Conversation with Econsoftcreatures Population

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Abstract: With progressing in ICT and achieved advances in applied informatics, computational intelligence and in cognitive sciences there arising several new opportunities for deeper dialogue with mental models and theories in class of social sciences and mainly in the branch of economic sciences. The actual manner in economics is relating with creation of virtual laboratories positioned by built-in formalized mental models and realisation of simulation experimentation with such creations. For those virtual devices the author are using only in working form the name "Economic Software Creatures Population", in short EconSoP. Such single equipments in appropriate software he is again similarly calling by working term "CI Economics Creatures" or shortly "CIEC". The dialogue with such software devices he is calling by term (mutual and/or two-way) storytelling, that is telling story by the active assistance of software devices not only in the form of conventional (dominantly verbal) stories but with parallel running experiments too. The goal of this essay is mentions on population habituated by various simple economic creatures and realisation of several small stories by assistance of appropriate (ready-to-use) software as practically examined in education and/or for other purposes. The topic of the essay is belonging to the class of emergent research/education/learning technologies. Their innovative power is in dominance of constructive upon instructive approaches and basing on holistic qualitative perceiving of the various complexities.

Keywords: Complex Phenomena and Stories, Computational Intelligence, Knowledge Based Economy, Mental Models, Population of Economic Software Creatures, Simulation Experimentation, Story Telling, Topological maps.

JEL classification: B15, B25, B40, B41, B52, C02, C18, C61, C63, C73, C92, D24, D63, D71, D73, D83, D85, E32, E58, F13, F53, F55, G2, J51, L16, L22, P16, P51.

1. Introduction

In global knowledge based society, there are coming up several complex phenomena and stories causing various difficulties in deeper understanding if there are approaches only by conventional methods. Such difficulties are evident in the case of various complex economic processes. Fortunately, because of progressing in ICT and achieved advances in applied informatics, computational intelligence and in cognitive sciences there arising several new opportunities for deeper dialogue with mental models and theories in class of social sciences and mainly in the branch of economic sciences. Farther forcing the quality and efficiency of investigation and learning process promote advancing in the branches of cognitive sciences. However, achieving such deep level understanding by using those emergent technologies is not easy task. It is need serious and long-time preparatory work for achieving appropriate skill enable to investigate and study so advance mode. In this relation the economists and students of economics are again in fortunate position thank to realize results of scholars and software engineers working in the area of applied Computational Intelligence (CI). It must be note that from to point of view of economists and students of economics all such products are generally perceive as software that is without commitment to differentiate among variety of CI products from the point of view of CI profession. Unfortunately with these differences may arising some possibility of creation misunderstandings between those two communities in general but more in the appropriate using of terms. Therefore, we get some attention to clear up the matter of differences.

Actually, the economists are staying in more simple, not very exact platform of terms explication in comparison with the platform using AI and CI specialists. Naturally, the users are inclining to more pragmatic and utilitarian approaches without analyzing the special character of those devices, methods and tools. We are partly in consensus with those approaches and handling with software creature terms as softbot[1], CI products, and software more freely, that is as with devices directly serving results in investigation/learning. Therefore, we have in mind typically something such as *partially software-like assistant* in research, education and individual learning in this essay. That is, those assistant is working under suitable computer software. In this sense the term softbot are describing certain software or routine device able to realize some intelligence-required tasks better or faster than learning subject does. The important constituent of economic softbot is his ability create/produce virtual stories not only in classical and/or conventional mode storytelling but also above that contain several enriched parts in the form of running qualitative/quantitative and/or econometric experiments. The more important character of those potentials is various possibilities for communication with entirety of softbots population and/or with docile chosen partial compilation of suitable softbots. The attribute "economic" in front of word "softbot" may have very rich contain from the point of view nominally chosen mental model. That comprehensive problem of economic mental models in the role of filling charge of softbots is the theme of part two of this essay. In the division three, we show simple built economic softbots and in fourth one, we are discussing problems connected with building and using computational stories for "ad hoc" talking between two different subjects, i.e. between human individual and computational creature.

2. The Family of Primordial Mental Models in Economics and their role in imagination

What is wrong with Economics notably in "Main stream" … that is the question?

In contemporary time we are facing up to increasing sharp attacks counter to *Economics* and notably towards to so called *Main stream Economics*. These phenomena are particularly understandable at least for two serious reasons: first, that is the unremitting tendencies to chaos and/or crises in national economies and global economy too, the second but parallel is the progressing global knowledge based society with their world economy. Despite of this hesitative consensus it must be clearly assert that in general those attacks are directing against improper subject. The reason is in the confusing of *positive* and *normative* function of Economics and imputing sins of politicians and of economic policy makers to Economics. In that confound sense the Economics is obligate to take on as it were executive responsible for happenings in real economic life. However actually, the Economics is responsible, in fulfilling their positive function, for quality of economic reasoning. In his second function, i.e. as fulfilling normative function Economics may (not directly responsible) serving up theoretical foundations for economic policy. On the other hand, evenly in those associations Economics is not without blame and in other cases certainly too. Economics as a whole or namely the Mainstream is dominantly uses simplified *constructive approaches* for creating mental models upon parts of objective economic reality basing on a few or in better cases on wider group of observed facts but with the great inputs of subjective imaginations (first line creators). The worse thing is that these defectively idealized results the economists in second

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[1] The term softbot in these cases have the power of implicitly perform certain action. On the other hand, the term softbot, as semi-explicit performative is some agent not only able performs certain actions but directly fulfilling it, so it is in the half way between implicit to explicit performativity. The softbot is computation product built by method of up-down direction. If software creature is built in opposite direction that is from bottom to up the author named it in some year ago as myslit.

line (narrators or verbal storytellers, teachers) releasing dominantly by instructive methods. Often such mental models and/or their population (ideology, theory) are submitting as the "dinkum oil" for direct accrediting by recipients. Actually, in the class of socio-economic sciences there are very narrow place for verification in live objective reality. Some is possible only ex post. Nevertheless, this limitation is not establishing title to resign commitment of validation. One way is "validation" by "experimentation" in owns mind of recipient subjects and the other, more developed and helpful, is special examination by softbot assistants in virtual laboratories.

