

The Contribution of Gregory Bedny's Systemic-Structural Activity Theory to the Science of Activity

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ABSTRACT

In this paper we present a brief overview of General, Applied and Systemic-Structural Activity Theories. The focus mostly will be on the creation and development of the Systemic-Structural Activity Theory (SSAT), and on its role for the science of activity. We will consider some basic concepts of activity theory and outline some difficulties that Western scientists experience in the process of interpretation and application of the theory. General activity theory (AT) was introduced by Sergey Rubinstein (1958). It was further developed in the works of Leont'iev (1977) and Vygotsky (1978). For a long period of time attempts were made to use this theory for the study of human activity. With the development of mechanization and automation in the industry, in transport, in the military sphere and other modern fields of human activity it became obvious that the direct application of general activity theory was not possible. To the response of technological progress a more advanced theory, an applied activity theory (AAT), was created in the works of these prominent psychologists in 1970s. The most important fields where AAT could be applied to were aviation systems, automated control systems for technological processes, remote control systems, software and some others. The further development of applied activity theory led to the creation of the systemic-structural activity theory authored by Gregory Bedny (1997, 2007, 2015, 2019). In SSAT, activity is understood as a process and a structure that consists of hierarchically organized units that unfolds in time. Based on general activity theory, as a theoretical and philosophical basis, applied and systemic-structural activity theories could be applied for the study and practice of human work. Later on, the SSAT received recognition in the West and, particularly, in the USA.

Keywords: Activity theory, Applied activity theory, Systemic-structural activity theory, Self-regulation of activity, Activity theory terminology

INTRODUCTION

The fact that general activity theory was developed in the former Soviet Union explains why philosophical, cultural and psychological roots of the theory is significantly different from the way Western scientists interpreted it. There was a strict government control over all spheres of people's life including science. Activity theory happened to be in line with the communist ideology that proclaimed the labour concept of human origin (Engels, 1868). That's why the theory was allowed for its development. However, due to

being overloaded by the same controlled ideology, the theory had restricted possibility for its application to the study of human work. This fact had its influence on publications and translation in the works of Western scientists. Rubinstein is known as the author of the subject-oriented activity theory, which is fundamentally important for the development of general activity theory. He wrote that through the organization of individual practice society shapes the content of individual consciousness. His famous quotation "external act through internal" emphasizes the dependence of activity on the subject's individual personality features. Rubinstein introduced personality principal in psychology that integrates individual and social aspects in human development. According to this principal human development is the result of the interaction of material and social practice with human subjectivity. That is, activity acts as a mediator between the social reality and human subjectivity. The social aspects depend on the individual, just as the individual depends on the social aspect. In the same social environment different individuals act differently as they are impacted by the social environment in a different way. In activity theory, a person who interact with a situation is considered the subject. Every human act changes not only the object and situation but also develops the self. Objects cannot exist without a subject. The objective world exists independently of the subject, however things become objects only through their interaction with the subject (Rubinstein, 1958). There was no significantly developed data in general activity theory to apply it to the study of human work. Activity theory, and specifically its applied fields, AAT and SSAT, utilize terminology with a totally different meaning of what it is used in the West. Bedny illustrates it by the following example. The Russian word *deyatel'nost'* loosely translates into English as activity. However, *deyatel'nost'* is a much broader concept than the English word activity. *Deyatel'nost'* is a coherent system of internal mental processes and external behavioural actions, and motivation, that are combined and directed toward achieving conscious goals. It explains why the adaptation of general activity theory to the task analysis in general and specifically to human-computer interaction were ineffective. That's why analysis of basic concepts of activity theory by Western scientists in the attempts to capture the original meaning of activity theory terminology demonstrates an unfortunate failure (Bedny, 1997). By analysing, interpreting, explaining, and translating the general activity theory terminology he provided a great gift to Western scientists in understanding the theory.

