ENGINEER OR ORACLE?
(SD/ST viewed from the System-Thinking-Activity Approach)

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Abstract

This paper distinguishes between System Dynamics (SD) and Systems Thinking (ST).[1] In order to discuss the similarities / differences and reciprocal functions a meta-position is necessary. It is suggested that such a position exists in another-culture paradigm, i.e. in the System-Thinking-Activity (STA) approach, elaborated by the Moscow Methodological Circle (MMC)[2]. STA schemes are used to describe the sense of ST, as it is understood in SD. Using the STA approach, the problem solver is more an engineer than the SD analyst who could be described as an oracle. Indicating a number of basic methodological difficulties in the modern development of ST, the paper proposes a Thinking-Activity Theory as an ontological foundation for SD/ST. The Activity-Organisational Games (AOG) method is considered as a way of analysing problem situations and of problems solving. It is suggested that the assimilation of STA experience by SD/ST could have many other significant consequences.

Key words: SD/ST, System-Thinking Activity Approach, Model Reification, Activity-Organisational Games

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[1] We'd like to emphasise that the discourse here is about ST in a narrow sense – as a special methodics in the frameworks of SD (see, Senge's Fifth Discipline), but not about ST as a wider notion from the field of System-Structural Methodology , commensurable with, if not synonymous to System Approach (Checkland,1981; Espejo, 1994)

[2] Moscow Methodological Circle (MMC) – an intellectual movement in the USSR, formed in the beginning of the 50-ies. Among its founders were the most prominent non-orthodox soviet thinkers – logician and social philosopher Alexander Zinovyev, philosopher Merab Mamardashvili, Boris Groushin- one of the founders of concrete social inquiries in the USSR, and methodologist Georgiy Shchedrovitsky. In the 60-80ies, MMC guided by G. Shchedrovitski, developed content-genetic logic (Shchedrovitsky, 1962), General Theory of Activity (Shchedrovitsky, 1975), System-Activity, and then – System-Thinking-Activity Methodology (Shchedrovitsky, 1991). MMC developed activity approaches in psychology (Rozin, 1994), semiotics (Shedrovitsky, Lefevr, Yudin, 1967), design theory (Genisaretsky, Sgchedrovitsky, 1965), created the Activity-Organisational Games (AOG) method as a powerful tool of collective thinking, complex problems articulation and solving. (Shedrovitski, Kotelnikov, 1983). Actually the representatives of different generations of MMC are working on the post-soviet space in very different spheres – education, science and management, in economic and political consulting.

1. The System-Thinking-Activity Approach

At the end of "soviet communism" (the expression of one of the founders of MMC Alexander Zinovyev) the intellectual autarchy of the former communist empire was destroyed. We thus now have the possibility to discuss and compare the ways, in which system inquiry and development were advancing in the West and in the East. As a subject for such a comparison we have taken the theory and practice of ST and SD on the one hand, and on the other hand – the STA approach, which was an active factor in the erosion of the communist system, but which is practically unknown to Western researchers.

The STA approach was developed at the end of the 70-ies and based on earlier thinking paradigms – the Theoretic-Activity and System-Activity approaches. In the following decades both the STA approach and Activity-Organisational Games (AOG), developed on its basis, gained influence in the USSR and post-soviet countries.

The STA approach is based on two principal ideas. The first one is *a general methodology*. It can be understood as a wide range discipline aimed at rationalising the connections between practically organised activity and logically articulated thinking. Secondly, it's a *principle of activity,* making the STA approach the ontological basis of a general methodology, which in turn is often called the STA-methodology. The system approach appears here as a modern way of co-organising activity, thinking, communication and their carriers (in different co-operative and communicative *positions*), as well as means, procedures and products – communicative texts, activity tools and different types of knowledge.

2. Managing the Future

Systems Dynamics, in principle, can be viewed as introducing technological ideas into the processes of management (technolising). From a STA methodology view, this technolising of control activity means applying some form of engineering (i.e. constructing the control practice using *ideal objects* of a theory). A major difficulty lies in the fact, that those processes are individual, i.e. situational, and thus are different to the ideal objects of the natural-science type (such as an "ideal gas" or "ideal pendulum"). This is the niche of System Dynamics. System Dynamics is a set of methodics (in Western transcription – a "methodology"[3]) of *ad hoc* model building, using substitutes of ideal objects. "System Thinking" is just the art of sculpturing of such ideal quasi-objects.

