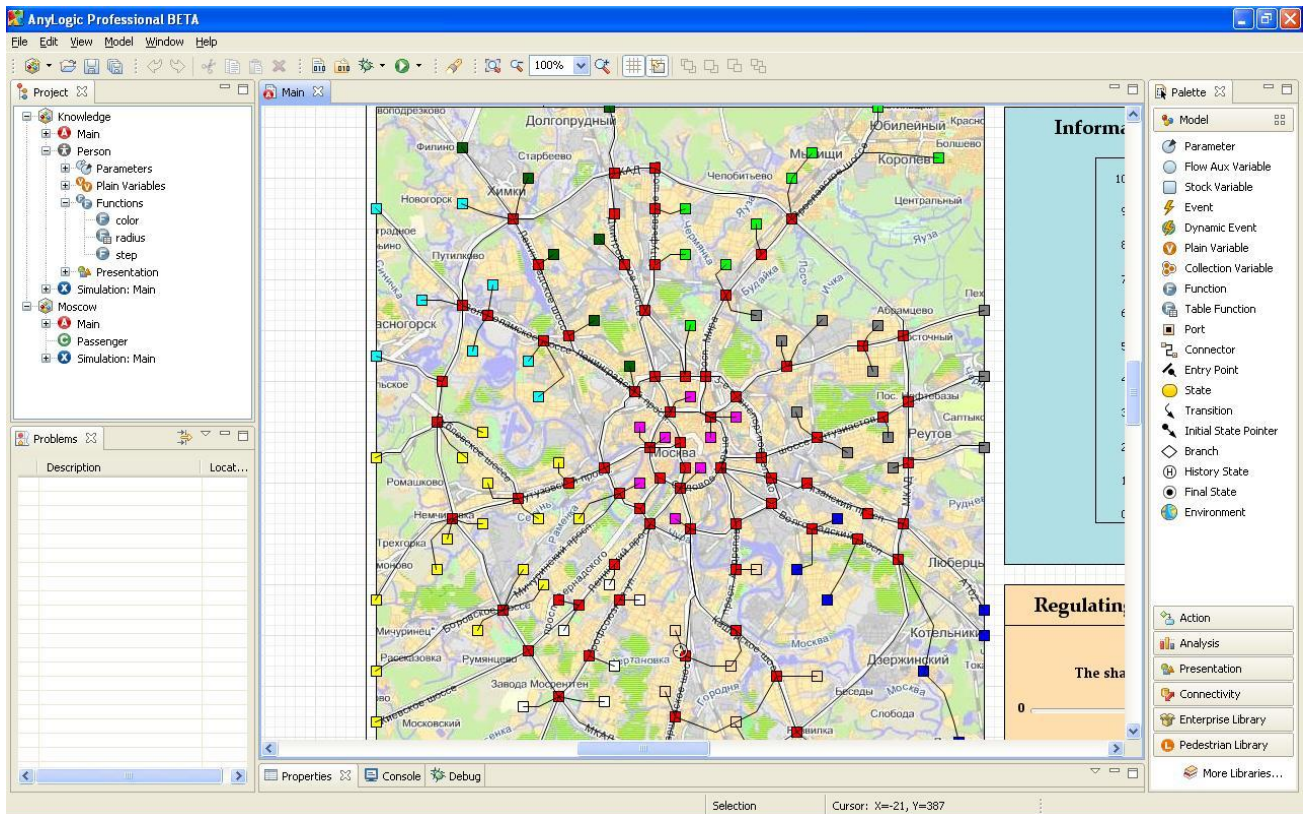
3. The demonstration by Armando Geller (George Mason University, USA) “Qualitatively informed agent-based models: Problems and ideas to solve them” studied various issues of data formalization, model specification tests and results interpretation.

4. Edmund Chattoe-Brown and Nigel Gilbert (The University of Surrey, UK) conducted the seminar “Teaching social simulation”. The seminar was exchange of experience in educational programs and recommended literature for teaching corresponding disciplines.

Researchers of CEMI RAS made two presentations at the conference:

1. “Moscow traffic jam is under attack of an intelligent agent-based model” (authors – V.L.Makarov, A.R.Bakhtizin, V.A.Zhitkov). The first part of the presentation described the means of representing the work of the transportation system of a mega polis (the example of Moscow city) as an agent-based model, implemented as 2-D application in AnyLogic 6.0. The developed model allows assessing the work of the whole transportation system of a city agglomeration in the course of the changes in the following parameters:

- introduction of radial or circle automobile roads;
- construction of new residential districts or objects, which concentrate traffic flows (e.g., large shopping mall);
- temporary closure or liquidation of an element in the transportation system;
- introduction of economic sanctions (payment for using the road, for entering the city center etc.).