Despite of predominated inadequacies, we are staying in the following platform. For understanding complex economic processes in contemporary global knowledge based society, it is as a first step, indispensable masterfully handling with wide family of primordial models belonging to the class of economic science, at least to the branch of General Economics. The second important step in the context of the purpose of this essay is however the higher-level skill in dealing with formal mathematical methods and tools. In addition, the most important prerequisite for successful solving complex problems and percolate to the deepest roots of contemporary economic puzzles is the competence and high-level skill for self-evident using advanced devices, tools, approaches, routines and methods from the area of IC-born products. That is to say precise, having the skill to command with them for ability to create virtual metaphors upon conventional mental models and theories. These three steps are obligatory forward ordering process. It has to start compulsory from subjugation of the whole contain of the family of primordial mental models of General Economics.

In the area of General Economics, there are collections of typical mental model in two divisions: i.e. the area of verbal and/or conventional of Microeconomic and of Macroeconomic mental models. Only as an example, we bring a small group of such and little more complex mental models:

- *Relation between and among psychologically different, socio-economic groups:*
    - *Competition*
    - *Conflicts in different settings of aggressively*
    - *Symbiosis*
    - *Cooperation and Collaboration*
    - *Commensalism*
    - *Parasitism (Racketeering) and Parasitoism (Tunnelling)*
    - *Dynamic (cobweb) game between producers and consumers in different type of markets*
- *Further noticeable socio-economic topics constructed as mental models (used in textbooks, and/or in/of wider purposes):*
    - *Trade-Off possibility frontiers*
    - *Opportunity cost*
    - *Monopoly, Duopoly and Oligopoly*
    - *Cyclical economic and social growth*
    - *Competitive scarcity*
    - *Inconsistencies in resource depletion*
    - *Renewable resources*
    - *Preferences (social, economic and others)*
    - *Conflicts between religion groups, communities*
    - *Conflicts between ethnics, races, and so on*
    - *Evolution (that is development with emergent qualitative changes) of socio-economic networks*

3. Possible example using primitive model of abstract competitive market

Let us to exhibit as a simple example the single (free-competitive) market with one homogenous good. Common thoughts on happenings in such market are that observed real market price is independent signal for both populations of actors, i.e. for suppliers (producers) so as for demanders (consumers). If the price level is increasing, from the point of view of suppliers it is signal to bring more goods on the market and for demanders is opposite behavior is right, i.e. the customers are buying less. It is vice versa if the price is diminishing. On those verbal prepositions, as a rule it is usual approach   this situations formally to descript by demand and supply functions of the price of the good with consideration that price adjustment equation depends on price observed in the former period (or former step of iteration) and on the difference between demand and supply. The formalism is as follows

$$D = a - bp$$
$$S = -c + dp \text{,}$$
$$D - S = 0$$
(1)

where the third equation is the requirement of so called market clearing the result of which is synonymy of market equilibrium. After substituting first and second equations to third and considering $D - S \neq 0$ we can receive the difference equation for evolving price

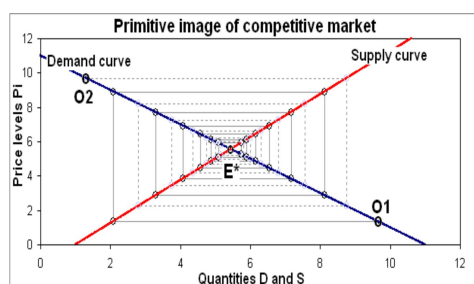$$p_{t+1} = p_t + (a - bp_t) - (-c + dp_t) = a + c + (1 - b - d)p_t.$$
(2)

Figure 1. Mutual positions and slopes of curves is leading to E* prom every level of price P_i

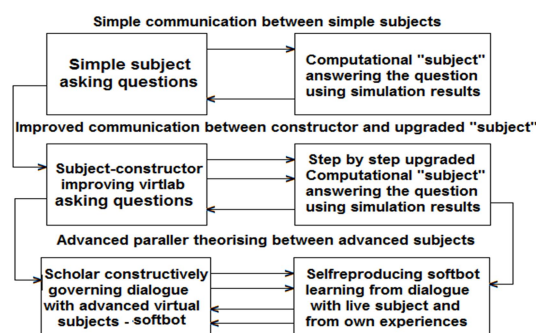The equation (2) is implicit performative and as such is after setting them to

Figure 2. Spontaneously evolving advanced story

algorithm (and/or routine) of virtual laboratory too. The (2) is turning to explicit performative only after pushing the button "Run". Therefore in this sense meant economic softbot as explicit performative is functional constructive entirety of association of difference equation (2) transformed to appropriate routine and activated by pushing the button "Run". For more ocular understanding the behavior in the market described by (2) it is familiar with the majority of other disciplines of science to plot graph. Such visualization of formalized mental model fortunately have further fertile and merits bringing charges for example in revealing former inconsequence's and mistakes in reasoning. In the given example, there are several such inconsequence's and mistakes even though of its seeming simplicity. In addition, much more