[3] In the Russian language and particularly in the STA approach, there is a strict differentiation between *methodics* (as a practical reflection and registration of activity experience) and *methodology* – as reflection, registered by means of theoretical thinking and presupposing use of ideal objects (Genisaretsky, 1992)

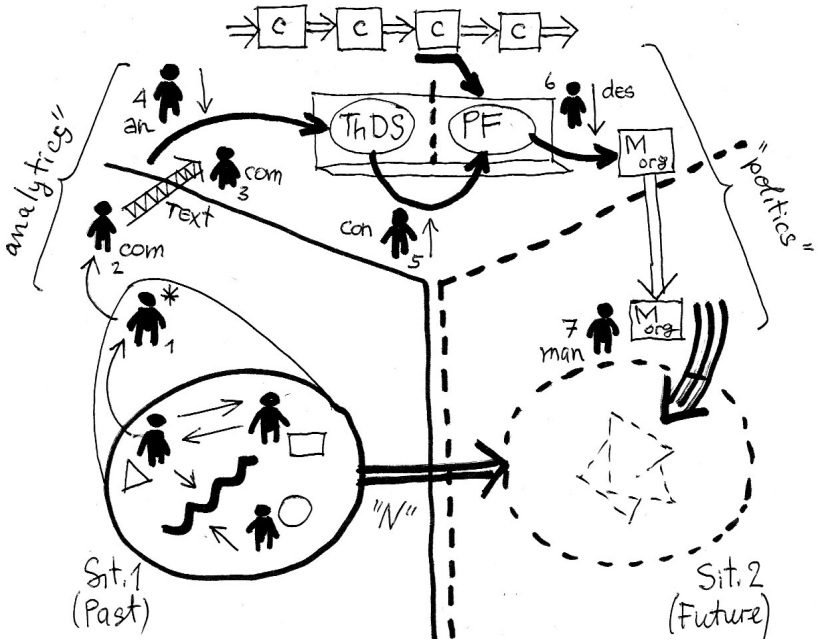

Table of symbols:
an – the analyst's position
com – communicators' positions
con – the constructor of the pictures of the future
des – the designer of organisational means
ThDS – thinking representations of the situation of the past
PF – pictures of the future
M_{org} – organisational means
man – manager

Fig. 1. Sphere-focal scheme

This can be explained using one of the basic schemes of STA approach, the so called sphere-focal scheme (figure 1)[4] Using this, the principal place of SD in the system of thinking and activity, aimed at *control of the future* is shown. To some extent this scheme can be said to be equifunctional to the scheme of "the shape of SSM", given by Checkland and Haynes (figure 2). Both schemes describe the path from the initial difficulty (a problem, break-up) to an "action, needed to improve the situation" (Checkland and Haynes 1994).

The sphere-focal scheme consists of three fields. The left hand side of the scheme depicts situations, which have happened, i.e. situations of the past (Sit.1) The right hand side shows situations in the future (Sit. 2) bounded by a dotted line. (The dotted line just means that there is no future yet, it's only being formed – in a "natural" way, – or is being constructed artificially.) The "embranchment" between the fields of past and future depicts the space of activity and thinking, aimed at the control of the future. This contains activities such as projecting, planning, programming, personnel tuition etc., which are reflexively "drawn out" of the time stream, in which the serviced situations are living. "Natural" translation, i.e. the spilling over of a situation's material from the past to the future is depicted in the lower part of the scheme (an arrow "N"). Above, in the embranchment, the primary positional structure of artificially formed future situations is shown.

[4] This scheme initially has been named the "Scheme of Natural-Artificial Step of Development". The name "Sphere-Focal" it has gained when "the organisational-technical superstructure in it was unrolled into a complex polysystem, fixing a number of highly complex interactions between systems of managerial thinking/activity" (Shchedrovitski, 1999). The name "Sphere-Focal" emphasises that all the elements of the *sphere of activity* can be *focused* on a local break-up solving.

This structure can be presented as two cycles or "branches". The first one, let us call it analytical, includes a reflexive position (*), from which the situation (for example, connected with the breakdown in a certain activity) is discovered, a communicative position (**com**), in which the "raw" reflexive text about the contents of Situation 1 is being produced, and, finally, an analytical position (**an**). The sense of (**an**) is in the transposition of the situation contents from the natural language of reflexive text into the material of idealisation. This is the basis from which it is possible to apply thinking transformations to the content, thus forming an ideal image of the future situation. Ideal – not in the sense of its correspondence to some extremely wishful pattern - but ideal according to the material i.e. layered together from formalisations of some theory. In the STA methodology, such images are called *thinking imageries* of the situation. This allows one firstly to submit them (as STA methodologists say, on the "pure thinking" boards) to allowable procedures within the logic of the theory, and, secondly, to get, as a result of such operations, realisable "matrixes" of the future, carrying the *objective contents* of the supposed future state. The results of the thinking operations may be projects, plans, programs, scenarios, – i.e. special sign constructions, in which the desired future is fixed and then realised.