BASIC CONCEPTS OF SYSTEMIC-STRUCTURAL ACTIVITY THEORY

Activity is the basic concept in activity theory. Activity is understood as a purposeful interaction of the subject with the world. Activity can be defined as conscious, intentional, goal-oriented and socially formed behaviour which is specific to humans. Activity is considered as a coherent system of internal (mental) processes and external (behavioural) processes and motivations, that are combined and organized by the mechanism of self-regulation for achieving conscious goals (Bedny, Karwowski and Voskoboynikov; 2010). The main postulate of SSAT is that it views activity as a structurally-organized

goal-directed regulating system rather than the set of responses to multiple incentives, as suggested in the works of behaviourist Skinner (1974). The system manifests itself in the way people through trials, errors, and feedback corrections create strategies of performance which are derived from the personality features. In activity theory there are such concepts as object, and subject-object relationship. An object of activity that can be material or mental (symbols, images, etc.) is something that can be modified by a subject according to the goal of activity. There is also subject ↔ subject interaction when subjects interact with each other using speech, material and mental objects. Activity is an object of study and cognitive and behavioural actions and psychological operations are basic units of activity analysis. Three basic terms of activity theory: activity > cognitive or motor actions > psychological operations. Actions are directed towards the achievement of conscious goals. Self-regulation manifests itself through both non-conscious (automatic) and conscious levels (Bedny and Karwowski, 2007). Activity theory emphasizes a great difference between human and non-human psychic processes. Psychic processes of animals are developed according to the laws of biological evolution, whereas the psychic processes of humans are influenced by the laws of social-historical evolution. Gregory Bedny, by years of research and analysis of the then scientists' views on the science of activity, brought clarity to understanding the theory which can now be used for the studying of human activity. We will briefly describe his explanation of the concept of self-regulation as a goal directed process, the concepts of goal and task, the psychological characteristic of actions and the individual style of activity.

The Concept of Self-Regulation in Systemic-Structural Activity Theory

The concept of self-regulation is critically important in AT and especially in SSAT. As a goal directed process it integrates cognitive, executive, evaluative and emotional aspects of activity, which includes conscious and unconscious levels that are interdependent. Goal and verbally-logical components of activity play a leading role in the conscious level of self-regulation, whereas imagination, intuition and non-verbalized meaning play their role in unconscious level. When studying work activity to consider mental processes sensation, perception, memory, thinking, etc. separately is not productive quite often because these processes are interrelated. They should be studied together and not only in terms of cognitive processes, but in terms of functional mechanisms of functional blocks as well. Functional mechanisms of functional blocks are the main units of activity analysis. They should be understood as stages of self-regulation. Self-regulation as a process manifests itself through both non-conscious and conscious levels (Bedny and Karwowski, 2007). At the non-conscious level, conscious and verbalized aspects of self-regulation play a subordinate role, and this level is particularly important when imaginative and nonverbalized strategies of activity play the leading role. At the conscious level of self-regulation, verbal and logical aspects of activity are dominant. Both levels are interdependent and the relationship

between them dynamic. This interdependency gives rise to the formation of different strategies of activity, which are adequate to the external and internal conditions of activity. Learning is considered a self-regulating process during which strategies of activity are transformed. At the unconscious level of self-regulation condition unfolds as an uninterrupted process. Automatic mental operations are not organized into cognitive actions. This can be explained by the fact that the unconscious level of self-regulation is not subordinated to conscious goals. Activity is triggered automatically and is performed through unconscious automatic reflective processes. The subject only conscious of the result of the process. The conscious level of self-regulation presents itself not only as a process but also as a system of logically organized actions. Each action is organized according to mechanisms of self-regulation and has a beginning and an end. At the conscious level of self-regulation activity can be considered a hierarchically organized system of uninterrupted reflective processes. At the same time these processes are discrete. Therefore, at the conscious level, cognition is continuous and interrupted at the same time. Understanding how activity is organized helps explicate the relationship between the external and internal components of activity. The socially determined aspects of our cognition are not based on external influences only, as it is suggested by Vygotsky's cultural-historical theory of human development (1978). Nor do they wholly depend on "object-oriental activity", as it is suggested by Leont'ev (1977). Psychic activity emerges as a function of social existence of the individual, and, as a result, the ability of psychological reflection develops. Psychological reflection is not a passive mirror-like reflection; it possesses active features that imply some systems of mental stages and operations and is always organized as a self-regulation process. Since the process cannot be fully determined in advance, it contains situated elements that are developed during self-regulation process of reflection. The more complicated a person finds a task, the more important and complicated the process becomes. The most complicated reflective process is thinking.

