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Telescopic model of the natural cycle of activity

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Abstract: The article deals with the telescopic model of the natural cycle of activity, reflecting the hierarchical structure of the human nervous system. The main goal of the study was to develop a model that duplicates the principle of hierarchy inherent in the nervous system and used in the "Priority" temperaments classification. The author analyzes existing activity cycle models, including the OODA cycle, D. Kolb's experience-based learning model, A. Kolb and D. Kolb's extended experience-based learning model, B. McCarthy's 4MAT model of learning styles, the Margerison-McCann model and M. Belbin's team roles. As a result, a telescoping model was developed with three links (levels of detail): a small model "2/4", a medium model "3/8", and a large model "4/16". The models are oriented to tasks of different complexity: from basic analysis (model "2/4") to a detailed approach to the management of complex processes (model "4/16"). The main advantage of the proposed telescopic model is the possibility of taking into account individual neurophysiological characteristics of workers, which increases the accuracy of predicting their behavior and the efficiency of personnel use. The use of the telescopic model of the natural cycle of activity will optimize labor processes, increase employee involvement and satisfaction.
Keywords: *"2/4" model, "3/8" model, "4/16" model, Hierarchical structure, Natural activity cycle, Nervous system, Telescopic model.*

1. Introduction

In management, activity is understood as any purposeful human activity aimed at achieving specific results [1, p. 24]. Since it is activity that is the main source of obtaining the desired result, it and its components should be influenced in order to achieve the set goals [2, p. 17]. Activity models, which are often called activity cycle models, include a large number of various models (cycles): decision-making; talent management; cognitive; self-organization; military activity; cognition; learning, etc. Structuring activities through models allows systematizing management processes, increasing their transparency and efficiency. In the context of management, such models serve as an important tool for optimizing human potential and managing organizational resources.

Russian researchers most often consider activity as a set of procedural (structural) components related to the psychological scheme of activity proposed by A.N. Leontiev, for example:

- Need → Motive → Goal → Objective → Tasks → Technology (content, forms, methods and means) → Action → Result [3];
- Needs, motives → Goal setting → Goal fulfillment → Result [1];
- etc.

The inclusion of such multifaceted concepts as need and motive in the components of activity, which refer simultaneously to both mental processes and personal (psychological) characteristics, complicates the practical application of such concepts. In this regard, most specialists usually prefer to use simpler models, in particular:

- OODA cycle: Observe → Orient → Decide → Act [4].

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- D. Kolb's Experiential Learning Cycle: Concrete Experience → Reflective Observation → Abstract Conceptualization → Active Experimentation [5-7].
- PDCA cycle: Plan → Do → Check → Act [8].
- PMBoK (Project Management Body of Knowledge) project management cycle: Initiating → Planning → Executing → Monitoring and Controlling → Closing [9].

Components (stages) of known activity models are, as a rule, sets of mental functions assembled in a certain order (cycle). The material (biological) basis (substrate) of mental activity is the nervous system, the basic principle of the structural organization of which is the principle of hierarchical subordination (subordination) of various nervous structures [10, p.38]. Since the mental functions serving as components of the activity model are manifestations, first of all, of the peculiarities of functioning and structure of the nervous system, it can be assumed that the process of activity will more accurately reflect the model whose structural organization corresponds to the structural organization of the human nervous system and the principle of hierarchy.

The hierarchical subordination of the components is laid down, in particular, in the model of D. Kolb and the models of his followers, as well as in the Margerison-McCann model [11, 12], where the priority of the components of the activity model is revealed on the basis of dichotomous division. However, in these models, the bases (criteria) of hierarchical division are not related to the characteristics of the nervous system, but reflect the features of mental (in D. Kolb's model) and psychological activity (in the Margerison-McCann model, dichotomies from the psychological typology of C.G. Jung and his followers are used).

A clear hierarchical subordination of nervous system components is prescribed and used in the "Priority" classification of temperaments [13, 14]. Transfer of the hierarchical structure of the nervous system, as it is realized in the classification "Priority", to the components (stages) of the model of D. Kolb allows us to obtain the so-called "model of the natural cycle of activity". The term "natural" in this case means that the structure of the cycle corresponds to the existing ideas about the structural organization of the human nervous system and the principle of hierarchy.