Implementation of Moscow's transportation network in AnyLogic 6.0

The second part of the presentation described computational simulations, which allowed revealing the most effective way to fight traffic jams.

2. "Agent-based model of human behavior: does similarity count?", poster presentation (author – *V.A.Istratov*).

The presentation described a model of human behavior in everyday and socio-economic environment. Various computational simulations conducted within the model were described. Simulations dealt with analyzing how homogeneity of the society influences the degree of life satisfaction by the members of this society, and how this degree of life satisfaction depends on enthusiasm of the society members.

Further details about the conference may be found at <http://www.essa.eu.org>.

Model for human behavior: preliminary calculations

© *Istratov V.A. (Moscow)*

Now we proceed from the construction of the model to the first calculations. We would obviously be eager to discover that the model can answer to the questions, to which other models may not give definite answers. Consequently, to test the model applicability we have chosen “economics of happiness” – an unexplored albeit extravagant field of economics.

In short, economics of happiness estimates happiness of people using methodologies of both economists and psychologists, and employing a more general definition of utility than does traditional economics. Researchers single out other factors apart from income influencing happiness (well-being) [3]. In the first place these are inequality, inflation and unemployment. The central issue in economics of happiness (the issue that in fact brought about the existence of this field) is the relation between dynamics of happiness (personal satisfaction) and dynamics of macro variables in the country. Some researchers have noticed that the growth of per capita income is not necessarily accompanied by the rise in population’s happiness [2].

Nonetheless, the very term happiness (satisfaction etc.) is so hard to capture that up till now descriptive methodologies according to survey-based regressions dominated in its modeling. Therefore, instability of survey data is multiplied by indifference of regression constructions, and the obtained dependencies are hard to interpret. Obviously, in case of such subjective terms as happiness, equalizing statistical approaches should be replaced by analytical models, where happiness (satisfaction, mood etc.) would be endogenous parameter, following from logically and substantially clear assumptions and procedures. Here, we propose the model of human behavior as an analytical tool capable to shed some light on the dark history of human happiness [1].

The above mentioned article [1] is devoted to the way a person's mood (happiness) depends on her monetary savings and income, and how this dependency is revealed in the model of human behavior.

In this paper I would like to share the first results of a slightly different research: how happiness of society as a whole depends on heterogeneity of its members. How can the model of human behavior be interesting in this regard?

I conducted a series of calculations to assess the impact of heterogeneity of long-term inclinations. In each case the society consisted of 20 agents. All agents differed in their long-term inclinations to all actions. The initial stock of money and income of all the agents were the same. To avoid repetitions in conclusions we fixed the income at the level that allows agents to live the way they want.

As was noticed in the previous articles in this series, initial values of long-term parameters are set randomly. Normal distribution is used in generating random values, and this requires determining the standard deviation (heterogeneity of the members of the society) and the mean (the degree of satisfaction of the members of the society). We considered combinations of the three scenarios, corresponding to different values of standard deviation (5; 25; 50) and the mean (0; 35; 70), i.e. the total of nine scenarios. Each scenario consisted of three checks, corresponding to three different societies (different values of long-term inclinations of the agents, but the same parameters of normal distribution). These scenarios were aimed at revealing and leveling the influence of random parameters on final result. All results of calculations were averaged within the societies.

As we aimed at making conclusions for the whole society, we worked with average mood in the society, which nonetheless was obtained as a result of individual interactions between agents.