Figure 2. The evolution of price is plotting in the form of time-step (discrete) trajectory

mistake reveals on the base of living experimentation with that mental model after putting them to virtual laboratory. It is right that some of stunning misleading of that approach is
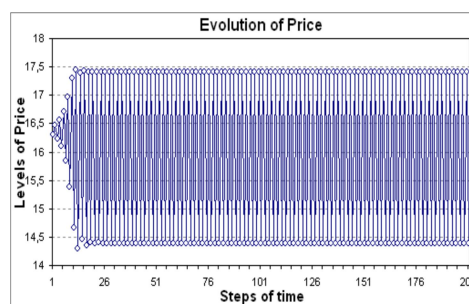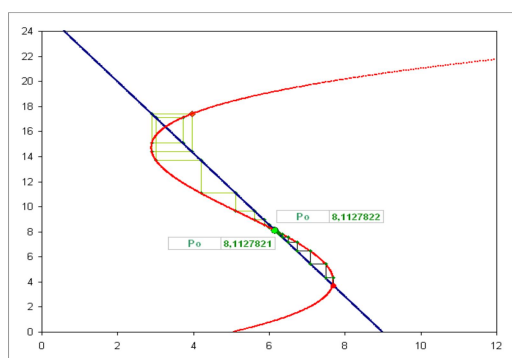
Figure 3. Inflection (turning) point as bifurcation leading to different qualitative behaviour

apparent also for intuitive observers. Among such belongs the lack of meaningful origin of the history of evolving to equilibrium, i.e. the lack of singular point and together with this the lack of trajectory too. From mathematical point of view, this is no problem, because it is evident, that there are continuous set of starting points for price independent from Supply and Demand quantities (meant set is strait line identical with positive part of price axis in the first quadrant of Cartesian coordinate system, i.e. with ordinate). From every point of continuous set in question can start authentic trajectory, consequently, we have again continuous set but trajectories, in agreement with formulae (2). In mathematics, such job belongs to the branch of topology, i.e. we are dealing with topological map. Nevertheless, from the point of view of economic as science, described situation brings nil knowledge or any answers on the question: "Why it behaves in such modes?", but in the MSE are holding over belief that answer is exist bringing meaningful knowledge. Actually, from abstract viewpoint, answers can be several and they are depending on already descripting economic presumptions. Because by the first and second rows of formulae (1) both graphs are strait lines with mutually opposite slopes (parameters b, and d) and they are located one to other in relations of parameters a and c, the possible abstract behavior is trivial, i.e. there may be only three behavior mode. 1. Convergence to fixed, i.e. equilibrium point E^* (E has attractive character). 2. Divergence from fixed point and/or from any other chosen starting point of continuous rectangular $p \times$ *amounts of D and S goods* (the character of those points are repelling). 3. The third case is (period two) *cyclical behavior* with one minimum and one maximum of price and of amount. Unfortunately, the behavior on the economically relevant market is not trivial. On the other hand, these inadequacies not mean that any dealing with such trivial cases is lost time. Just reversal, the mistakes and inadequacies of trivial cases calling sequences of looking after better approaches and methods. The construction of softbots and talking with them are among such approaches those are capable going ahead in solving difficult problems in the way of repairing primitive mental models. On the state of snapshot from Excel construction (fig. 1) one can even on intuitive looking at Supply and Demand lines come to conclusion that level of starting price has impact only on the longitude of cobweb trajectory. Line shapes of graphs, their slopes and their mutual positions assign the (three possible mode) qualities of evolution. From this is only step to discovery that the decisive factors conjoint with qualitatively divers of market behavior are economical-subjective nuances staying behind the actual shape, slope and positioning of graphs. The conclusion is that the mental model of competitive market in the descript form is wholly unrealistic and has to be remit to upgrading. The effective way to improving that mental model is construction of virtual laboratory with changed graphs, for example using so called backward bending or better yet using "S" shaped supply curve. Paradoxically the situation also in seemingly simple market is so complex that imaging the behavior by continuous curves is not concisely.

4. Builting economic mental models in sotbots

There is several suitable software enabling realization of various, less or more complex, economic softbot in our time. On the other hand, for achieving advanced stories for wider using in economic community as storytelling it is indispensible the assistance of scholars from the community of branch of computational intelligence. In running simple communication between simple subjects (top layer of scheme in fig.2) the story spontaneously moving on governed by asking question with human subjects. This story is automatically saving in the memory of human subject and the other story, i.e. digitalized topological map, by human subject settings of starting points coordinates, chosen values of parameter and simulation runs is saving in the software. That top layer can be perceives as based on phenomenological approach, i.e. by

Figure 6. Visualizing chaos by connecting of dots on diagonal and on curve (cobweb graph made in Excel)

another subject deliberatively predisposed built "from up to down" research and/or learning system (CI "subject") serve as assistant of investigating subject. In this case, the human subject (prevailingly student) is only in the role of user non-intervening into mental model, map and architecture of virtual "subject" (virtual "triad"), i.e. he/her giving instructions for experiment and is waiting for answers and working with them in own mind. It can however arise situation that authentic subject (he/her may be student too, but mainly being researcher) is not satisfied with achieved information and setting mind on doing some improvement of "triad". After such step, the second (middle) layer is coming into action. In this situation, the human subject isn´t only in the role of asking questions, but he/her becoming creator and constructor of "tried" too[2]. Basing on these improvements he/her can