The aim of the study is to develop a natural cycle of activity, the structure of which reflects the structure of the human nervous system and is built in compliance with the principle of hierarchical subordination of the cycle components. In the course of the research, aimed at specialists in the field of personnel management and decision-making, scientific publications on the topic were searched and studied, comparative analysis of activity cycles was carried out using the methods of analysis and synthesis.

2. Overview of the Concepts that Served as the Basis of the Natural Activity Cycle

The OODA (Observe → Orient → Decide → Act) cycle, developed by military strategist John Boyd for battle management, has demonstrated its versatility and applicability in various fields. Therefore, Boyd's cycle is currently considered as "a universal model for the activities of individuals and organizations" [15] especially in competitive environments [15]. The number of application areas of the OODA cycle is constantly growing. Among them are business operations and software development [16], political strategy and artificial intelligence [17], improving the efficiency of intelligent systems [18, 19] and military operations [20, 21]. The cycle has been effectively used to reduce energy consumption [22] and decision making in medical facilities [23], search and rescue of distressed people at sea [24]. It finds applications in human decision-making modeling [25], public order protection [26], educational practice [27], sports analytics [28], and so on.

In the 'observation' phase of the OODA cycle, information is collected. This information must be complete, reliable and free of "noise". The "orientation" stage consists of a) destroying information and existing mental models and b) creating new models that more accurately reflect reality. At the "decision" stage, a choice is made between the variants of plans developed at the orientation stage (if there are several), and a decision is made whether to implement the chosen plan or not. At the stage "action" the practical realization of the developed plan, model, concept is carried out. The effectiveness of this stage directly depends on the quality of the previous stages of the cycle and the speed of feedback.

In general, we can say that the OODA cycle is a dynamic and adaptive model capable of optimizing management and decision-making processes in a variety of contexts. Its flexibility and versatility make it a sought-after tool for professionals in management, strategic planning and process organization in highly uncertain and competitive environments.

The experience-based learning model proposed by D. Kolb, was initially focused on educational processes, but over time it acquired a wider application and began to be considered as a universal model of any activity. The model contains four consecutive stages, each of which reflects key aspects of learning new experience. The first stage involves the acquisition of concrete experience, which creates the basis for subsequent analysis. The second stage is a reflexive observation, in which the acquired experience is analyzed and comprehended. The third stage is abstract conceptualization, in which new knowledge is integrated with existing knowledge. The fourth stage is associated with active experimentation, practical application of the developed concept.

From the point of view of D. Kolb, any person usually has a predisposition to some stage of the cycle, i.e., his/her dominant style of activity. In this regard, four styles of activity were identified, and their names were associated with the features of the corresponding stages of the cycle.

Later A. Kolb and D. Kolb improved D. Kolb's model by expanding it to eight stages. Each stage was associated with its corresponding activity style: Experiencing → Imagining → Reflecting → Analyzing → Thinking → Deciding → Acting → Initiating [29]. Additionally, a ninth style called Balancing was introduced. This style is not tied to a specific stage and is an integration of different styles.

Bernice McCarthy, based on D. Kolb's concept, developed his own model of learning styles, which was named 4MAT [30]. In this model, each stage of D. Kolb's cycle was divided into two stages. At one stage, the right hemisphere of the brain, responsible for figurative, concrete thinking, dominates. The other stage is dominated by the left hemisphere of the brain, responsible for abstract, logical thinking. According to B. McCarthy, this alternation of hemispheric dominance ensures maximum learning efficiency. The 4MAT model includes 8 stages: Attend → Image → Inform → Practice → Extend → Refine → Perform → Connect.

At the stages of Image, Extend, Perform and Connect the right hemisphere of the brain dominates, which promotes creative (imaginative) perception and processing of information. At the stages of Attend, Inform, Practice and Refine, the left hemisphere of the brain dominates, providing logical and analytical processing of information. According to B. McCarthy, this alternating involvement of the hemispheres creates a balanced approach to learning, combining both creative and logical methods of perception and mastering knowledge.