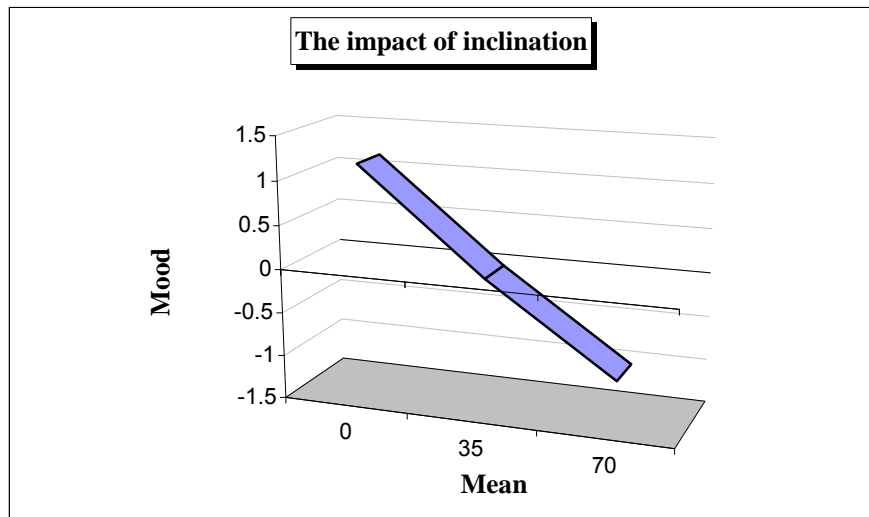


Figure 1. Mood as a function of the degree of agents' inclinations

In case of mathematical mean we unambiguously see that with rise of mean the average mood decreases. This leads to a conclusion that the society will be happier when there are fewer people who passionately follow their inclinations. The larger the number of such people in the society, the less happier on average it is.

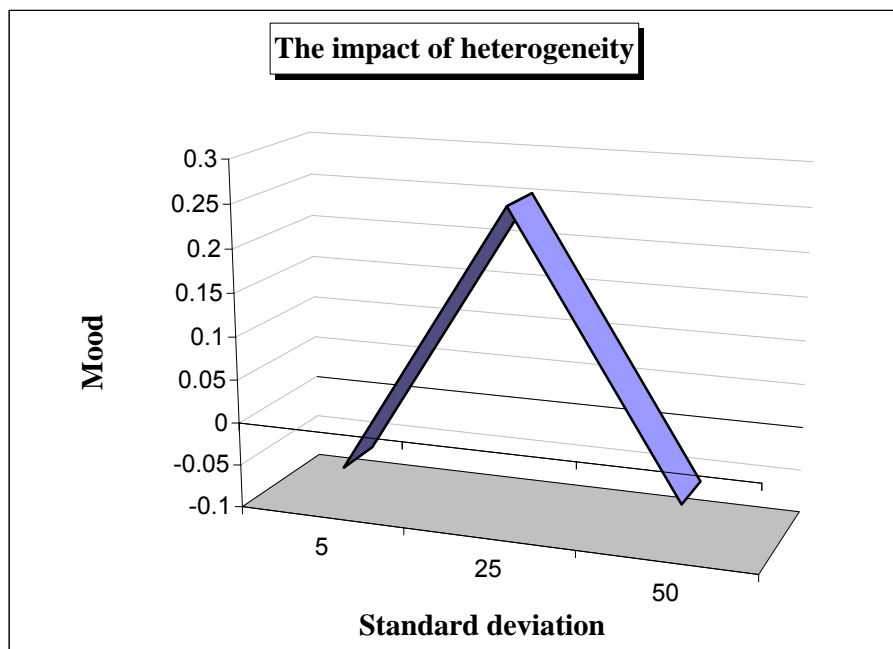


Figure 2. Mood as a function of heterogeneity of agents' inclinations

In case of standard deviation, the picture is more interesting: in principle the values of society's mood are close but still there is a clear peak at medium values. This may be interpreted in the following way: if society is very homogeneous (all think, wish and act similarly) or on the contrary, very heterogeneous (when a person can hardly find a one with the same views), this leads to decrease of mood in the society. The optimal way is a moderate variation of interests and views, which would allow to maintain good mood in the society.

The conclusions obtained in the course of preliminary estimations have already caused certain discussion, especially in the part which deals with inclinations (mean). However, it would be difficult to expect general agreement in the issue of human happiness, even in such approximation as a human behavior model. In hundreds years of existence of philosophy (and for the most part of scientific life of a mankind this field dealt with consideration of human happiness) scientists did not reach an agreement: there have been views of searching happiness in passiveness and aloofness, or in other extremes.

1. **Истратов, В. А.** (2009) Агенто-ориентированная модель поведения человека: не в деньгах счастье? / В. А. Истратов // Экономика и математические методы. Т. 45, № 1. – С. 129-140
2. **Easterlin, R.** (1974) Does economic growth improve the human lot? Some empirical evidence / Richard A. Easterlin // Nations and households in economic growth: Essays in honor of Moses Abramovitz / Ed.: P. David, M. Reder. – New York: Academic Press, 1974. – P. 89-125. – ISBN 978-0-122-05050-3
3. **Graham, C.** (2008) The economics of happiness / Carol Graham // The new Palgrave dictionary of economics / Eds.: Steven N. Durlauf, Lawrence E.