Figure 7. Bifurcation portrait with chosen bifurcation value of w generating cycle with eight periodic points

realize more suitable environment for investigated problems and naturally, the story is more rich, but still spontaneous. In new birth possibilities, because of activation of human subject, there arise also platform not only for writing down verbal story, but for building story on technologies used for improving "triad". We are introducing one of possible primitive form of such passing from top to middle layer using two types of perplexing the "linear" market by introducing nonmonotonic supply function. For first case, we are dealing with "S" shaped supply curve based on squared and cubed price and in the second case we are based supply on arctan function of price with waging the impact of price expectation on process of adjusting supplied amount of good to market. For this purpose, namely we used the following price function for nonmonotonic supply and linear demand
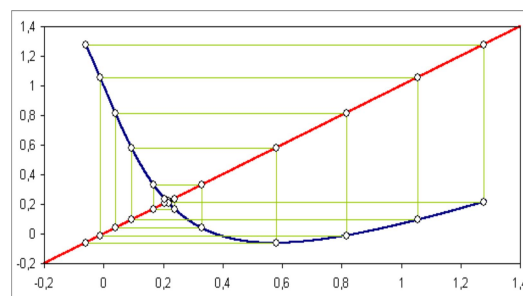

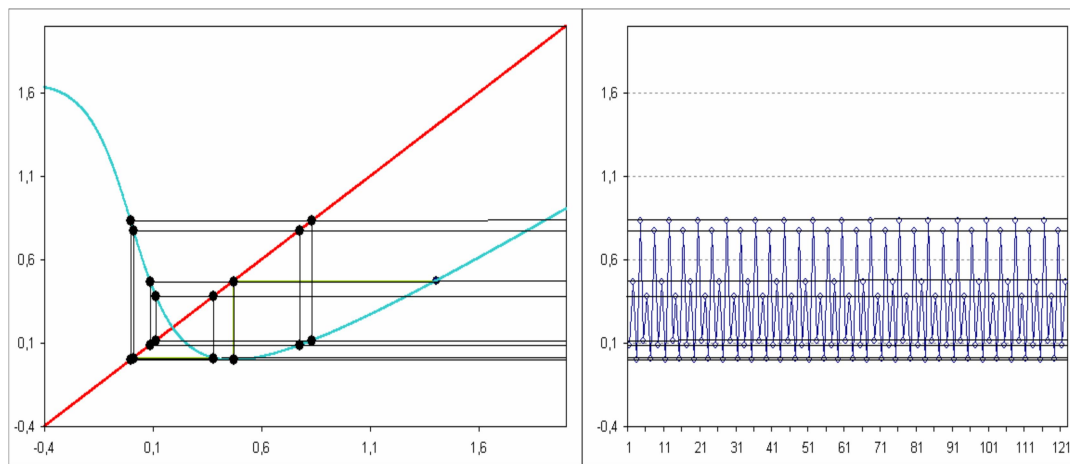[2] It must note that he/her is still only economist not pretending on the role of (not act as if) PC programmer.

Figure 8. Comparison of two possible exposition of same event

$$p' = p + a - (1+b)p + cp^2 - dp^3,\tag{3}$$

the supply function is

$$S' = k + lp - mp^2 + np^3,\tag{4}$$

and the demand function is

$$D' = g - hp',\tag{5}$$

i.e. by typical economic convention between demand and supply prices is one step lag. The exhibitions of result of the first case qualitative experiments are in the snapshots of fig. 3 – fig. 5.
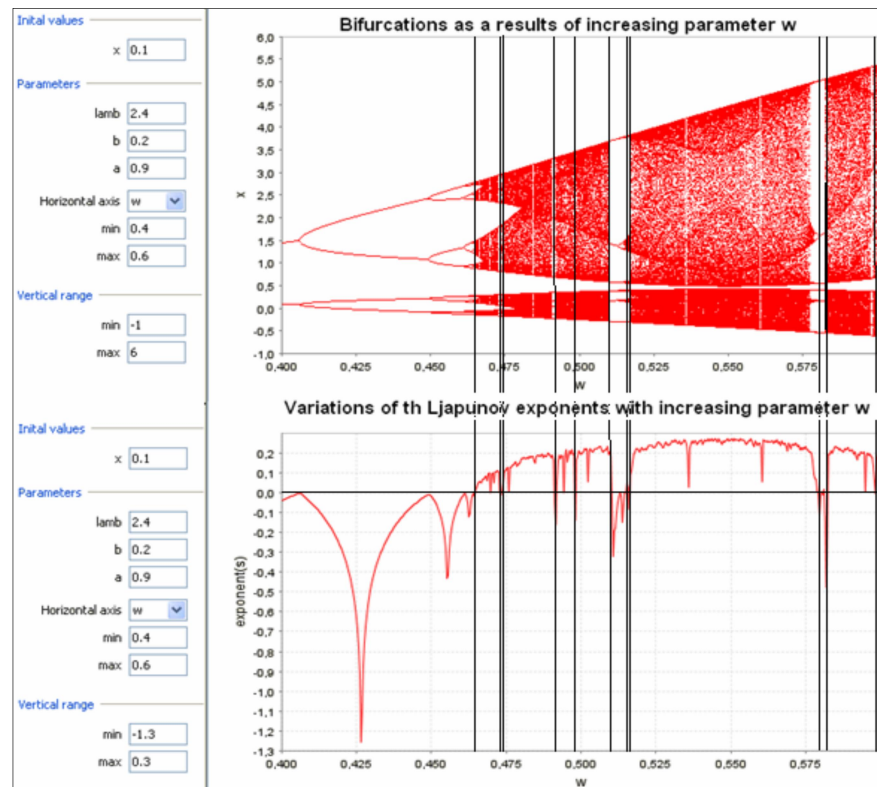