Charles Margerison and Dick McCann developed their team management system using Carl Gustav Jung's type theory. The Margerison-McCann model is based on four dichotomies and is aimed at defining work functions and role preferences of team members. The system identifies 8 key functions-roles that are arranged sequentially in a closed loop-wheel:

1. Reporter-advisor - gathering and presenting information.
2. Creator-innovator - generating ideas and experimenting.
3. Explorer-promoter - exploring and discovering new opportunities.
4. Assessor-developer - analyzing, evaluating, and planning.
5. Thruster-organizer - organizing processes.
6. Concluder-producer - working systematically to achieve results.
7. Controller-inspector - detailed inspection and control.
8. Upholder-maintainer - maintaining team standards and values.

At the center of the cycle-wheel is the ninth function, Linker (forming links). This function is outside the cycle because it lies simultaneously on all team members and ensures their interaction. Functions and roles in the system are grouped into 4 main activities: Advisers, Explorers, Organizers, Controllers.

Role preferences in the Margerison-McCann model demonstrate significant similarity with team roles emphasized by M. Belbin. In M. Belbin's model, each of the eight team roles is responsible for certain aspects of teamwork [31-33]. M. Belbin's roles can be arranged in the form of a cycle of activity, which in its structure resembles the 4MAT model and the eight-stage cycle of A. Kolb and D. Kolb: Chairman (Coordinator) → Shaper → Teamworker → Monitor-Evaluator → Plant → Company Worker (Implementer) → Resource Investigator → Completer-Finisher [34]. Each role, ensuring the fulfillment of key functions at the relevant stages of teamwork, contributes to the creation of a holistic cycle of activities.

The hierarchical structure of the natural cycle of activity duplicates the hierarchical structure of the nervous system used in the "Priority" classification of temperaments [13, 14]. The type of temperament in the "Priority" classification is determined by the priority poles of two dichotomous pairs of nervous subsystems (Figure 1):

- Visceral (internal) / somatic (external);
- Afferent (input) / efferent (output).

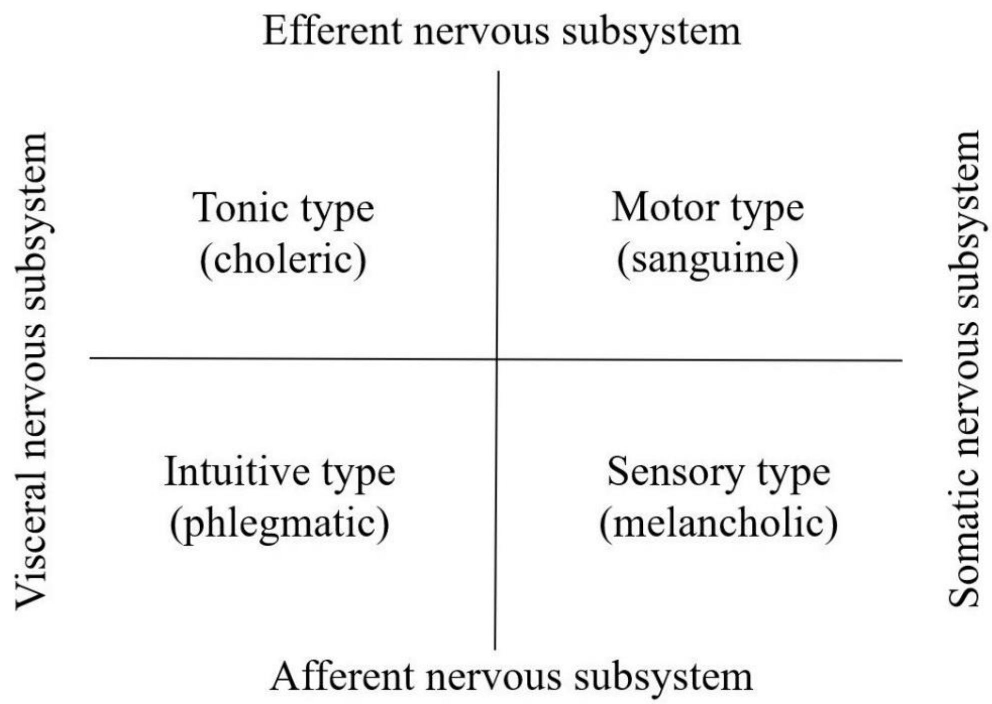

Figure 1.
Classical temperament types of the "Priority" classification.