Model for human behavior: preliminary calculations

Blume. – 2nd ed. – Basingstoke, Hampshire: Palgrave Macmillan. – ISBN 978-0-333-78676-5

Special issues in modeling artificial societies

© *Konkova T.A. (Moscow)*

As a living system, society is an open system in a constant exchange with neighboring environment. This is exchange of matter, energy and information. Society has higher degree of organization than this environment. To maintain itself as an integrity, society has to satisfy its needs, in the first instance, material needs of people. These needs are objectively and historically changing, and the degree of satisfaction of these (material, social, spiritual) needs is the major indicator of effective functioning of the society as a system.

As a functioning system, society objectively aims at reaching a certain goal, which consists of a number of sub-goals. Society may not even think about existence of such a goal, may define it falsely or deny its presence. However, the very behavior of society and its certain actions prove the existence of a certain goal.

Attaining this goal is done in the following way [1]. On the basis of available information on the environment and on the society, the governing agent formulates directions to the object of control. The directions are obligatory and deal with object's further interactions with environment. The signals from the governing subsystem are called direct coupling. There is also a feedback from the executor to the governing subject – information on the results and on the degree in which the results correspond to the set tasks. The correct adjustment of goals and actions on the part of governing agent becomes crucial for the destiny of society as a system.

It is insufficient to mention that society constantly and purposefully conducts material and informational exchange with the environment according to the feedback. We should describe various forms and ways in which society explores the environment. These ways reveal universal character of relation of society (humans) to

nature and to itself. As a member of a society, a person discovers environment in three possible ways: through sensual and practical exploration, through theoretic exploration and through integral exploration. Such type of society is hard to model.

Major characteristics of the society. Characterizing society as a system of relations implies that there are stable forms of interaction between the subjects of social links, between people and social groups. This systematic characteristic of the society needs to be supplemented by functional characteristic: system of social interactions must exist, or in other words - function.

Society as a way of person's existence is characterized by the following major functions:

1. Production of material goods.
2. Reproduction and human socialization.
3. Distribution of products of labor activity.
4. Consumption.
5. Exchange of products of labor activity.
6. Exchange of information (communication).
7. Regulation of the forms of labor, distributional and consumption activity.
8. Regulation of the forms of other interactions (social, political, moral etc.).

To realize these functions special organizations (social institutes) are created in the society. Their appearance makes human relations more sophisticated and creates new vectors in the forms of interactions.

Let us single out major functions. The first is production of material goods. The second is reproduction of humans, who are the medium of social relations. The third is distribution, consumption and exchange of produced goods.

Different models are applied to incorporate functions above in forecasting adaptive behavior of a person in the society. The way of modeling all practical actions of a person influences the precision of the prognoses for development of the society. Let us study special issues in creating artificial societies.

Special features of artificial society. Creating artificial society, a person puts in her own understanding of the mechanism and functioning of this society. Some social scientists (J.Locke, T.Hobbes, M.Weber) considered society as a complex rationally created system. Others (O.Koht, H.Spencer, T.Parsons, F.Ratzel) – as a natural system etc. Despite the absence of a general understanding of the society, up till now rational (integral) model of the society has been dominant. The essence of this model is understanding of the society as a system created to reach a certain goal (goals). As a result, most modeled societies (especially in economics) are created as “machines”, producing certain good (which is a major goal). In these constructions, structures and functions provide for integrity and stability of societies.

Having chosen goal(s) for creating artificial society, a social engineer has the dilemma of choosing an appropriate conceptual model, which would be usually based on a certain initial prototype. The correctness of choice is crucial for many issues. If the model is chosen well, the project of artificial society created on the basis of this model will be successful. Otherwise, artificial construction will be worse than natural prototype.

Actions of a real person are impossible to describe by one algorithm. In formalizations it is necessary to restrict the variety of scenarios of human behavior,

getting rid of some of them and simplifying others. Consequently, we must part with the real situation and replace it with a simplified, artificial one. In modeling we move from real society to “artificial society”. A social individual becomes an agent of “artificial society”. “Artificial society” itself consists of a number of agents, endowed with certain characteristics and interacting with each other, i.e. having “artificial life”. This method of modeling social groups and society is called multi-agent simulation.

Method of multi-agent simulation is based on the idea of computerized studying of society. The society is modeled as decentralized system of interacting agents. The approach is a supplement to the “alife” paradigm, related to works of John von Neumann on self-reproducing automates.