Let us examine this in the context of ST/SD. For structuring the content of the "*verbal descriptions of situations"* ("problem", "crisis", i.e. connected with difficulties or gaps in activity), ST uses archetypes or typical elements of causal diagrams. These causal diagrams, formed on the "operational board", are repeatedly refined by new reflexive texts and by checks on the models which are being developed from the diagrams. By operating with these *ideal objects* on the "boards of pure thinking" the means to manage the situations are created: "Systemic thinking is learning how to manage situational complexity" (Espejo, 1994)

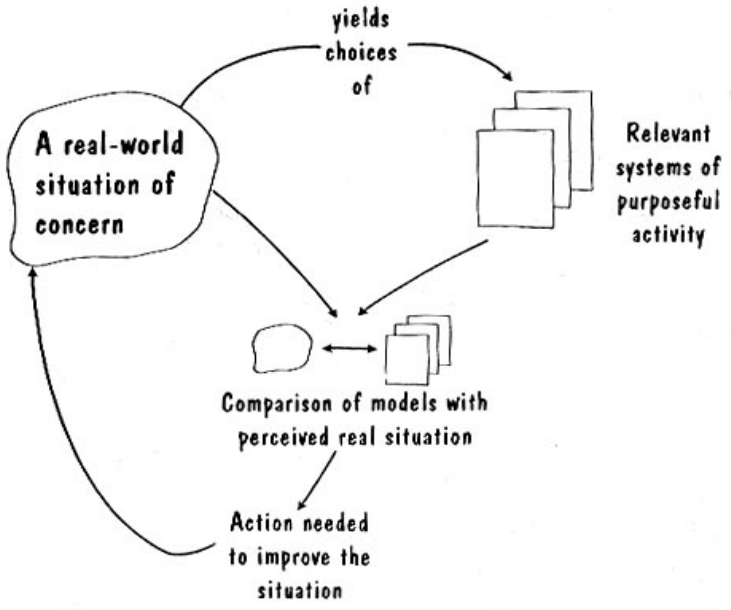

Fig. 2. "The shape of SSM" by Checkland and Haynes

Management efficiency depends first of all on the adequacy of the diagrams and models to the initial situation. Therefore, the assessment of model quality supposes a certain procedure for comparing it (the model) with what is modelled. But the quality of the verification and validation procedures for SD models remains an open question (Barlas and Carpenter 1990). In the scheme depicted in figure 2, the question about the mechanism of comprehending the situation contents is not raised in principle. Similarly, the possibility of comparing the given situation with standard patterns from a compendium of former relevant decisions ("purposeful activities") is not called in question. This is quite contrary to the principle of situation analysis, as it is understood in the STA methodology.

Secondly, the quality of control depends on the *reliabilit*y of using SD models as a means of managing situations, as a part of or in connection with projects and programs (in particular, organisational projects). In other words, if SD is really a technology, there should be standard procedures of model *reification.* If such procedures are not built, SD practice turns to be an artistic needlework, and SD analysts are oracles.

The mechanism of reification is shown on the left hand side of the sphere-focal scheme (fig.1). Thinking descriptions of past situations on the thinking board are constructively transformed into the pictures of the desired future (position 5 – **con**structor). This process is guided by cultural norms – the chain of their translation is symbolically depicted in the upper part of the scheme. In order to reify the picture of the future, it should be transformed into managerial procedures (position 6 – **des**igner of organisational means). The managerial procedures are translated into a managerial position (position 7 – **man**ager), from which an organisational action upon the situation is accomplished. This second branch of the scheme can conditionally be called politics, because it shows a way to implement situation-based culture-conformable (or ideologically oriented) management decisions. Of course, in this simplest representation, the secondary loop of communication about the consequences of any organisational decisions and any pre-project analysis are omitted.

The main focus of our interest now becomes:

- Using ST/SD procedures, is it possible to construct an activity, similar to engineering, which could guarantee the reliability of results, recommendations, programs and projects?
- Does SD possess the means to provide an isomorphic correspondence of its models to situations and activity systems, which are described in the SD models and which are transformed with their help?
- And thus, what is a system analyst who creates a SD-model – an engineer or an oracle?

The answers to these non-trivial questions are determined by the nature of the ST procedures, by their *objective content*[5]. In the practice of System Dynamics, there are, to

[5] The *objective content* category occupies one of the central positions in STA-methodology: "If I'm objectivising a principle, I begin to realize it in my life. But not vice versa. Because the reverse way is a subjectivist error. A very large trouble, which everyone must fight against. Don't objectivise what justifies your life" (Shchedrovitsky, 1993).

all appearances, serious problems with that. The STA approach may provide a step towards overcoming this difficulty. Both the ST/SD and STA methodologies constantly keep as a focus of their attention, the differentiation and binding together of "its own" thinking (analytical, constructive, acute and refined) and of the "outsider's" (someone's from the street) thinking, taken as an object of analysis and reconstruction. But they do it differently.