Based on these dichotomies, 4 classical types of temperament are distinguished:

1. Motor type of temperament is diagnosed when somatic and efferent nervous subsystems are prioritized. It corresponds to sanguine according to the Hippocratic classification.
2. Sensory type is diagnosed at dominance of somatic and afferent subsystems. This type corresponds to the melancholic temperament.
3. Intuitive type of temperament is diagnosed with the dominance of visceral and afferent subsystems. This type corresponds to phlegmatic temperament.
4. Tonic (tonus) type is diagnosed with the prioritization of visceral and efferent nervous subsystems. It corresponds to the choleric temperament.

An important feature of the hierarchical structure of the classification "Priority" is its connection with the natural structure of the nervous system, which can be used in the development of the natural cycle of activity.

In the classification of temperaments "Priority", due to the use of the third dichotomous pair (right-hemispheric / left-hemispheric) nervous subsystems, the number of types of temperaments increases

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from four classical to eight basics. The increase in the number of temperament types by a factor of 2 is due to the fact that each of the four classical types of temperament priority can be both right and left hemisphere of the brain. The work of the right hemisphere of the human brain is mainly associated with the activity of the first (concrete, figurative) signaling system. In turn, the left hemisphere of the brain is associated with the second (abstract, verbal, logical) signaling system.

Thus, the identification of priority poles in three dichotomous pairs of nervous subsystems allows us to identify eight basic types of temperament:

1. Motor (sanguine) right hemispheric (concrete) – active, energetic and task-oriented.
2. Motor (sanguine) left-hemispheric (abstract) – active and organized, with developed analytical thinking.
3. Sensory (melancholic) right-hemispheric (concrete) – sensitive, prone to perceiving images and details.
4. Sensory (melancholic) left-hemispheric (abstract) – sensitive, analytical, and oriented toward inner experiences.
5. Intuitive (phlegmatic) right-hemispheric (concrete) – calm, stable and receptive to imaginative information.
6. Intuitive (phlegmatic) left-hemispheric (abstract) – poised, systematic, and oriented toward abstract concepts.
7. Tonic (choleric) right-hemispheric (concrete) – determined, emotionally expressive and quick to respond to concrete stimuli.
8. Tonic (choleric) left-hemispheric (abstract) – energetic, goal-oriented, and prone to strategic planning.

Increasing the number of temperaments types up to eight increases the differentiability and practical applicability of the classification "Priority", makes it possible to more accurately take into account the individual psychophysiological characteristics of a person, which is especially important in management and personnel management. It allows to form teams more accurately, distribute roles and optimize professional activities of employees in accordance with their natural psychophysiological preferences.

In the temperament classification "Priority" there is a fourth dichotomous pair of nervous subsystems, determining the priority of afferent or efferent subsystems in the auxiliary (non-priority) subsystem from the dichotomy "visceral / somatic" nervous subsystems. With its application, the number of temperament types increases from eight basic to sixteen integral types. This is due to the allocation in motor and sensory classical temperaments intuitive or tonic specialization of the auxiliary nervous subsystem. Correspondingly, in intuitive and tonic classical temperaments motor or sensory specializations of an auxiliary nervous subsystem are allocated. As a result, the following integral types of temperament are distinguished:

1. Motor right hemispheric (concrete) intuitive.
2. Motor right-hemispheric (concrete) tonic.
3. Motor left-hemispheric (abstract) intuitive.
4. Motor left-hemispheric (abstract) tonic.
5. Sensory right hemispheric (concrete) intuitive.
6. Sensory right-hemispheric (concrete) tonic.
7. Sensory left-hemispheric (abstract) intuitive.
8. Sensory left-hemispheric (abstract) tonic.
9. Intuitive right hemispheric (concrete) motor.
10. Intuitive right-hemispheric (concrete) sensory.
11. Intuitive left-hemispheric (abstract) motor.
12. Intuitive left-hemispheric (abstract) sensory.
13. Tonic right hemispheric (concrete) motor.
14. Tonic right hemispheric (concrete) sensory.
15. Tonic left hemispheric (abstract) motor.
16. Tonic left-hemispheric (abstract) sensory.