The most important feature of the method is the fact that each modeled object consists of a number of distributed agents, who act in a parallel way without a global control, responsible for agents’ behavior. Moreover, actions of each agent depend on condition and actions of a certain limited number of other agents. The resulting state of the system is determined by competition and coordination between agents, acting according to structural restrictions.

Artificial society can not be an ideal copy of the natural prototype. Firstly, its technical realization is impossible, and secondly, humans never aimed at absolute copying of nature. A model (a copy) always differs from the original. Moreover, the model is poorer than the original. Not all, but only understandable and useful features are reflected in prototypes. At the same time, certain peculiarities of the original are missed.

Agent-based approach. The approach is based on using intellectual (rational) agents. According to the approach, intellect is a computational (planned) part of the ability to reach the set goals by intellectual machine. This machine will be an

intellectual agent, cognizing the surrounding world by sensors and capable of influencing the objects in the environment by executive mechanisms. This approach emphasizes those methods and algorithms, which may help intellectual agent to survive while completing his task. Therefore, in employing agent-based approach special attention is given to the studies of search and decision-making algorithms.

Agents are the central moment in modeling. Most papers on modeling are devoted to defining agent's behavior so that computerized agents resembled real agents in the best possible way. First of all it is necessary to study sociological theory on structure and possible actions of the modeled objects. Then, creating an agent of artificial society, researchers reveal those characteristics of his inner component structure, which pay major role in solving the modeled tasks.

Characteristics of the modeled agents should enable us to answer to the following questions:

- What will agents do in the set environment?
- Under which conditions agents will realize their goals or desirable interactions with other agents or the environment?
- As environment changes abilities of agents, what should be properties of agents so that they could successfully interact under particular aspects of environment?
- What forms of interactions are necessary to agents in order to apply certain elements of their inner architecture, such as memory?
- What forms of interactions allow agents to obtain new knowledge or skills?

In modeling agents with the above characteristics it is necessary to take into account how agent would master a certain type of behavior, i.e. obtain knowledge or skills. Consequently, it is necessary to consider intellect of the modeled agent.

Agent's intellect. In the context of artificial intellect research, there are different definitions of artificial societies [2]. The first view defines artificial society as a colony of robots, capable of self-organizing and functioning under uncertainty (e.g. in conditions incompatible with human life). In order to make robots fulfill their tasks it is necessary to divide “labor”, “language”, “rule”, “subordination” and other attributes of a society. The second view treats artificial society as a model of human society, whose vital activity is regulated by theoretically justified rules of behavior. The third view considers artificial society as a computer model of human community, set by socio-constituting and socio-constructing parameters (such as values, meanings, ideas, material features of activity etc.). The first two approaches are filled with practical and reformatory intentions and may be applied in engineering activity (the first definition) or in political science applications (the second definition). At the same time, the question of the artificial personality project, “Why a person needs consciousness” in the context of artificial society becomes, “Why a member of the society needs understanding of the community?”

Understanding of the community is possible only by intellectual agent, consequently, there is a question about the nature of intellect of such an agent and the way this intellect is modeled. To answer this question we may employ functional paradigm of philosophy of consciousness.

Functionalism as a theory developed in two ways. On the one hand, first views on functional character of consciousness can be attributed to psychophysical research. As an example, we can mention the theory of functional systems by P.Anokhin. On the other hand, functionalism formed as a result of attempts to describe activity of consciousness in a way analogous to calculating machine.

An important argument of functionalism is a thesis of “autonomy” of mentality. The term autonomy has two rather independent meanings. On the one

hand, it was impossible to empirically find any specific correlate for higher cognitive functions. On the other hand, advocates of wider understanding of mental autonomy think that consciousness is a certain purely informational, ideal structure, which is often treated analogous to computer program and is indifferent to the fact at which physical medium it will be executed. As H.Putnam once said, we could have been made out of Swiss cheese, and yet this would not have had any importance [3].

According to H.Putnam, the opinion that “if our consciousness is substantial, there is physical or mental explanation of our behavior” is wrong. Strictly speaking, functionalism avoids direct ontological issues on the essence of consciousness and considers the issue in another way. Functionalism starts from the fact that the answer to the question “why consciousness is necessary?” is identical to the question “what is consciousness?”. Functionalism aims at reducing consciousness to a certain group of functional relations. In this way, the volume of the term “consciousness” is limited by the set of functional relations we know.