Figure 9. The bifurcation points are identical with Lyapunov coefficients in zero level

Concerning the other type of nonmonotonic supply, the possibility for approaching more complex form of market mental model is the consideration laying on S-shaped supply curve (relation between quantities of good and the levels of price) not created by help of cubed price but by arc tan trigonometric function. In such case beside price function (3) we used function

$$p' = -\frac{w\tan(\lambda p)}{h} + (1-w)p + \frac{aw}{g}. \qquad (6)$$

Because of famous special shape of arc tan function graph (enables sigmoid learning), the (two key) economic considerations (EC) are easy (naturally follow from the shape of graph) for subsequent formulations. First EC: If price levels are low then supply increases slowly, because of start-up costs and fixed production costs. Second EC: If price levels are high then supply increases slowly, because of supply and capacity constraints. These two EC are leads to strong bounding of possible extremely behaviour on comparison with using cubed price. Based on these considerations it is possible to price. Based on these considerations it is possible to create a second kind of a non-linear, increasing supply curve. By choosing the inflection-point of the supply curve to be the new origin is one of possible to simplifying the imagination. In such a way the coordinates changes and the graph splits to upper (signed plus) and bottom (signed minus) part. In the snapshot of fig. 6 there is a section of the supply curve against diagonal and the cobweb. The
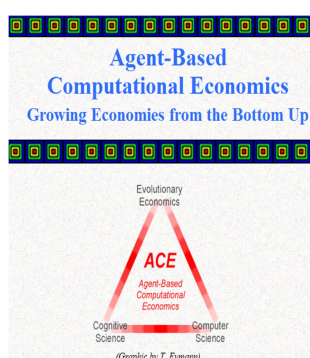

Figure 10. The title page of ACE website

shape of the curve is causing deterministic chaos. The snapshot on fig. 7 exposes the series of bifurcations causing different qualitative events, after increasing the value of wage parameter *w*, i.e. period doubling bifurcations, deterministic chaos, odd periods and their folds. We are choosing the value *w = 0.2045* for demonstration of eight period event. That value we are also use for exhibition of transient to succession in cobweb graph (left) and time step trajectory (right) snapshots of fig. 8. By these results of experiments we shoved that some of simple mental model can be investigates also by assistance of Excel, i.e. by device popular among economists. Nevertheless, such job is too

Figure 11. Illustration by STELLA block diagram of benefits of using storytelling made by Chris Soderquist (Pontifex Consulting)

complicated and the construction of such triad takes great part of memory even in the simplest cases. For it is for such jobs more favourable to use better devices. As an example, we are using iDmc, which is, in subjected cases very friendly to constructor and economical to PC. In snapshot of fig. 9 we are combining the bifurcation portrait (upper snapshot) with graph of Lyapunov exponents (bottom) for clear presentation of coincidence of bifurcation values with Lyapunov coefficients lying in zero level. The third (bottom) layer of scheme in fig. 2 is entirely different case. In that case, there are two decisive innovations against two upper levels. The first is the change of method creating mental models and the second is construction of computational environment. In the first innovation the up to down method is changes to the form from bottom to up, i.e. the mental model is not creating by mental
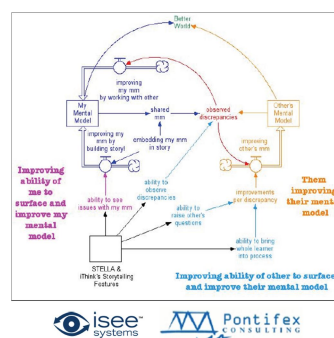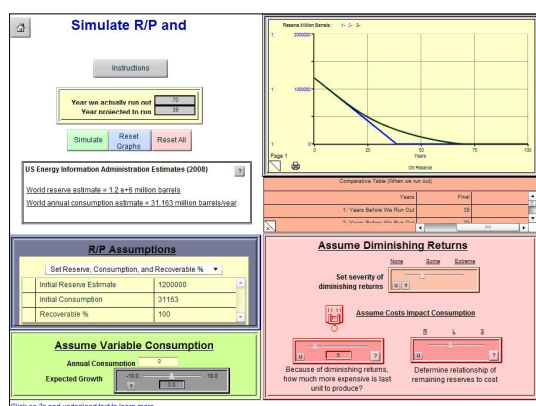
Figure 12. Panel made for experimentation with oil consumption