The allocation of sixteen types of temperament allows you to move to a deeper level of diagnosis of natural features of a person and, accordingly, to obtain more long-term and detailed forecasts of his behavior, more accurately distribute the roles in the team, etc.

3. Construction of the Natural Cycle of Activity

The similarity of the descriptions of the four classical temperament types of the "Priority" classification (Fig. 1) and the four activity styles according to D. Kolb's model has been noted by researchers and is confirmed by the high degree of correlation between them [35]. In particular, the motor (sanguine) type of temperament demonstrates a high consistency with the style of activity, which corresponds to the stage of acquiring new concrete experience in D. Kolb's model. Sensory (melancholic) type of temperament correlates with the style of activity associated with the stage of reflexive observation. The intuitive (phlegmatic) type of temperament correlates well with the style of activity related to the stage of abstract conceptualization. Tonic (choleric) type of temperament correlates with the style of activity related to the stage of active experimentation (realization of a new concept in practice).

The combination of D. Kolb's model and the four classical temperament types of the "Priority" classification forms one of the links of the telescopic model of the natural cycle of activity - the small telescopic model or the "2/4" model (Fig. 2). In this model, each stage of the activity cycle corresponds to a certain type of temperament of the "Priority" classification: the motor type of temperament corresponds to the stage of search, the sensory type to the stage of analysis, the intuitive type to the stage of synthesis, and the tonic type of temperament of the "Priority" classification to the stage of realization [34, 36-38]. The name of the model ("2/4") indicates the number of criteria (bases), according to which the stages of activity are allocated (the figure in the numerator of the fraction), and the number of stages of activity (the figure in the denominator of the fraction).

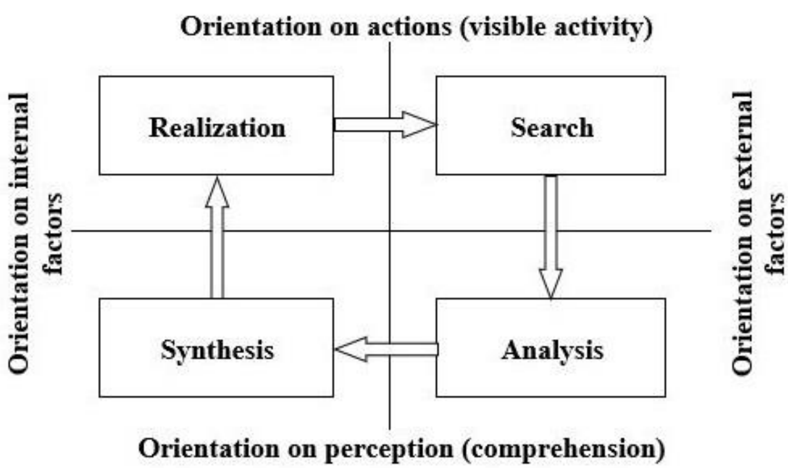

Figure 2.
Small telescopic model (model "2/4") of the natural cycle of activity.

The "2/4" model is the result of the integration of two approaches: the process approach, based on the functional stages of D. Kolb's model, and the typological approach (Priority classification). Such integration, synchronizing the neurophysiological characteristics of a person with the stages of the work process, allows to better understand and thoroughly describe the stages-components of the activity cycle, as well as to use the techniques of the original concepts to develop more advanced ones, providing increased accuracy of diagnosis and prognosis.