In this way, modeling agent’s intellect is reduced to modeling functions of agent’s interactions with other agents. However, here difficulties arise: an individual in the society has many interactions. This is her interaction with the environment, interpersonal interactions, gender interactions and interactions within the family. Consequently, an agent should realize her actions, i.e. have a model of “knowledge about oneself” and have “pseudo consciousness”, i.e. functional resemblance of human subjective reality.

As a result we see the necessity to model artificial intellect in modeling artificial society. According to T.Parsons artificial society includes the following systems of social interactions [4]: 1) biological system, 2) personal system, 3) social system, 4) cultural system. Artificial society represented as an agent-based model does not fully represent real society if the above mentioned social actions are not

taken into consideration. The number of agents should be at least two, and agents should interact with each other. What is most important, agents need to be alike and treat each other as similar ones. In this case social behavior arises among the agents of artificial society [5]. At the current state of development of computer-based cognitive sciences, creating a model using artificial intellects seems to be rather hard.

References

- [1] Философия: Учебник для вузов // Под общ. ред. В. В. Миронова. — М.: Норма, 2005. — С. 709
- [2] Алексеев А.Ю., Кураева Т.А., Тумасян А.К.(2005) Проблема зомби и перспективы проектов искусственной личности и искусственного общества.//В кн: Новое в искусственном интеллекте. Методологические и теоретические вопросы. Под ред. Д.И. Дубровского и В.А. Лекторского — М.: ИИНТЕЛЛ. — 280 с. — С. 26-33
- [3] Патнэм Х.(1999) Философия сознания. — М. — С. 88.
- [4] Западная социология. Под. ред. И.А. Громов, А.Ю. Мацкевич, В.А. Семенов. — СПб., 1997.
- [5] Макаров В.Л.(2006) Искусственные общества. // Искусственные общества, № 1.

On the possibility of conscious modeling of the unconscious in artificial systems

© Savelyev A.V. (Ufa)

1. Outline. Unconscious in information technologies

The paper underlines the fact that the attempts to model unconscious processes reflect researcher's understanding of the object and not the object itself. It further assumes that a reason for the failure in this modeling may be the specific nature of the unconscious. In particular, the unconscious is evolutionally an older and much more diverse substance than our consciousness itself. Therefore, the possibility of studying the unconscious by conscious methods is being doubted. Consequently, the paper proposes a number of approaches which go beyond methodological ones (meta approaches). The paper further suggests implementation of these approaches on the scientific basis, by applying them to the analyzed object (proto approach).

2. Ontological issues in modeling the unconscious in information technologies

It should be noted that humanity has accumulated a large experimental and theoretic material in studying the unconscious. Representatives of various physiological schools had to deal with issues related to the unconscious, in the course of applying natural science approaches in their research of living substances. Most studies in philosophy, which nowadays has a number of intersections with psychiatry in its search for research methodology, tend to analyze the issues of conscious or unconscious. The variety of phenomena of unconscious may be discovered in cultural heritage of most nations. However, we can not state that modern understanding of the unconscious has developed much if compared to the science in the ancient times. In this regard we should note the critique of methodology for studying psychological

On the possibility of conscious modeling of the unconscious in artificial systems activity, offered by I.M.Sechenov in 1860s. These issues, which were further developed by I.P.Pavlov, had a tremendous impact on the outlook of the whole generation of natural scientists. Nonetheless, although we have seen a 100 years of intense advances in direct methodology and of search for adequate research approaches, the major questions about psychology in general and unconscious in particular remain unsolved.

In these years we have witnessed a number of partial successes in modeling, yet, one may ask if these attempts to model the object itself do in fact reflect rather the subjective views about the modeled object. There is a feeling that existing neural computer technologies try to fit something big into something small, while this big obviously does not fit in the given limited framework.

Therefore, we consider the following questions: is the study of unconscious methodological at all? Is it apt to any methodology? Maybe this issue could explain many failures and disproportions between modest results and great effort put into research?

What are the limitations of any methodology? While sketching the limits, methodology allows for the unlimited, too. Moreover, the very procedure for defining, separating and hence learning creates something unlimited. It is important that it creates it ontologically and not gnosiologically (in beliefs and understandings).

Currently, the sphere of human cognition may be attributed exclusively to the sphere of conscious. Therefore, there appears an illusion of free will in creation of cognitive schemes and plans for cognition. Here, however, we propose the program which studies unconscious by getting over the limits of methodology of consciousness.