reconstruction of objective reality with using of former perceptions and empirical data, but it is here leaves room for autonomous self-creation. For these purposes there are using among other such methods as MAS, ANN, cellular automaton, percolation theory, classification theory, genetic and evolutionary algorithms and similar method and approaches. In the second innovation there are using for construction of virtual subject methods and tools of "computational life" and "computational intelligence" in *sensu stricto*. As potential contents of advanced softbots, we can focus attention on the products of community of socio-economics scholars working in the area of Multi-Agent-Based Simulation organizing workshops under label MABS[3]. Other very interesting direction producing topics appropriate for imputation to the advanced softbot bodies is the community of scholars collaborating under title Artificial Economics. Similar and very successful ensemble is working around L. Tesfatsion on the problems of Agent-Based Computational Economics (ACE). (ACE website). Special economic entities may be creating by using assistance of theory, approaches, methods and tools of ANN. In economic and financial modelling, the seminal work in this area was the publication of Beltratti, Margarita and Terna (Beltratti, 1996). In our time, there is wide palette of models in scientific literature and pragmatic too, usable after suitable adjustment as contents blocks to building bodies of variable economic softbots. Therefore, in this way there are openings entries to very heterogeneous softbot population occupied with comparable simple to high advanced computational creatures. Such circumstance is very beneficial for heterogeneous users from students to researchers, teachers and economist in real praxis too, to talking with. Naturally, the greatest utility from talking with softbot population can win students, because with this nonconventional method they can percolate to deep tangled coves of complex economic entities. The mutual conversation between researchers and softbots forced by two-sided improvement of mental model of research subject going ahead not only in the quality of knowing complex economic phenomena but taking them new brainwaves.

5. Talking with Softbot alone and with Structured Computational Story

The economic knowledge and skill emerging today "CI gratias" may be so very new that posses perturbing power that is able destructs structural stability of conventional economics and creatively contribute to birthing new one.

The new technologies of learning and investigation of complex economic phenomena assisted by ICT, applied informatics, computational intelligence and cognitive science bringing at least three level of dialogising with softbots as we showed in scheme of fig. 2. From other viewpoint it is ought to emphasize that such process in every cases begin with endosomatic investigation and/or learning by authentic subject. Only after overmastering all of knowledge and skill potencies of such device, there are arising possibilities for realisation some form of codification of achieved knowledge. It is clear that without codification

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[3] The proceedings of first workshop published in 1998 (Sichman, 1998).

Figure 13 Implications drawn from done experiments

(exosomatisation) of new achieved (endosomatic) knowledge cannot effectively reach required intersubjectivity of them. On the other hand, it is interesting, that great cohort of independent discussants with similar or same computational entity are reaching higher level of intersubjectivity than group of reader of same textbook or monograph. Reaching similar level of intersubjectivity and equal understanding among book readers as in meant cohort is need wide mutual face-to-face and collective discussions after reading. Upon that experience, it is clear that discourse with not a bit accomplished computational story device is more than hearing or reading conventional storytelling. Fortunately upper meant devices, methods and tools offers also new technologies and methods for creation deep structured computational stories built-in with not only conventional verbal stories, pictures, graphs, and tables and so on, but populating them by variety of softbot communities[4]. In this sense, the talking with virtual discussant can has several levels from very simple talking (in the form of asking questions) with single softbots in the bottom level, to exceedingly advanced one with deeply structured computational story in the top level. At preliminary level of being contiguous with computational entities are prevailing the form of passive observation of events provoked by pushing the desired buttons localised on the main command board (interface) of computational story. Admittedly, this activity is not same as observation by listing in textbook and/or in scientific monograph. The important difference against print on essay is consists in possibility to contemplate evolution of experiment running in PC with adjustable singular point, values of parameters, time and speed by buttons, sliders, tables, "rheostats" and/or "potentiometers". However, saying more exactly, the observer can use whole scale of routines built in computational entity. In this context, it is interesting that in past years are emerging in Internet several computational stories that are appropriate for social sciences and economics. Only for creation clear imagination about the matter, we are including a few simple and semi advanced stories made in software STELA in Pontifex Consulting, see fig. 11 – 16. However, if he/her change his activity from passive observer and enter to the process of modification of softbot, or moreover trying to build new one for own purpose, the situation going to change dramatically. Such activity becomes more constructive and/or more creative because the subject is forcing to looking after anonymous or hidden approaches, methods and tools. The profit from this is higher form of verification achieved investigation results because the subject is pushing to activity by curiosity and is pulling to process by desire to achieve effectively functioning device.
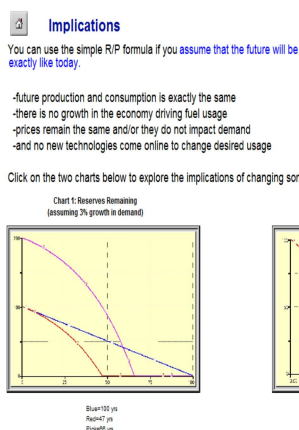

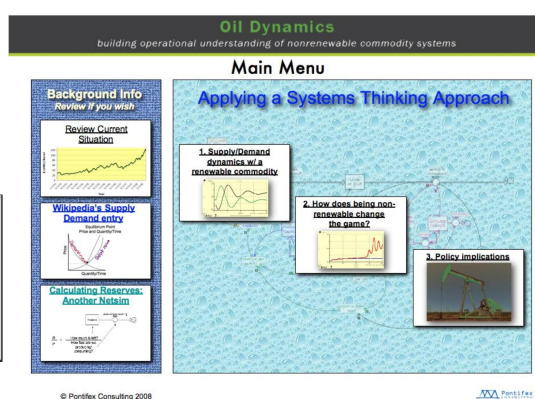Figure 13 Implications drawn from done experiments   Figure 14. The snapshot from oil story: windows of "Main Menu"

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[4] Of course, the creation of structured computational story in ececonomics is not isolated job only for economic scholar. Such job is need integrative collaboration between economist and software engineers at least.