3. Thinking

In considering the methodology of thinking, there are radical differences between the SD and STA approaches. In SD sources, System Thinking is interpreted as the state inside an individual head, i.e. from a psychologist's point of view (thinking belongs to a *man* and can be systemic or not). The STA approach considers thinking to be, in principle, impersonal. It is a component in the structure of large-scale systems of human activity (activity mega-machines) and is an important element in their systemic co-organisation and development control. Thus, in SD, "system thinking" is an *attribute* (of an individual), while in the STA-approach, it is considered as a *function* of a thinking-activity system. "Traditionally, as far as the very notion of activity was developed from the notion of "behaviour", the activity itself was, in most cases, considered as an attribute of a separate man, as what produced, created and realised by him. Accordingly, man himself appeared as an "actor" (agent). Till now, the majority of researchers – psychologists, logicians and even sociologists, not to mention physicists, chemists and biologists, – have thought the same; the very assumption, that the question may be put otherwise, for example, that an activity has an impersonal character, seems to them wild and absurd.[6]

But there is quite an opposite point of view. The works of Hegel and Marx have proposed that, beside the traditional understanding of activity, there is a more profound one. According to this view, human social activity must be considered not as an attribute of a given man, but as an initial universal whole, much wider than "people" themselves. These are not separate individuals who create and produce activity, but, on the contrary, activity itself grasps them and makes them "behave" in a definite way. In respect of a particular form of activity – *langue/parole* (speaking/language) – Gumboldt

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[6] Though *empirically* in SD practice, system thinkers constantly come across the manifestations of this nature of thinking, which develops not in the heads, but in the inter-personal communication, upon the sign carriers. The most shrewd of them are even fixing it as a principle. It's remarkable, that *activity systems* are declared as the subject of such "intellectual machines": "... a number of models of purposeful activity systems, based on different worldviews, would be built. These models are thought of as relevant to exploring the situation;... They are epistemological devices, intellectual devices in terms of which what counts as knowledge, concerning the problem situation and how to improve it will emerge. Methodologically this is done by using models as sources of questions about the real world... The models thus structure a debate (which ought to be participative) about taking action to improve the problem situation" (Checkland and Haynes 1994).
Though on the whole specialists in SD share the first attitude. It is amusing to observe their genuine amazement, when they meet from time to time manifestations of thinking as a non-individual phenomenon, taking place in the space between the communicants – for example, upon causal diagrams: "as anyone who has seen a client's eyes glaze over at the sight of a pre-prepared causal loop diagram will know (even if consultant believes it to be a more complete representation of the problem than that of a client)" (Hocking and Orford 1993)

has expressed the similar thought: “these are not people, who are mastering the language, the language is mastering them” (Shchedrovitsky 1975).

The term “System Thinking” is interpreted, firstly, as *thinking about systems*, and secondly, as *systemically organised* thinking. The characteristics of the ST subspecies (*creative, divergent, lateral, non-linear, closed-loop, dynamic, holistic, scientific)* do not distinguish these two modes of consideration - “pasting” them together. Nevertheless, the main understanding of ST is “thinking about systems” and its subspecies are distinguished according to certain, perceived aspects of the systems being analysed (transformed). From the STA approach viewpoint, the ideas about the normative-methodical organisation of thinking-activity (e.g. *lateral, dynamic..)* look like methodical superstructures (in Russian terminology, “приемы” – takings) over the general SD scheme. They are based on empirically fixed patterns of chance situations operating in the framework of SD as of a kind of artistic ability (comp. Shannon’s “Art and Science ....”). But, for all that, the experience of structuring follows not the structure of ST/SD themselves, but the empirical typology of the analysed objects and situations:”... doing good systems thinking means operating on at least seven thinking tracks simultaneously:

Skill 1: dynamic thinking - …the ability to see and deduce behaviour patterns rather than focusing on and seeking to predict, events...

Skill2:closed-loop thinking people will look to the loops themselves as being responsible for generating the behaviour patterns exhibited by a system...

Skill 3: generic thinking – ... apprehending the similarities in the underlying feedback-loop relations that generate a pattern of behaviour...

Skill 4: structural thinking – ..thinking in terms of units of measure, or dimensions.

Skill 5: operational thinking –thinking in terms of how things really work – not how they theoretically work, or how one might fashion a bit of algebra capable of generating realistic –looking output...

Skill 6: continuum thinking – is nourished by working with continuous simulation models...

