The principle of continuity, longevity and perpetuation of the life of human systems as a basis for the mathematical theory of human behavior and activity:

Part 1. Quantitative interpretation of the principle of continuity, longevity and perpetuation of human life [1]

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Abstract

All actions and different types of activities of people and human systems pursue one goal: with highest probability to ensure the continuity and longevity with highest quality of their oun life.

This suggests that the desire of human beings for the continuity and longevity of their lives can be turned into a scientific principle that can explain the behavior and activities of human systems of different scales, as well as predict their near and distant future.

Moreover, the principle of continuity and longevity of human life can also serve as an axiomatic basis for building an adequate mathematical theory of the life, behavior, and activity of human systems.

The present work is devoted to the construction of mathematical models of human behavior and activities based on the principle of continuity and longevity of life.

Introduction

The challenges facing humanity, in the form of overpopulation, depletion of natural resources, accumulation of non-disappearing garbage, ecological and other environmental problems, raise many fundamental issues related to the continuity and longevity of human life.

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Often the main reason for the difficulties in resolving such issues is the lack of a common scientific approach to the conceptual explanation of life, behavior and activities of humans and human systems and their management.

In this sense, a natural question arises about what can be a general principle in a conceptual sense that can just as successfully explain the life and activities of an individual, the structure of organizations and their dynamics, phenomena and processes at the state and civilizational level, and so on.

In other words, what should be the general principle of an axiomatic nature that can be applied to the explanation and management of the life, behavior and activities of the human system of an arbitrary nature?

Even superficial observations of human life and the activities of human systems show that their main desire is to ensure the continuity, longevity and systematic improvement of existing life.

According to a slightly different definition, the indicated desire, according to which people always want to achieve the maximum of their generalized benefit in all situations, is equivalent to the principle of the same egoism, but at the level of the human system or group of people, which at the same time implies the presence of intragroup altruism as a prerequisite for existence.

One side piece of evidence for this obvious claim is the fact that, on average, human history is a history of an increase in the duration and quality of human life.

In addition, another fact that speaks of the desire of people to the life continuation and its longevity is that a normal human system never tends to self-destruction, another thing is that due to circumstances, having no other choice, people accept their defeat or not having alternatives, they commit suicide, preferring non-existence to what they consider to be the worst existence.

Naturally, people prefer such continuity and longevity of life, which are accompanied by a steady increase in the level and quality of life.

To this end, people strive to acquire more and more property and values in the form of food, goods, finance, prestige, fame, security, success, victory and others that contribute to a better quality and standard of life.

The fact that the quantity of goods and values necessary for life is limited, and people strive to take over more and more of it, leads to competition, struggle and conflict between human systems.

All this happens in the conditions of big and small errors made by people, which accompany the activity of human systems everywhere.

The combination and analysis of the above-mentioned circumstances show that the idea of continuity, longevity and perpetuation of life has a general nature, through which one can explain and manage the life and activity of people and human systems.

In other words, if we consider a strategically complete part of the life and activity of a person or a human system, then the goals and behaviors of the people during the implementation of the latter must be in full agreement with the pursuit of continuity and perpetuation of life.

Such a conclusion allows us to raise to the level of a scientific principle the desire of people to make life as continuous and perpetuative as possible, on the basis of which a mathematical theory of the axiomatic nature of behavior and activity of human systems can be built.

Proceeding from such a general principle, a quantitative description of human life activity can be based on the fact that the need for the continuity, longevity and perpetuation of life is provided by the current actions of people and the activities of human systems.

All types of human activities are sequences of interrelated actions that have a beginning, a process and an end, and they also pursue certain goals.

Human life, and especially the life of human systems, can be viewed as a group of interrelated projects, in which individual projects are the training and education of people, their various types of work activities and, finally, the whole human life, with its beginning, course and end [1].

The same can be said about the human system of any scale and complexity, up to the levels of state and civilization, which also have a beginning, rise, decline and end.

Projects of various scales that accompany the life and activities of people and human systems may have specifications of varying degrees of clarity and concreteness, conscious and partially conscious goals.

Resources of a different nature and quantity can be spent on achieving these goals, as well as errors of different sizes and with different consequences can be made and, in addition, to achieve successful completion or failure of projects, and so on.