Activity Theory vs Behaviorism

General philosophical and psychological principles for the study of personality in psychology in accordance with the concept of AT were first formulated by Rubinshtein (1958). According to this principles human development is the result of interaction of material and social practice with human individuality. Personality is developed through a person's participation in activity, which depends on the relationship between a subject, a situation and social interaction. This principal eliminates the contradiction between social and intraindividual aspects of human development. Rubinshtein's personality principal addresses inadequacies in the Skinner's behaviouristic approach (1974). External reality in his view is portrayed as a variety of stimuli to which a person reacts. That is, human emerge as reactive organisms and display no mental activity between stimulus and response. Behaviourism ignores mediated function of activity which provide a basis for personal development. It denies any importance of activities such as reasoning, judgement, creativity, and concept formation. Human behaviour cannot be reduced to

the external stimulus-response manifestations of activity. In activity theory a person who interacts with a situation is considered the subject. That is, we are talking about action and cognition, not about stimuli to which the subject reacts. It's worth noting an important assertion concluded by the Symposium Cerebral Mechanisms of Behaviour held at the California Institute of Technology in 1948. The Symposium regarded by many as the end of the reign of behaviourism in psychology and the beginning of cognitive science as a formal field of study (Gardner, 1975). No strict stimulus-response explanation of human behaviour considered acceptable. With the rise of cognitive science human behaviour was not looked at as the conditional responses anymore, but rather as the ability of human mind to explore between stimuli and response.

The Concepts of Goal and Task in SSAT

In activity theory, the concept of goals is closely linked to the concept of task. Bedny emphasized on the importance of understanding the concepts of goal and task as necessary for the analysis of task performance (2015). The goal is a mental model of the desired future result that is formulated by the subject in the process of activity. The goal is only a cognitive component of activity that includes conscious imaginative and verbally-logical components. Without awareness of the goal, there is no goal of human activity. Existence of the conscious goal is one the most important factors that distinguishes human activity from animal reactive behaviour. Even highly automated human actions should be distinguished from reactive behaviour. For example, a very quick response to the emergency signal looks like a reactive response. However, this is not a reaction but a meaningful and purposeful action because it has the specific goal for achieving the future desired result. The desired future result emerges as the goal only when it is accompanied by motivation, and when the subject is involved in the activity for achieving the result that matches the goal. The concepts of goal and motives are often interpreted incorrectly. If the goal is a cognitive component, then motivation is an energy component. The object cannot be a motive, but rather a source of motives. On the other hand, needs can turn into motives when the goal of activity is to satisfy these needs. In the frame of the SSAT, motives are connected to the goal and metaphorically can be presented as vector "motive→goal". The more intense the motives are, the more the person will apply the efforts for reaching the goal. Human activity is a continuing performance of various tasks. The task analysis includes the description of the structure of activity during the task performance. In the studying of traditional types of work the term production operation should be considered as a synonymous to the term task which is performed in a particular order. Each work process consists of a number of tasks. Any task consists of logically organized cognitive and behavioural actions that are directed toward achieving the goal of the task (Bedny and Meister, 1997; Bedny and Karwowski, 2007). General hierarchical scheme of work activity can be presented as follows: work activity, task, cognitive and behavioural actions, and operations. Every task is regarded as a situation-bounded activity under the given conditions. In

engineering, means of work, tools and equipment are defined when the subject operates with machines or equipment. For example, to cut a metal part, the worker installs it in the specific ways and use specific tools. In manual work, the worker manipulates with hand tools directly. Means of work is a general term that identifies a combination of physical equipment and tools. Computer in this sense is not a tool, but means of work for creating various artificial tools and objects, that can be modified by user (G. Bedny and I. Bedny, 2018, 2019). In ergonomics and in SSAT there are such notions as error, mistaken failure, range of tolerance acceptable level of deviation, and so on. In Vancouver's publications we can see that he reduces self-regulative process to elimination of errors in different disturbances (2005). This example says about an incorrect understanding of the concepts of goal and task and self-regulation that are necessary for task analysis. Industrial-organizational psychologists who study human activity cannot apply such primitive data to practice. Self-regulation cannot be considered as elimination of the so-called disturbance and errors. Self-regulation process in conscious activity is a goal directed process that allows not only correction of errors but also prediction and prevention of them. Self-regulation process takes place even when there is no disturbance and errors. Self-regulation is a complex process that regulates the entire activity. Disturbances include danger, unanticipated events, emergencies, etc. Subjects have to improvise and adapt to the contingencies of such disturbances. Thus, self-regulation process becomes more complex and strategies for task performance change accordingly (Bedny, 2015).