Skill 7: scientific thinking – means being rigorous about quantification and about testing hypotheses. (Richmond, 1990)

Apart from these, there exists “vertical” and “lateral” thinking (De Bono) and also “holistic”, “stochastic”, “divergent” thinking. These and other “thinkings” are distinguished, analysed and normalised. Thus, if in practice, “breaking through” situations are regularly reproduced, there appears a methodical generalisation of “creative thinking”. If it’s noticed that a certain derivation from an object, a “sliding”, peripheral glance, can be effective for getting new quality in the analysis, a “theory of lateral thinking” is formulated. It’s interesting to speculate what other kinds of ST could appear in the future and is there a limit to their reproduction? After all, even with seven different modes, Richmond is complaining that they cause “cognitive overload” among students.

In the STA approach, thinking is whole by nature, though not homogenous. STA approach considers thinking as operating with ideal objects ("pure thinking"). Thus, the systemic character (systemicity) of thinking in the STA approach means, on the one hand, the systemic embedding of an ideal object into the logical "machine" of subject knowledge (Shchedrovitsky 1975) and, on the other hand, the systemic reflection by thinking of its own structure and the processes of development (figure 3)

4. Thinking about Systems

Let us consider, how the central category of the system approach is thought about in SD. Strikingly, its categoric status is not a subject of a systems analysts' concern. Have you ever seen a craftsman, who takes no care about the construction and condition of his instrument? This is a system analyst. He considers a system only as an *object* of thought, but not as thought's *working means*:

> *" The reasonable degree of coherence of that [system] movement stems from the common factor that they all make use of the concept "system": an adaptive whole, an entity having emergent properties, a layered structure, and processes of communication and control that allow adaptation in a changing environment" (Checkland 1981*).

On the contrary, during several decades, the STA methodology has analysed the system category as a phenomenon of the world of thinking and thus, the system approach as a historical-cultural phenomenon (Shchedrovitsky 1985, 1991).

The STA approach perceives two necessary cases in *thinking about systems*. Firstly, it's necessary to "take" a potential object of SD operating, as a system, to conceive the subject of thought as systemic. For that, thinking should attribute to any of its subjects quite definite characteristics. There are at least the following four co-related and inter-connected categoric plans, which have to be distinguished in the subject of thought:

- Processes
- Structures and Functions
- Morphology
- Material

From the STA viewpoint, this is the simplest and, at the same time, the most complete idea of the category of system as an instrument, as a *thinking pattern*.

The second case is connected with answering the question – what is the *nature* of the class of systems which SD is dealing with, and, thus, what are the rules of operating with such systems. A trivial-naturalistic declaration that all the things in the world are systems, doesn't suffice. If an analyst has no other answer than this, it is impossible to answer questions about the boundaries of the applicability of SD and the means of replicating its results. After all, using the ideas of the system approach, systems are a means, *by which* things of the world become objects of thought. The categories of the system approach are only one way of presenting what SD is dealing with and what it is aimed at, i.e. it is its procedural sphere – the means, by which the content of thinking is structured. In order to work comprehensively, an analyst must put on his "thinking workbench", *separately* from the means, the content itself, the content as it is.

From an STA approach viewpoint, SD objects are *thinking-activity systems*, i.e. the systems, "composed" of processes, acts, structures of activity, thinking and communication. But it seems, that SD itself *doesn't know* about this, as it doesn't contain such a picture of the world, on the basis of which its objects would be constructed (i.e. there's no *ontological picture*, and accordingly, no *basic theory*). A theorist of science would say that SD has no *scientific knowledge* about its systems. The specificity of the content is hidden behind mechanical analogies, piercing the instrumental plan of the method – feedback schemes, "stocks and flows" etc. Nevertheless, it's possible to assert that just the processes and structures of thinking and activity constitute, so to say, a "load-bearing frame" of the phenomena, studied and modelled in System Dynamics.

At first glance, the use of SD for solving control problems in purely technical, engineering systems, looks like an exception. This sufficiently widespread use is non-specific. If the engineering process, based on a natural-science type theory, is insufficient and one needs SD, then this is a bad engineering. Then an object is not an engineering system, but a natural phenomenon, with all the subsequent dangers. We have already seen that a system analyst is more of a predictive oracle than an engineer, giving the technical guarantee. It's quite another matter, that SD models can help reveal the defects in the processes and structures of human thinking and activity, connected with the development, realisation and operation of engineering systems. Thus, engineering "hardware" turns to be immersed into the stream of activity, and this confirms our thought, that the real ontology of SD is connected just with the activity systems.

5. Thinking within Systems

In the second case, System Thinking is just *systemic* thinking, i.e. thinking, which is organised in a systemic way. This applies both to its internal organisation and its inclusion in the external, wider connections in the thinking-activity system. In ST literature, the systemicity of thinking is understood, from a psychologist's viewpoint , as well developed, multi-component and coherent individual thinking[7].