Comparison of the "2/4" model with J. Boyd's OODA cycle demonstrates their structural and functional similarities, in particular:

- The “search” and “realization” stages in the “2/4” model correspond to the “observation” and “action” stages of the OODA cycle. These stages are respectively information gathering and implementation.
- The “analysis” and “synthesis” stages in the “2/4” model represent two parts (“destruction” and “creation”) of the “orientation” stage of the OODA cycle. Analysis corresponds to the destruction of information and existing mental models, while synthesis corresponds to the creation of new models that more accurately reflect reality.
- The “decision” stage of the OODA cycle in the “2/4” model is absent as an independent component. Decision making takes place either at the synthesis stage (if the purpose of the cycle was to build a concept), where a new concept is accepted or rejected. Or decision-making occurs in the realization phase, where a new concept is used to select a specific solution.

The “2/4” model retains the possibilities and advantages of D. Kolb's and OODA models, but is supplemented with a hierarchical structure duplicating the hierarchical structure of the nervous system (from the “Priority” classification). The organization of stages-components of the model “2/4” in accordance with the hierarchical structure of the nervous system allows us to consider the model “2/4” as a model of the natural cycle of activity. And distinguished in the model “2/4” components (stages of the natural cycle of activity) are simultaneously and types of temperament, determining the natural specialization of the human nervous system for its optimal functioning at a certain stage. Thus, the motor type will be more effective at the stage of search, sensory – at the stage of analysis, intuitive – at the stage of synthesis, and tonic – at the stage of realization.

The widespread use of eight-stage models of the activity cycle, such as the 4MAT model, the extended learning model based on the experience of A. Kolb and D. Kolb, the Margerison-McCann model, as well as team roles of M. Belbin and others, indicates that four-stage models do not always provide the necessary depth and accuracy of forecasts and decisions. At the same time, the undisputed favorite among dichotomies for doubling the number of stages in a four-stage activity cycle is the priority of the cerebral hemispheres. This dichotomy is applied in the 4MAT model and is discussed by other activity cycle researchers. The validity of the application of this dichotomy is supported by the large number of research papers on interhemispheric brain asymmetry and its use in the “Priority” temperaments classification.

However, dividing each of the four stages of the activity cycle into two parts and building the resulting eight halves into a single closed chain, as realized in the 4MAT model, does not quite correctly reflect the interaction of the hemispheres. This interaction sometimes happens and sometimes it does not. It can be single or multiple. The left hemisphere may be the first to engage in interaction in some situations and the right hemisphere in some situations. In the well-known eight-stage models, this interaction takes place necessarily in each cycle, once, and even the sequence of hemisphere involvement is strictly specified.

To eliminate this unreasonable limitation, the interaction of the hemispheres in the cycle of activity should be reflected not by increasing the number of stages in the cycle, but by complicating (deepening) each stage. This approach allows for a more accurate modeling of hemispheric interaction, taking into account their variable interaction at different stages of the cycle. This option is implemented in the middle telescopic model (model “3/8”) of the activity cycle (Fig. 3), which has a more complex hierarchical structure that more accurately reflects the dynamic nature of the interaction of the cerebral hemispheres in the process of activity.