Psychological Characteristics of Actions

Action is defined as a discrete element of activity that has a purpose of achievement an intermediate conscious goal of activity. Performance of all actions which required by the task leads to the achievement of the goal of the task. The structure of activity during the task performance is formed by a logically organized system of motor and mental actions. An action emerges as the primary unit which can be further divided into sufficiently conscious or even into unconscious operations. The actual of which is determined by the specific conditions where activity takes place. In activity theory, cognition is considered not only as the storage of images and concepts or propositions, but also as the system of mental actions and operations carried out with and upon them. All actions have a temporal dimension. The initiation of a conscious goal of an action constitutes the starting point of the action. It concludes when the actual result of the action is evaluated in relation to the goal of action. This understanding allows presenting continual flow of activity divided into individual units. Actions are the result of the social-historical development. They are socially mandated prior to the subjective realization. Subjects are taught to perform socially required actions. Each object has specific associated actions, governed by social norms and values. Actions are facilitated by tools that possess historical and cultural context. Actions imply an existence of the object of action. They are not isolated but typically related to a class of similar actions. Individuals can extract principals of performance of particular actions from these classes because actions of the same class share

general functions and purposes. There is a certain similarity exists between actions and words. Verbal activity may also be presented as a system of actions possessing syntactical, semantic and pragmatic features. Verbal actions are more often used as a tool for communication that may also be used for self-regulation in a dialogic process. Non-verbal actions are typically object actions, or may be mental actions involved with the manipulation of mental signs and images (Bedny and Karwowski, 2007). Leading experts in the theory of activity in the West based their analysis of the concept of action on the works of Vygotsky and Leont'ev (Nardi, 1997; Suchman, 1987). They assert that human actions cannot be utilized as units of analysis of work activity. In their view, actions are always included in the context of activity and therefore unit of analysis is activity. However, according to the activity theory action is a basic unit of activity analysis while activity is the object of study. The incorrect interpretation by these authors due to the unclear description of basic characteristics of action in Leont'ev psychological school. According to Leont'ev, activity is a dynamic system, and by stressing on the dynamism of activity and its elements, he did not sufficiently justified his explanation. For example, he asserts that some simple actions can be combined into more complex ones. He gives the following example. You can physically dismember a material object with different tools, each of which determines the way action is performed. In some conditions, the cutting operation will be more adequate, while in others - the sawing operation is more adequate assuming that a worker knows the appropriate tools - a knife, or a saw, or other (Leont'ev, 1977). This example is evidence of Leont'ev confusing technical operation of cutting metal with a hacksaw with a psychological operation as a component of motor action. Metal cutting with a hacksaw is a production operation. It includes various perceptual and physical actions which requires sufficiently significant efforts and coordination of these actions under visual control. For example, if the metal piece is fixed in a vice and the hacksaw lies on the work bench to the right, a worker does the following: extend right hand to the right and grasp hacksaw (first motor action); move the hacksaw to the exact position above the work piece in the exact position (second motor action); move left hand forward and grasp the hacksaw (third motor action); and then begins performing a sequence of motor actions by moving the hacksaw forward and back under motor and visual control. As a component of motor actions motions should be considered a psychological operation. Real psychological operations represent motions which include motor actions in the content and these motions are integrated into motor actions by the goal of action (Bedny and Karwowski, 2007; Bedny, 2015). Bedny further outlines two methods of action description. One is based on the description of changes with objects that are performed by actions. Typically names of action and changes performed are formulated as instruction analogues to a software code. For example, "turn on the engine", "move the lever", "read display", etc. These kinds of actions are conveyed by instructions and are classified according to specific features of the object. However, actions may also be classified according to their psychological characteristics, i.e., by psychological processes and mechanisms implicated in their performance. For example, "memorize", "detect", "move your hand", etc. Based on these criteria we can