In contrast, in the STA approach, the systemicity of thinking *internally* is assigned by the connections and relations between the *facts*, specific *models* ("ideal objects") of the theory, by *ontologies*, on the basis of which models are constructed, by the corresponding *means of expression* (science "languages'), by research *tasks*, by the *methodics* of their solution, by results – different kinds of scientific *knowledge*, and by the *problems* of the given scientific sphere. These connections and relations are shown on the methodological scheme of "scientific subject" (Shchedrovitsky 1993) (fig. 3).

From the point of view of these STA approach ideas, the subject sphere of SD is under-formed – in particular, as it was said earlier, because the ontology, to which one may refer causal and stock/flow diagrams (conceptual SD models), is not clear. In the STA

[7] On the Internet one may find, for example, "System Thinkers Habits of Mind" (http://ww.Stconcep.htm)

approach, the ontology is built on the differentiation and the structural connections between thinking-activity, "pure thinking", reflection and thought-communication, genetically derived from the basic activity ontology.

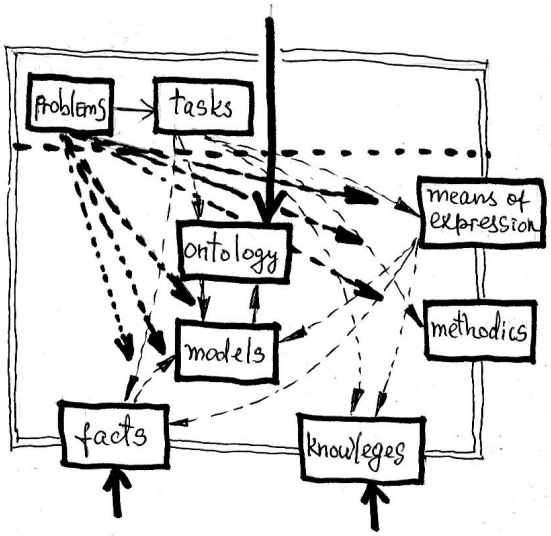
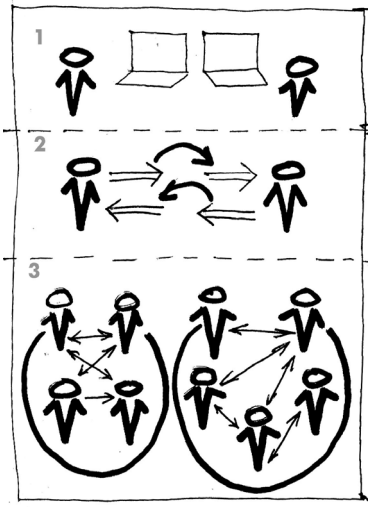


Fig. 3. Scheme of scientific subject



1 – Pure Thinking Zone (T)
2 – Thought-Communication Zone (T-C)
3 –Thinking – Acting Zone (T-A)

Fig. 4. General scheme of Thinking-Activity

In fig. 4, the basic scheme of the STA approach is presented – the so called *general scheme of thinking-activity*, which contains three comparatively autonomous zones, placed horizontally one above another:

1) the zone of socially organised and culturally being fixed collective-group thinking-activity (T-A);
2) the zone of polyphonic and poly-paradigmatic thought-communication, being expressed and fixed first of all in verbal texts (T-C); and
3) the zone of pure thinking, developing in non-verbal schemes, formulas, graphs, tables, maps, diagrams etc. (T)[8]

In its structural model, which is distantly similar to SD diagrams, the STA approach singles out and joins together the processes and structures of activity (more precisely – thinking-activity, T-A), "pure thinking" (T) and thought-communication (T-C); the sphere-focal scheme is an example of such models. This creates the possibility of substitution of flat diagrams by multi-level schemes of subject contents (i.e. to create layered models).

[8] "The central part in this try-zone system is the T-C zone, because just this zone connects the right and the left parts of the scheme as one whole. Two other zones may be considered as laying on different sides of the T-C axis. This is a principal moment regarding the definition of the place and functions of Thinking in a Thinking-Activity system and its relation to T-A zone: each of the zones has its own specific reality, which may become the place, where the content of other zones is projected, and thus become the basis for decoupling and isolating each of them into a reduced T-A system.
Under such considerations, the reality of thinking (T) turns to be the second limit, constraining the T-A system and laying as if opposite to T-A reality, developing directly on the real-practical material of human vital activity. This circumstance precisely corresponds to what we may fix phenomenally: the platitude of the board or the paper, on which we are drawing schemes, formulas, graphs, tables etc., expressing ideal content of T, is opposed, if one considers it (the platitude) regarding the T-C axis, to the real content and the world of T-A" (Shchedrovitsky 1987).