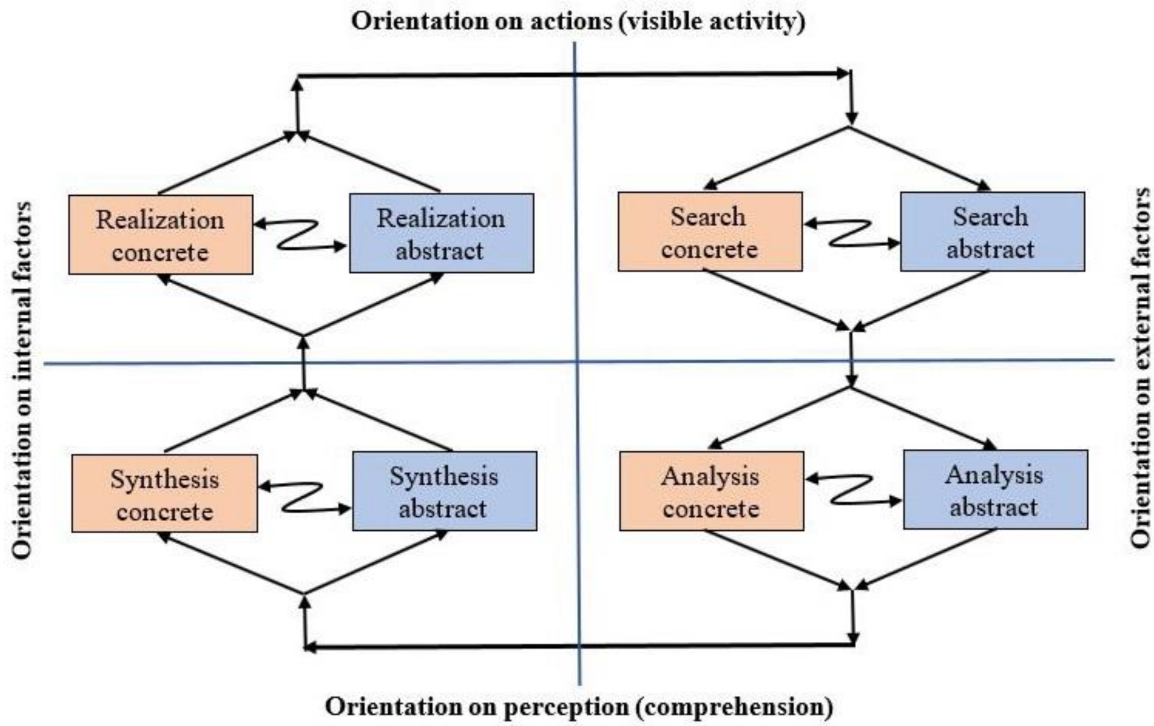

Figure 3.
Average telescopic model (model "3/8") of the natural cycle of activity.

Since the left hemisphere of the brain is associated with abstract and the right hemisphere with concrete thinking, the terms "abstract" and "concrete" are used in the names of the stages.

Relying on the hierarchical structure of the "Priority" temperaments classification, the eight components of the middle telescopic model of the natural cycle of activity can be detailed to the large telescopic model "4/16". The use of the fourth dichotomy allows each of the eight components of the "3/8" model to be divided into two parts. At the stages of search and analysis, the intuitive and tonic parts are distinguished, and at the stages of synthesis and realization, the motor and sensory parts are distinguished (Fig. 4). Deep detailing of the stages of the activity cycle makes it possible to highlight more subtle aspects, which reduces the probability of errors and increases the efficiency of activity.