Consequences of the principle of continuity, longevity and perpetuation of human life

The principle of continuity, longevity and perpetuation of life as an axiomatic basis creates a chain of qualitative consequenses, the sequence of which is as follows:

1. Any human system seeks to ensure the continuity, longevity and perpetuation of its life with maximum probability.

2. The only means to ensure the high quality, continuity, longevity and perpetuation of human life are the goods and benefits of a biological and social nature, as well as various types of resources.

3. The scarcity and limited nature of goods and resources, and the aspiration of human systems to take over as much of them as possible, creates competition in all spheres of human activity in the form of struggle, tensions and conflicts.

4. In all forms of competition, the sole purpose of human systems is to emerge victorious and maximize overall generalized benefits.

5. Generalized interest unites all possible material and non-material benefits and values necessary for life, including territorial, financial, moral and many other types of benefits.

6. In order to beat competitors, humans and human systems must have or strive for maximum power and influence.

7. To achieve maximum power and influence, people strive to:

- Maximum wealth or, in relatively simpler cases, maximum possible property and belongings,

- The maximum strength and power, or in simpler cases, the largest possible local sphere of influence,
- The strongest possible ideological, spiritual and intellectual influence on others,

8. The influence and power of human systems serve the purpose of continuity, longevity and perpetuation of life due to the ability of people through their experience, knowledge and skills.

9. The capabilities of human systems can be multiplied by a variety of tools, ranging from simple tools that increase the physical capabilities of people to tools that enhance their intellectual capabilities.

10. As tools for large-scale human systems such as countries and states serve their infrastructure, transport routes and facilities, as well as their laws and institutional structure.

11. The capabilities of human systems are limited and in all areas of activity they have upper limits of feasible difficulties to be overcome in the process of life, and the approach to which sharply reduces the effectiveness of human activities [2].

12. Regardless of this circumstance, people, in order to achieve with the greatest probability of success and victory in the process of competition, act close to the upper limits of their capabilities, where both the risks of failure are high, and the chances of success and victories by finding radically new solutions.

13. Such behavior of people is fully justified by the fact that if they do not act to the best of their ability, the opponent will do so, thereby achieving a greater chance of winning the competition.

14. That is why the activity of people in overcoming new difficulties in the life process at the limit of their capabilities has been and remains the main source of human progress in the form of innovations and emergencies.

Structural representation of the course and lifespan of humans and human systems

If we consider the most ordinary course of a person's life, which is a sequence of decisions and actions, we will see that each step taken by a person is associated with the satisfaction of the next demand of life, for example, if a person is hungry, eats, is attacked, defends himself, the baby needs communication, he learns to speak, if a problem is assigned to a person, he tries to solve it, and so on.

To ensure the continuity and safety of their lives, people perform a series of actions that are biological or social in nature, including people's work activities and relationships with others.

An analysis of the various actions of human beings shows that they all pursue one goal: to contribute to the continuity, longevity and perpetuation of human life.

In general, for all varieties of human systems, the process of ensuring the continuity and longevity of life remains unchanged: at every step, life makes its next demand on a person or people who, based on their capabilities, in one way or another react to this demand, trying to achieve a subjectively understood success.

In other words, in order to satisfy the next demand of life, people, in pursuit of certain goals, spend various types of resources and, relying on their own experience, knowledge and skills, achieve specific results that may be sufficient or insufficient, and in some cases exceed the needs of life.

If we consider the life and activities of people from the point of view of balance and imbalance between the requirements of life and the abilities of people, then the following three options for their relationship are possible:

1. Human capabilities exceed the demands of life or

$$\text{Abilities of people} > \text{Requirements of life} \tag{1}$$

2. Human capabilities are equal to the demands of life or

$$\text{Abilities of people} = \text{Requirements of life} \tag{2}$$

3. The demands of life exceed the capabilities of people or

$$\text{Abilities of people} < \text{Requirements of life} \tag{3}$$

The obtained qualitative relations (1), (2) and (3) can be turned into mathematical equations and inequalities if we can quantitatively describe the requirements of life and the abilities of people based on their parametric representations.

The fact is that the demands of life can be represented by a set of descriptive parameters that describe the activities of people at a high level, and the capabilities of a group of people performing those activities by another set of parameters.