This desire is directing the subject to brooding and creative activity in the form of building entities from bottom to up (third level of schema, fig. 2). For creating such very advanced story, it is need to use special requirements and routines in creating relevant softbot. In such case, as a rule, it has to be use another methodological approach than phenomenological.
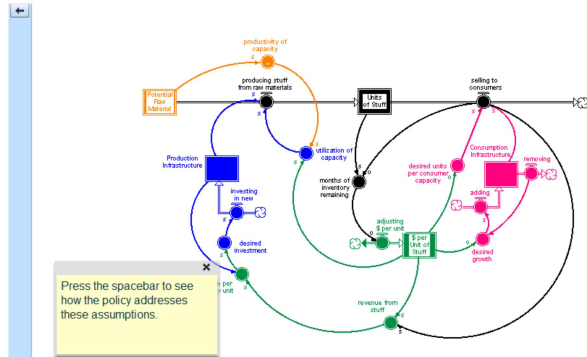

Figure 15. The snapshot from oil story: the story is in state after „pushing" several steps of progressing.
(The button at the left side top is for coming back to Interface-Main menu.)

Mostly, the constructor in this case is using building approach from bottom-to-up, or quite implicitly, he/her is using multi-agent approach with specific aspirations. However, the constructive approach and/or doing something constructively has, at least may have deeper sense. Realising the process of creation mental model, the transformation it to topological or other mathematical construct, moreover the construction of functioning-able creature in appropriate software one can perceive something as learning-by-doing but not in manual work sense. The creature, of course is made by hands, but is clearly intellectual process running not only in vigilant but in deeper layers of mind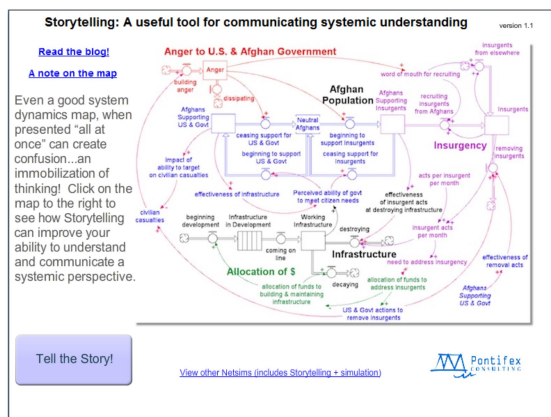 (in brain structure not under direct control of subject). As example of such process, we remit to case of spontaneous scrabble by oneself subject on essay in the process of intensive reasoning. However, the building the block and principal diagram, the programming and so on is another "scrabbling". Among other important requirement is, so called *Principle of Minimum Prejudices*. A little simpler saying – if the purpose of using bottom-to-up modelling and suitable multi-agent simulation in economics is accomplishes wholly, at least partially, independent authentic evolutionary story, it is need to carefully considering what and how much

Figure 16. The example of little more complex socio-political story

existing knowledge to implement and what commands and routines to embed. Among others, the creator of such simulation model should have to permit endogenous co-development and to permit any or all agent attributes and methods to vary over time. To say those requirements by poetic parabola the ideal case is to create such entity as innocent. In this perspective, as to handle of software, SWARM as one of the well known, most widespread, and adequately powerful simulation frameworks popular among social scientist and economists is frequently using tool for building simulation models for creation powerful intelligent story. There are several successful product of economic issues made in SWARM. The author of this essay used for building stories some of such SWARM product created for example by authors of publication F. Luna at all. (Luna, 2000). He used also several products presented in

International Workshops, MABS, published by Springer (Bosse, 2011), (Moss, 2001), (Sichman, 1998) and (Sichman, 2003). For those purposes is very fitting the products created by Ch. Bruun at all, published in (Bruun, 2006). By lending from the area of ANN used by original authors for creation economic products, we used for the same purposes some models from publication (Beltratti, 1996). Obviously all of those creatures we used as specimen adapted to our subject purpose.

Relatively easy attainable and giving comfort tool for user in the role of teller computational story[5] and better yet for applicants[6] of beforehand prepared story approved itself is the environment of software STELLA. In last twenty years, we made more than hundred economics stories in STELLA not only for all level of university education but for researchers working in class of economic science and businesspersons too. Unfortunately we are reach regardable result only in the community of students of electrical and information engineering. The upper meant stories may everybody found in (instant running the story is free):

http://forio.com/simulate/pontifexconsult/response-to-ny-times/simulation/. This address is relate to story´s snapshot shoved in fig. 16. Naturally, economic stories prepared by using mental models built by technology bottom-up are more multiplex yet.

6. Conclusions

Everybody who is interesting on the computational studies of economies perceived as complex dynamic system can find in conventional literature and in Internet several good studies on these issues in former 10-15 years. He/her routinely met with term "Virtual economy" and/or with "Artificial economy". It is normal phenomena in evolving general science that of arising new scientific disciplines. In this context, that is the discipline with name Economics (e.g. former known as Political Economy), emerged in the last third of Nineteen Century. Similarly, no great surprise is further diversification of such disciplines (with unique attributes), in this case of Economics arises new part with attribute "Artificial". The Artificial Economics is perceives as new partial paradigm in economic sciences and/or only as methodological variance. From the point of view of this essay, these approaches and terms are confusions. Forasmuch as word "artificial" means "manmade", the whole of science is artificial too and such is Economics without futile attribute. Better attribute is the word "Computational" because the communication but moreover cooperation between live subject and "computational subject" actually works. Unfortunately, neither the name "Computational Economics" is not without problems with its intersubjectivity. The main source of misunderstand is the fact that computation, computational etc., is preconscious with idea on handling of real content numbers not with numbers as only agent of computational process bringing various qualitative events and shapes. In the first meaning, the obvious imagine on computational approach among economist is econometrical treatment with past/present empirical dates by the aid of computer, i.e. the results of such operations can serve as foundation for identification of quantitative history of investigated phenomena and for creation mental models upon them. In this position it is necessary to emphasize that creation

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[5] It has to be note again, that word computational may in this case too lead to confusion, e.g. by computational story can easy be meant very common text printed not on essay but proliferated in electronic media. Novel printed on essay or copied in verbal text form on CD is in the same qualitative level. Conversely, the attribute computational in front of word story implicitly means story with intelligent behaviour contents.