The *external* systemicity of thinking means including the units of thinking (procedures, acts, bunches of acts) into wider thinking-activity systems. For example, in the understanding of methodology as "the way of connection between logically articulated thinking and practically organised activity", methodology is represented as a part of a thinking-activity hyper-system, including thinking, activity and methodology. This definition contains an important restriction: thinking, which was not subjected to logical treatment, can't be a structural component of methodology, i.e. simply has no chance to become efficient.

6. Realisation procedures

How is the problem of the reification of the subject depictions of reality, being solved in organisational practice according to the SD/ST and the STA approach? One can draw on the diagram a "good" ("stabilising") feedback, but it's not obvious that life will accept it. The STA approach bases the "implantation" of the schemes on the principle that life must perceive itself by means of a model. For that to be true, an object should draw the model and special practice is needed, partly similar to participation. Life itself will then elaborate and implement this feedback and will use it. In present practice, SD models are constructed by system analysts and the procedures of participation are only discussed as a desired norm. (see the footnote on page 5; Sterman 2000). In the scheme constructed by Forrester, the appearance of "system description" really looks like *deus ex machina* (fig. 5, Forrester 1994)

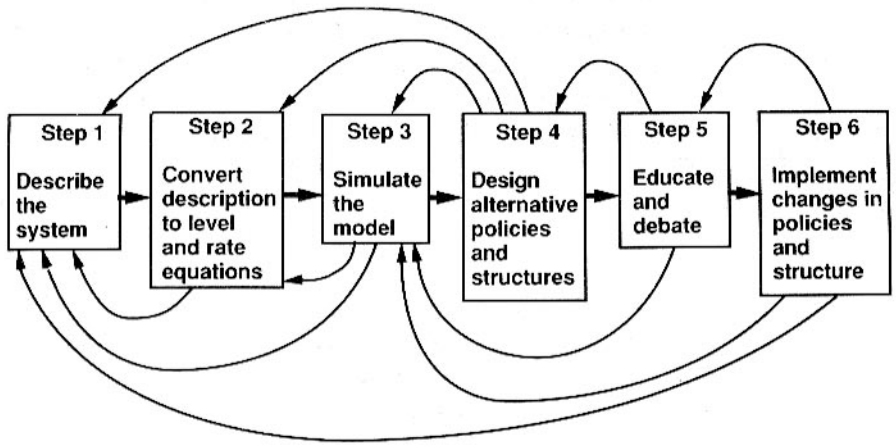


Fig. 5. SD steps from problem symptoms to improvement (by J. Forrester)

Here we must go back to the interpretation of how ST/SD works, using the sphere-focal scheme (fig. 1). There the problem is represented in the sequence of positions 1-3. One should pay attention to the "reflective coming out" of the positioner (it is marked by *) from his position inside the problem situation (Sit. 1) and the transition to the communicative position (**com**). From the STA approach viewpoint (and this is verified by the practice of participation programs), the only complete and authentic knowledge about the situation is carried by its participants. It's quite another thing, that this knowledge is incomplete, non-qualified, and represented in clumsy, laymen's texts. In short, in order to put this knowledge on a "thinking board" as a thinking reflection of the initial situation, special analytical work is needed (**an** position on the scheme). The

guiding principle is that " the thinking reconstruction" of the objective content of Situation 1 is possible only on the basis of the descriptions given by its participants and the more points of view there are – the better. A similar view on the communication between analyst and situation participants can be found in Sterman's "Business Dynamics": "...the modeller's role during this early phase is to be a thoughtful listener, not a content expert" (Srerman, 2000).

This is the basic principle of Activity-Organisational Games (AOG) where the participants of a potential problem situation are included in systemically organised collective work on thinking boards with the aim to set and solve their problems. "Realising a grandiose attempt to construct a theory of thinking, the MMC had to pass from the research of thinking to its cultivation. This was the turn from a research or theoretical approach towards the problem of thinking to an engineering-practical one <...>" (Popov, 1994). The AOG method was elaborated in 1979 and during the next two decades several thousands of such games of different scale and in different spheres of activity were conducted in the former USSR. The range of their use can be compared perhaps, only with the width of the sphere of SD applications. In particular, with the help of AOG, programs of development of companies, science-research institutes, ministries, cities and regions, the programs of oil basins development and many others were created. For example, due to the AOG method the program of withdrawal of the first energy block of the Beloyarskaya nuclear power station was realised – the first in the world. AOGs are used as powerful educational means, during election campaigns and finally – for holding public hearings on large-scale or insecure technological projects.