The combination of these two groups of parameters through the relations (1) (2) and (3) makes it possible to construct mathematical models of the life and activity of human systems in the form of equations and inequalities.

The simplest parametric representation and mathematical model of life's requirements to human systems

The successive necessities of life or the demands of life that people face differ from each other in their magnitude and difficulty of realization.

Actions to satisfy these requirements of life can be large or small, easy or difficult, that is, any human action or activity can be quantitatively described by its size or magnitude **W** and the difficulty of its practical implementation **D**.

In turn, the volume of activity that is put before people as a requirement of life, or its complexity $\mathbf{C_D}$ can be represented as the product of these two quantities.

$$\mathbf{C_D} = \mathbf{W} * \mathbf{D} \qquad (4)$$

This activity can be a work process, during which people produce different types of products, it can be a biological processes related to human nutrition, security, it can be a social movement that will generate freedom for people, or an unfree life, it can be a business rivalry that can lead to a fair market share between competitors, it can be a war that can give birth to victories, defeats, or peace, and so on.

From a quantitative point of view the role of a bridge between human activities and its results can play the value of **W**, each unit of which creates some kind of result or results.

In any area of human life, an activity **W** of an arbitrary scale produces or generates a corresponding result **R**, which in the simplest approximation can be represented as a linear function of **W**.

$$\mathbf{R} = \mathbf{K_R} * \mathbf{W}, \qquad (5)$$

where the $\mathbf{K_R}$ is the result produced or generated by a unit of human activity.

Hence, for the activity **W** one can obtain

$$\mathbf{W} = \frac{\mathbf{R*D}}{\mathbf{K_R}}. \qquad (6)$$

Taking this expression into account, for the complexity of life requirements $\mathbf{C_D}$ from formula (4) we will have

$$\mathbf{C_D} = \frac{\mathbf{R*D}}{\mathbf{K_R}}. \qquad (7)$$

Parametric representation and simple mathematical model of people's reaction to the demands of life

To satisfy the requirements of life and to give adequate answers to them, people perform certain actions and deploy activities of various scales.

In the process of life, each person has the ability to carry out activities, which in general can be called the efficiency of human activities or in simple cases of people work, human productivity **P**, which is the amount of work done by a person per unit time.

This means that a person, during a time interval **T**, acting with productivity **P**, can perform an activity with complexity $\mathbf{C_S}$:

$$\mathbf{C_S} = \mathbf{T} * \mathbf{P} \qquad (8)$$

In the case where the human system is not a person but a group of **N** people acting together, the value of $\mathbf{C_S}$ will be determined by the following expression:

$$\mathbf{C_S} = \mathbf{T} * \mathbf{N} * \mathbf{P}\,. \qquad (9)$$

There are two possible interpretations of this expression.

First, if we take into account that the value $\mathbf{T} * \mathbf{N}$ is the effort **E** applied by **N** people in a period of time **T**, then for the value $\mathbf{C_S}$ we will have

$$\mathbf{C_S} = \mathbf{E} * \mathbf{P} \qquad (10)$$

According to this interpretation, the value $\mathbf{C_S}$ is the amount or volume of human activity.

On the other hand, $\mathbf{N} * \mathbf{P}$ is the total efficiency or productivity of the group of **N** people, which can be interpreted as the power **H** of that human group or human system, and as a result we will have

$$\mathbf{C_S} = \mathbf{H} * \mathbf{T} \qquad (11)$$

Here the value **H** is interpreted as the power of social activity of the human system.

Following the same logic, the value $\mathbf{C_S}$, defined by expression (11) as the product of social power and time, can be interpreted as social energy spent on the activity of the human system.

Mathematical models of the activity of human systems based on the principle of continuity, longevity and perpetuation of life

Conditions (1), (2) and (3), considered above and reflecting the continuity, longevity and perpetuation of life in combination with parametric mathematical models of the requirements of human life and people's capabilities, make it possible to build mathematical models of human life and activities, including models of their development, decline and their unchanging and a balanced life.

Let's start considering such mathematical models with the simplest case when the human system lives in conditions of unchanging or balanced life in accordance with the equality $\mathbf{C_S} = \mathbf{C_D}$.