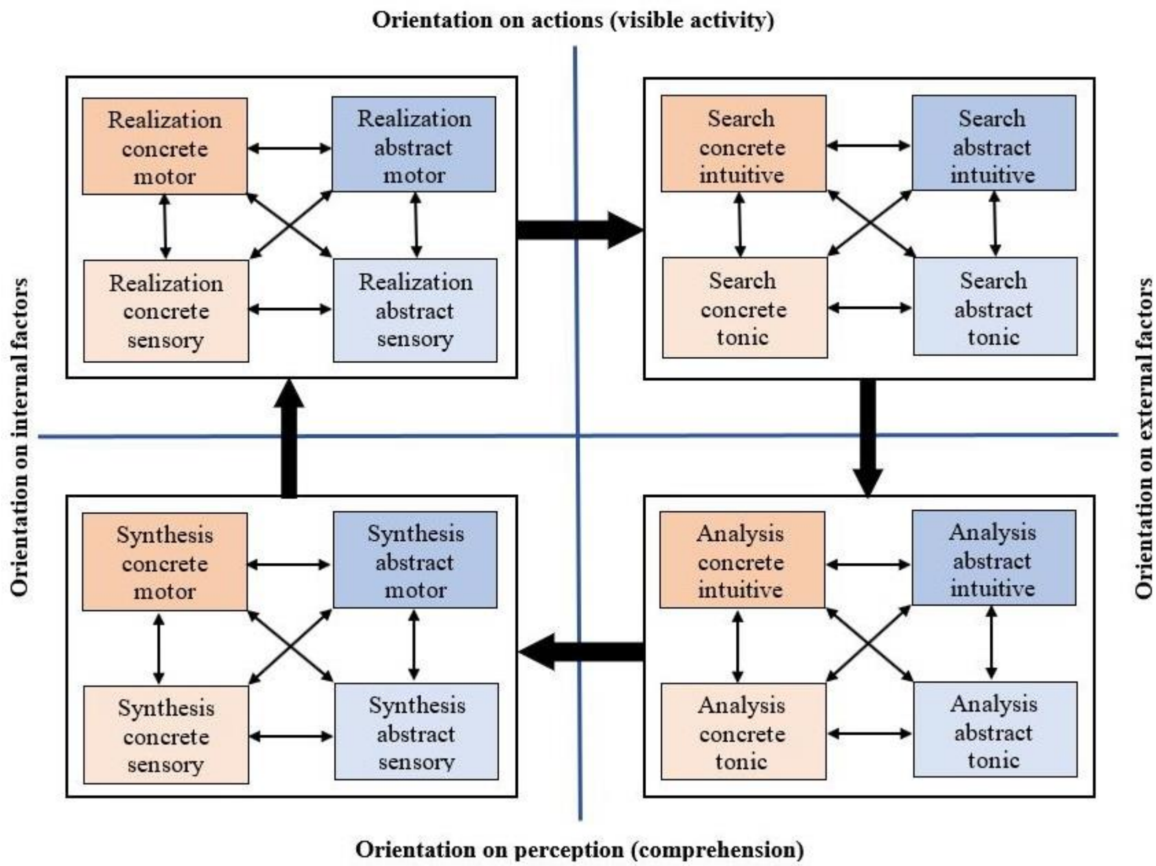

Figure 4.
Large telescopic model (model “4/16”) of the natural cycle of activity.

The telescopic model of the natural cycle of activity includes three separate links, which are independent models of activity (small “2/4”, medium “3/8” and large “4/16”) of different level of detail. The choice of a particular variant of the model depends on the degree of complexity of the problem to be solved, its urgency, the required accuracy of the forecast, etc. The small telescopic model “2/4” can be useful, for example, in training, while the large telescopic model “4/16” is more suitable for working with complex tasks requiring knowledge of many nuances.

Thus, the three private models (“2/4”, “3/8” and “4/16”) can be seen as successive steps of deepening the analysis: from the simplest (the “2/4” model) to more complex tools. The small telescopic model “2/4” stops at four stages of the activity cycle: search, analysis, synthesis, realization. Medium telescopic model “3/8”, distinguishing concrete and abstract thinking, draws attention to their interaction, which increases the accuracy of diagnosis and prognosis. The large telescopic model “4/16”, increasing the number of components of the activity cycle by another two times, allows working with the most complex tasks.

4. Conclusion

The conducted research was aimed at developing a natural activity cycle duplicating the principle of hierarchy inherent in the structure of the human nervous system. To achieve this goal was carried out:

- Search and analysis of scientific publications on the research topic covering various models of the activity cycle and their theoretical foundations:
- comparative and systematic analysis of known activity cycle models: the OODA cycle by J. Boyd; the experience-based learning model by D. Kolb; the extended experience-based learning

model by A. Kolb and D. Kolb; 4MAT model of learning styles B. McCarthy; Margerison-McCann model; team roles M. Belbin.
- Combining D. Kolb's model with the hierarchical structure of the human nervous system used in the "Priority" temperaments classification;
- Development of a telescopic model of the natural cycle of activity, including three links (levels of detail): small model "2/4", medium model "3/8" and large model "4/16";
- Comparison of the developed telescopic model with some known models of activity cycles, which allowed to confirm its practical applicability.

The presence of three levels of detail in the telescopic model of the natural activity cycle allows choosing one or another model (small "2/4", medium "3/8" or large "4/16") depending on the task at hand. As the level of detail (complexity) increases, the efficiency of the activity cycle increases. The small "2/4" telescoping model can be used for basic analysis. The medium telescopic model "3/8" deepens this analysis by accounting for interhemispheric interaction and allows for more accurate prediction of results. The large telescopic model "4/16" is used for a detailed (by taking into account additional characteristics) approach to the management of complex processes.

The use of the telescopic model of the natural cycle of activities will optimize labor processes, increase employee engagement and satisfaction, as well as labor productivity, which is especially important in conditions of staff shortage.

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