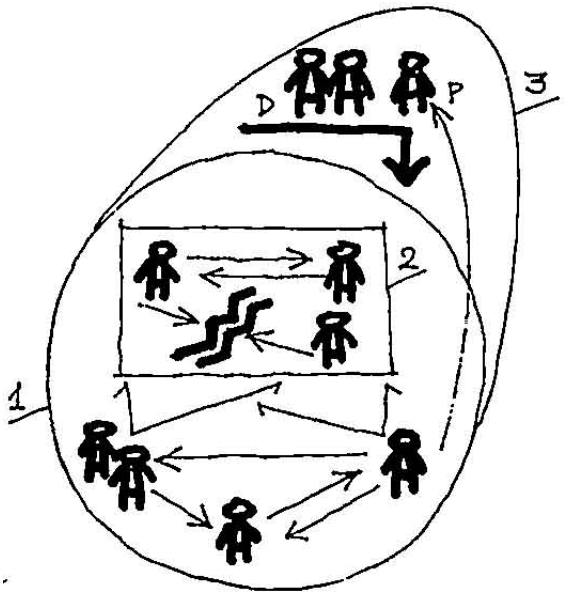


Fig. 6. Fundamental scheme of Activity Organisational Game structure

From this list of possible uses, anyone imaginative person can see that AOGs have nothing in common with trainer-simulators or business games based on algorithmic forms of organisation. In AOG, the real situation is simulated not "life-like", not in spontaneous improvisation but by means of situation content translation on the language

of the theory. In real practice, such refined constructive work on the "boards of pure thinking" is being accomplished by AOG, i.e. by the people from the street. Due to their design features, AOGs became a powerful participation technique.

AOGs turned out to be an extremely powerful *pedagogical system*, essentially intensifying the development of the participants' thinking. AOG technology makes trainees full-right co-authors of their collective learning process. It was used in a number of pedagogical experiments in the former USSR (Bouryak, Chudnovsky, 1997).

The general idea of AOG is shown in figure 6. Here one can recognise the following layers of AOG structure:

- A game bridgehead (contour 1), where all the participants are and where they operate. The construction of this "playground" is always unique and is set by the general design of a game;
- A *simulated situation,* on account of which the game is provided (contour 2) – this situation, a fragment of the outside reality, is presented in AOG space by STA "working tools" – schemes and notions. It exists and unrolls on the game boards. Such a reconstruction of the situation is one of the main goals of the game, which is achieved by the mutual efforts of all the participants;
- A control-organisational superstructure of the game (contour 3) – this is a field of the struggle between the different groups of game directors (position D) and participants (position P) for the control and leadership in the game, and correspondingly – for the character of its results.

In principle many different kinds of games and game-like procedures, aimed at the intellectualisation of business, can be constructed, in the framework of the STA approach, as modifications of AOGs. Using this technique, different forms of interaction between business and consulting, such as think tank activity, the so called "controlled electiveness" (i.e. people exchange between firms and universities), cooperative education and others, can gain a new quality. The design development and organisational support of AOGs are rather expensive, but AOGs are accordingly effective, especially in new or unique cases, when in principle there are no general solutions.

7. Conclusions

Construction of the schemes, based on the STA methodology and on thinking-activity theoretical constructions allows one to form a kind of "methodological engineering". The STA-methodologist, in contrast to the SD analyst, is surely not an oracle. The results of his work, Organisational-Activity Schemes, are engineering constructions of a special type – *activity and thinking mega-machines*. These structures are "combined" of activity positions in co-operation and communication structures, with the corresponding goals, means and methods. The STA methodology has approved methods, which allow leading the real people into positions within created structures.

At the same time, STA methodologists, unlike system analysts, have never been striving for the development of quantitative methods for the systems, which they were creating. The STA approach hitherto remains strictly in the frameworks of qualitative analysis.

Analysing, by means of the STA approach, the theory and practice of SD/ST, we not only see a number of principal difficulties, impeding development, but also rather evident ways of overcoming these difficulties. We would consider it to be highly perspective to organise a cycle of systematic STA developments on the identification of the boundary of applicability of SD/ST, its methodical blind alleys and potential growing-points in this sphere.

At least four groups of important methodological results, which would be the first steps towards this development are :

- Construction of a systematic history of SD/ST in the framework of the modern System Movement. This direction of research would be most effective through the acquaintance of STA-methodologists with the principles and structure of the problem sphere;
- Organising a series of AOGs with SD practitioners and theorists to formulate the problems of modern SD/ST practice;
- Cessation of uncontrolled generation, in the frameworks of ST, of still new "types of thinking". Reduction of the ST typology to a common ontological base and as a result creation of something similar to Mendeleyev's periodical system;
- Elaboration of strict methodological principles and regular procedures of including of other scientific formalisms (natural-scientific, engineer-technical, sociological and others) into SD.

It's rather difficult to say at this moment, what would be the first organisational steps towards the convergence of the SD and STA methodologies, but it seems, that there are many reasons to begin the substantial dialogue between these directions of advanced system studies.

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