For this purpose, substituting expressions (4) and (9) into the condition $\mathbf{C_S} = \mathbf{C_D}$, one can obtain the following equation

$$\mathbf{T} * \mathbf{N} * \mathbf{P} = \mathbf{W} * \mathbf{D}, \qquad (12)$$

It is a parametric equation, which is a mathematical model of the balanced activity of people, combining the requirements of life with the proposal of people to realize these requirements.

Taking into account expression (7), which represents the results of human activity, from equation (12) it is possible to obtain a new equation of equilibrium between human activity and its results.

$$\mathbf{T * N * P = \frac{R*D}{K_R}} \tag{13}$$

The numerical values of all parameters of equations (12) and (13), which at the system level represent the activities of people, can vary within certain limits.

Each set of numerical values of these parameters, for which equations (12) and (13) are correct, represents a specific state of the human system and its activity.

That is why these equations are typical equations of state, which are similar to the equations of state widely used in physics and mathematical economics [3, 4].

The course of life, its continuity, longevity and perpetuation is ensured by the use of different resources and different skills of people, thanks to which they generate the results necessary for life.

This means that mathematical equations that adequately describe the life of people should unite the chain "resources - people's abilities - the goals they pursue - the results obtained."

If we consider the meaning of the equations of state (12) and (13) from this point of view, we will see that they combine the resources necessary for human activity, the skills of people and the results of their activity.

The details of the problems considered in this work will be presented in the second part of the work, and the methodological and mathematical aspects of these problems can be found in more detail here [5].

Conclusions

1. In light of the principle of continuity, longevity and perpetuation of the life of human systems, any action or activity of people can be adequately explained and substansied.

2. The course of human life is a sequence of human actions corresponding to the sequence of life requirements and, ultimately, to the principle of continuity, longevity and perpetuation of human life.

3. The demands of life and the actions of people with each other can be in states of balance and imbalance, which correspond to the modes of development, decline and equilibrium of the life of human systems.

4. Requirements of life and the actions of people performed in response to them can be quantitatively described using parametric means, on the basis of which they can be represented in the form of simple mathematical models.

5. Representation of the requirements of life and people's reactions to them using mathematical models also allows to quantitatively describe the very principle of continuity, longevity and perpetuation of human systems in the form of equations or inequalities of their state.

6. The equations and inequalities of the state of the activities of human systems combine various resources that ensure the continuity and safety of their life, the abilities and capabilities of people, as well as the goals and results of human activity.

Future research

This paper deals with issues of a fundamental nature related to the principle of continuity and duration of life and activity of human systems, including a quantitative interpretation of this principle and some of its simple applications.

These applications relate to the case when the life and activities of people have an unchanged and balanced charcter and proceed in a homogeneous deterministic environment.

But in fact, the life and activities of people proceed in random, nonlinear, dynamic conditions, which will constitute the main content of future research.

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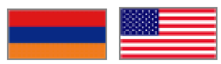

Dr. Pavel Barseghyan is a consultant in the field of quantitative project management, project data mining and organizational science. Has over 45 years' experience in academia, the electronics industry, the EDA industry and Project Management Research and tools development. During the period of 1999-2010 he was the Vice President of Research for Numetrics Management Systems. Prior to joining Numetrics, Dr. Barseghyan worked as an R&D manager at Infinite Technology Corp. in Texas. He was also a founder and the president of an EDA start-up company, DAN Technologies, Ltd. that focused on high-level chip design planning and RTL structural floor planning technologies. Before joining ITC, Dr. Barseghyan was head of the Electronic Design and CAD department at the State Engineering University of Armenia, focusing on development of the Theory of Massively Interconnected Systems and its applications to electronic design. During the period of 1975-1990, he was also a member of the University Educational Policy Commission for Electronic Design and CAD Direction in the Higher Education Ministry of the former USSR. Earlier in his career he was a senior researcher in Yerevan Research and Development Institute of Mathematical Machines (Armenia). He is an author of nine monographs and textbooks and more than 100 scientific articles in the area of quantitative project management, mathematical theory of human work, electronic design and EDA methodologies, and tools development. More than 10 Ph.D. degrees have been awarded under his supervision. Dr. Barseghyan holds an MS in Electrical Engineering (1967) and Ph.D. (1972) and Doctor of Technical Sciences (1990) in Computer Engineering from Yerevan Polytechnic Institute (Armenia).

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