[6] We are using that term rather than reader, because that human subject will to be forced work with methods and tools of relatively rich toolboxes.

of mental model literally the subject of research/learning cannot realize without backup of some passage of real and/or virtual process. These two possibilities of foundation lead to two alternative approaches and technologies of qualitative talking with mental model imputed to computational subject[7]. *The first* is talking with virtual subject created upon existing mental model based on some real data. As one of possible example, we are using the abstract model of market in third and fourth sections. Third section show the idea to exhibit free competitive market with two graphs of functions of three variables in original case is in some correspondence with observed reality and discussing some of their problems. A little more complicate model we showing in section fourth. Both we are using for evidence of hidden limitations and faults of ad hoc reasoning upon such fabricated conception. Among others, about to dealing with such models metaphorical to form of virtual laboratory can reveal several mistakes potentially having emergences in customary, not once fuzzy reasoning. *The second* alternative is talking with virtual subject created upon mental model based on qualitative results of simulation achieved on the base of virtual entity arising in the process of running model built on the method bottom-up. In this way, we can achieve independent process of evolving "economy" which is able create background for comparative study with part of economy in objective reality. Advancing and sensual attracting of that second approach is rest in possibility to monitor all evolution, i.e. not only past and present but also the future evolution. Problems connected with that second approach we are discuss in section fifth.

Mutual communication between human subject and subject living in software bringing, or at least should bring potency to imagine and investigate in the environment of higher layer of quality and efficiency and in this way can facilitate of more advance understandings in entirely class of economics science. Those forms of imagination, reasoning, dealing with real and computational artifacts may be (but not in every case) veritable innovation of reasoning in own nominal sense. It is so because the degree of using those technologies, methods and toolboxes is depending on variety of objective and subjective conditions of concrete universities, institutes and firms. In the perspective of using that approach in wide area of universities and research institutes we have in mind the integrity of research, education in system forms (state and private schools), individual learning, especially endosomatic investigative learning of authentic individuals. Our imagination about talking with virtual creatures has multilevel character. In our essay, we have in mind, at least two levels: - talking with single econsoftbot intentionally for done purpose chosen from their population, - talking so that learning/investigating subject is submerging oneself into the environment not only of softbot population but into computational stories with built in softbots too, and is realizing complex multilevel conversation. We also have in mind that softbot population may be connect either to very lax network sovereign bots or being imputed into keen-edged grid of bots like elementary (von Neumann and/or Moore neighborhood) cellular automata, percolation entities or stochastic graphs. In those ways, there emerging in population different softbot groups, enclaves, and/or communities more or less clear border between and among them. In such cases, the differences against technology of PowerPoint[8] may be dramatically

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[7] In the case of econometrical approach, the subject talking with data acquired and stylised from objective reality, i.e. not with mental model constructed upon them. On the other hand, the investigator, after all must nevertheless base his/her constructions and analysis on some concrete theoretical and methodological background.

[8] The authors positions is that PowerPoint technology is fitting only to very simple narrations, using them for complex dynamic and/or evolutionary stories is problematic and sometimes even detrimental.

deep abyss. In those cases, we can say that there are raising abilities for conversation with parallel reality and/or world.

Impact of using conversation with computational storytelling devices on the quality of reasoning may be multidimensional and multispectral. For example, in the case of student the econsoftbots may help him/her improve their former, by customary way constructed mental models by engaging his/her personality in a more insightful way. The conversation with appropriate econsoftbot may facilitate his/her asking important causal questions too. In higher level of activity in dealing with computational creature he/her may improve the quality of former mental model using dialogue for getting over his/her inertial vague imagination and false understanding. Several of conventional mental models of mainstream economics are beget to fuzzy reasoning or at least open paths to potential theoretical and methodological mistakes. We are presenting such possibilities on the examples of free competitive market in third and fourth sections.

All that approaches, methods, devices and tools are creates entirety result in the form of increasing knowledge capital of firms, institution, nation in both of endosomatic and exosomatic form of knowledge. We discuss some of those aspects of mutual talking try out mode in section sixth. In this essay, we are using, but only tentatively, the term softbot with attribute economic. That pleonasm may evoke in the community of informatics some abashments. However, that was not our intention. Actually, at least in integrative scientific community, the term *Economic softbot(s)* anybody can apperceive as *economic storytelling + running economic simulation model(s) in virtual laboratory*.

It is without any doubt, that interdisciplinary cooperation, moreover integrative collaboration among social scientist and economist in one side and scholars of community working in the area of computational intelligence in other one is useful already in our days and even more is promising for increasing quality of economic imagination and professional reasoning in the future. On the other hand, maybe some little positive profit from this can birth in the society of Computational Intelligence too.

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