1. *Teleological approach.* Assessing actions from the point of view of goals and hidden motives may give keys to understanding of actions, which otherwise would have looked as chaotic. For example, reading books is absolutely

On the possibility of conscious modeling of the unconscious in artificial systems unexplainable in the eyes of ancient man. Therefore, it is important to study hidden incentives of conscious goals.

2. *Axiological approach.* Assessment of actions from the point of view of individual values can shed the light on cognition of hidden motives.

3. *Global approach.* As was demonstrated within psychoanalysis, separation on conscious and unconscious is rather vague. What is called unconscious and what we can not understand may be related to immanent features of our material world. Yet, consciousness is a certain center for concentration of the totally unconscious. This unconscious may be distributed in anisotropic and multi-scale way. Since the aggregate result of individual's inclusion into general natural functional systems is reflected in the superstructure (cognition), it is impossible to understand the nature of cognition without interaction with these systems.

To obtain results about functioning of unconscious mechanisms, it is necessary to implement these three meta approaches in the course of activity principle. This activity principle may be viewed as proto approach to a certain extent. In other words, it is possible to investigate unconscious only through its reflections in conscious sphere, i.e. through its influence on individual's life and on dynamics of individual's logical component. Consequently, we witness the shift to more fundamental level and this gives us hope to encompass both onto – and philo-genetic dependencies and super-structured levels (unconscious and conscious).

Historical spiral of methodological development may be reconstructed in the following way. Activity-based approach was used in ancient psycho-technologies only relative to cognitive subject (psycho-technologies of trance conditions etc.) (9). The spread of Sechenov's psycho-physiological approach shifted attention to the object of research without taking into account the cognitive subject at all. Although in the course of recent post-modernism, the issue of the "observer" is being discussed, the observer's role does not correspond to objective methods for research. Indeed, in

On the possibility of conscious modeling of the unconscious in artificial systems fact this role is separated from actual observer and is transformed into the very objective method of research.

Next, we propose the following step. If activity-based approach is applied to cognition of the research object, then it is necessary to apply it simultaneously to the subject of cognition as well. Employing the relativity principle, it is possible to assess such methodology of cognition as a desire to decrease the distance between changes of object due to activity of cognitive action of the subject and between the state of the object itself. This is achieved by artificial change of this condition according to the noted variation of the object. In other words the learning subject should be “existentially organized” in a due course. The effects of his/her actions on his/her life pattern and cognitive sphere need to be investigated. This approach may allow studying unconscious not in the indirect way through methodology, but directly with the help of very existence.

3. Issues of epistemic adequacy

Modern western interpretation of eastern way of life through psycho technologies, as well as numerous psychological developments (from psychoanalysis to neural linguistic programming and other synthetic approaches) provide for work with mentality and for changes in mentality. The actual goal is adapting a person to his/her calm perception of possible failure (instead of teaching a person to accept the expected results). In this case, the failure stops being the failure. The reason for insolvency of “European synthesis” is the fact that western way of ignoring unconscious is built over the principles of eastern mentality. Yet, ignoring and underestimating the unconscious are the dead-end of western civilization.

It does not imply that unconscious can not be governed. It should and must be done. One should just remember not to work directly with unconscious and study it, as in this case it slips off. Historic material, social environment and our unconscious

On the possibility of conscious modeling of the unconscious in artificial systems become determinants in psychological characteristics of individual's behavior and mentality. Therefore, one experiences increase of freedom of will. In fact, however, this is a compensation mechanism for real decrease of this freedom, since in fact the above determinants do govern our lives.

We over believe in the results of our conscious actions, so that these actions become our existence and our reality (and not just the results which we wanted to achieve). In this way artificial character of social environment is created.

On mathematics. Although it may seem strange, mathematics is in the least degree apt to unexpected results. This may be determined by its level of reflection, which has a high degree of abstractness. Mathematics, as outlined by Pythagoras, deals with ideal objects and demonstrates maximal detachment from real life (15). In this way mathematics is most successful in avoiding unconscious.

We are too serious. Ancient Greeks used to say that constant seriousness is the sign of limitedness. We are serious in doing various things and do not notice that these things form us in the larger extent than we form them.

Ecologic paradigm. All ecologic events (including possible consequences of various technologies) are implemented within the principle of direct orientation on the results. In this context similarly to all technologic activity, ecologic events do not take into consideration transformation of intentions in the unconscious (16).