infer two methods of the description of actions. One method consists of actions classified as typical elements of the task based on technological principals of the nature of modifying the object. The other method is based on psychological principals that involve the description of typical elements of activity (Bedny, 2005). Usually, at the first stage, actions are described according to technological principals and then are transformed into typical elements of activity. For example, an action “move the lever into a particular position” is a technological description of the action. At the second stage the same action may be described as “move the hand with the object into an exact position with force of two pounds for a distance of 30 centimetres”. The latter is more precise. Later on, an exact description of the actions, unrelated to technological aspects of the situation, were developed. From these descriptions one can infer that this is a motor action that requires a high level of attention (third level of complexity) and performed over the distance of 30 cm. with musculature effort which equal 2 pounds. This gives us a precise picture of motor action even without knowledge of the specifics of equipment and technology which was used. Since actions are organized as a self-regulated system the starting point of any action is the moment when the goal for the action is formulated or accepted. The terminus of any action occurs when the result is evaluated, thereby engendering a continuous flow of activity, divided into individual units, delimited by intermediate and terminal goals subject to the evaluation of the outcomes of the action.

The Study of Individual Style of Activity

While in the West the selection method was used more intensive, in the former Soviet Union an attention mostly was directed towards the development of methods for individual training based on the personality features. The concept of individual style of activity was first introduced by Merlin (1964) and Klimov (1969). In subsequent years some other authors studied the effect of individual personality features on performance. The outcome of these studies was an establishment of the fact that different individuals can perform with equal efficiency through the use of their own strategies of performance which are more suitable to their personality features. That is, people attempt to compensate for individual weaknesses with their personal strength in a given task situation. By implementing the individual style of activity on performance they diminish the impact of their weaker features of personality. Individual style of activity should be considered as strategies of performance deriving from the mechanism of self-regulation which depended on personality features (Bedny and Voskoboynikov, 1975; Bedny and Seglin, 1999; Voskoboynikov, 2014). Such strategies occurs at the conscious and unconscious levels and are based on principles of self-regulation. Both levels are tightly interconnected and transfer from one to another. The process of self-regulation manifests itself in a formation of desired goals, in developing of a program of actions which correspondence with these goals with conditions for achieving the goals and with persons' individual abilities. Other words, people through trials, errors and feedback corrections create strategies of performance suitable to their individuality. For example, people with inert

nervous system develop a predisposition to plan their work in advance and attempt to utilize a stereotyped method of performance. The individual style and methods of performance is not the same. The latter is not dependent upon individual personality features but rather upon organizational factors, imposed supervisory procedures and etc. Sometimes methods of performance that derived from organizational factors may contradict with individual features of personality, which is not desirable. In cases of an inadequate training which ignores individual features of personality, the subject may acquire methods of performance that contradict with his/her individuality. It may have a negative effect on performance level and job satisfaction. Based on the individual style of activity the subject can adapt to the situation more efficiently.

CONCLUSION

In this article we made an attempt to briefly analyse the development of the theory and its interpretation by Western scientists. We began our discussion by considering general activity theory. This theory has been used to examine a number of different practical problems in such domains as education and performance. However this theory does not provide applicable methods and principals, and methodology for the study of human work. General activity theory is only the philosophical framework for studying human performance. In the framework of applied and systemic-structural activity theories important data were obtained that has an applied meaning. A more detailed analysis can be found in the multiple works of the founder of systemic-structural activity theory Gregory Bedny. The theory attracted great attention of professionals in the West. However there were some difficulties for Western scientists to interpret the theory, particularly due to the translation of the activity theory terminology. Particularly, due to the fact that there are no precise words in English language for the correct translation from Russian. Translation between different cultures is a complex process that require theoretical analysis of existing terminology. The words utilized for translation in the West have different meaning. Based on such analysis it is possible to provide an adequate translation of the basic terminology and develop a more advanced one, which eventually will allow to make it more applicable for various field of psychology. The creation of SSAT has greatly advanced the science of activity because it can be applied to the study and practice of human work.

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