Pedagogical paradigm. It is quite possible that the above discussed issues could be used for applied scientific results not only in the sphere of unconscious but in any type of research. The science and art of organizing existential component of the researcher deals with studying the impact on the very process of obtaining results. This may be adopting or applying certain ancient heritage in upbringing or in creating life style (Daoism) or development of new approaches accounting for the goals and special feature of scientific activity. We think it is necessary to create principally new scientific schools that combine methodological achievements of objective research

On the possibility of conscious modeling of the unconscious in artificial systems and the attitude towards the subjective as an object of research. Researcher's life style should also be organized in such a way to account for the work of his/her unconscious sphere [17].

References

1. Дорер М. Г.(1998) Психологическая интуиция искусственных нейронных сетей // Автореферат канд. дисс., Красноярск.
2. Симкин Г. Н. (1990) Атомы поведения, или этология культуры // Человек, № 2, с. 17-30.
3. Савельев А. В.(1998) Подходы к нейротехнологическому моделированию инсайта // В сб.: "Нейроинформатика и ее приложения", Красноярск, с. 128.
4. Riedl R.(1985) Die Spaltung des Weltbildes: Biol. Grundlagen des Erklerens und Verstehens. B.: Hamburg: Parey, 333 s.
5. Симкин Г. Н.(1990) Атомы поведения, или этология культуры // Человек, № 2, с. 17-30.
6. Симкин Г. Н. Явление жизни и функциональная организация биологических макросистем // Бюлл. Общества испыт. природы. Отд. биологии, т. LXXIV (3), 1969, с. 158-159.
7. Savelyev A. (1998) Stress and Functional System Theory // In: Proceeding of Second World Congress on Stress, Melbourne.
8. Савельев А.В.(2005) Онтологическое расширение теории функциональных систем // Журнал проблем эволюции открытых систем. Казахстан, Алматы, № 1(7), с. 86-94.

9. Бакусов Л. М., Репкин И. С., Шосталь С. А., Савельев А. В. (1997) Техника трансовых воздействий // Медицинская техника, № 4, с. 14-18.
10. Платон Диалоги: Федон, М.: Мысль, 1996, с. 21.
11. Симкин Г. Н. (1992) Экология духа. Даосизм: алгоритмы Великого Неделания // Человек, № 6, с. 6-19.
12. Савельев А. В. (2004) Учение об эпистемологической стратегии // Философия науки, № 2 (21), с. 3–17;
<http://sciteclibrary.ru/rus/catalog/arts/Philosofy/philosophicallaws/8374.html> , 2006.
13. Симкин Г. Н. (1992) Экология духа. В высшей школе Учителя Куна // Человек, № 5, с. 25-39.
14. Савельев А. В. (2004) Internet и нейрокомпьютеры как социотехнологические стратегии искусственного мира // Философские науки, № 6, с. 100–113; <http://www.sciteclibrary.ru/rus/catalog/pages/7759.html> , 2005.
15. Lomova J. J., Savelyev A. V. (2000) Pythagorean syndrome and numerical nature of information // в сб. тр. I Всесибир. Конгресса женщин-математиков, Красноярск, с. 123-124.
16. Савельев А. В. О возможности сознательного моделирования бессознательного // Докл. на 2-й Всерос. науч.-тех. Конференции. “Нейроинформатика-2000” // Москва, МИФИ, 2000, т. II, с. 211-217.
17. Савельев А. В. (2007) Эпистемология самопознания в нейрокомпьютерной парадигме // Философия науки, № 3(34), с. 42-59.

About the authors

Makarov Valery Leonidovich	—	Academician, Director of CEMI RAS
Bakhtizin Albert Raufovich	—	Doctor of Sciences in Economics, Leading Researcher of CEMI RAS
Istratov Viktor Alexandrovich	—	Candidate of Sciences in Economics, Researcher of CEMI RAS
Zulkarnai Ildar Uzbekovich	—	Doctor of Sciences in Economics, Head of Sector, Institute of Socio-Economic Research, Ufa Research Center of RAS
Gizatov Nafis Ramisovich	—	Trainee Researcher, Institute of Socio- Economic Research, Ufa Research Center of RAS
Bobkova Irina Alexandrovna	—	Candidate of Sciences in Technology, Researcher of CEMI RAS
Lavrov Alexander Alexandrovich	—	Head of Training Center of Adobe Systems
Konkova Tatiana Alexandrovna	—	Engineer of CEMI RAS
Savelyev Alexander Viktorovich	—	Senior Researcher of Interuniversity laboratory (Ufa State University, Ufa State Aviation and Technical University, Bashkortostan State Medical University)