

УДК 301

## A Theory of Correspondence of Proportions and Functions in Social Systems

**Andrey Davydov\***

*Institute of Sociology, Russian Academy of Sciences,  
Krzhizhanovskogo st., 24/35, b.5, Moscow, 117259 Russia <sup>1</sup>*

Received 1.09.2007, received in revised form 1.12.2007, accepted 15.01.2008

---

*The basic postulates of this theory, which unites proportions in statics and dynamics, explain their ties with social system Junctions. The theory has been verified. Its value is supported by concrete examples, not only for forecasting social processes and determining optimal correlations in society, but also for developing a general theory of systems.*

*Keywords: theory, social systems, functions, proportions.*

---

### **Introduction**

The proportion shall be determined as the balanced ratio of the system parts [21 p. 162]. Formally this proportion may be written up as follows:

$$a : b = c : d,$$

where a, b, c, d - parts of the system.

The parts of a system may be social groups, products of their material and spiritual activities, as well as periods of the system development cycles. Harmony ensures stability and constancy of structure, functioning and development of the social system [8].

The function is a method for achievement of the goal of social system [19,25]. Since the social systems are characterized by the principle of unity of structure and functions, it may be expected that certain functions will correspond to various other functions. At the same time the analysis of existing theories of social systems [15,19,25,27,29,etc] showed that the problem of

harmony of proportions and functions was not elucidated in them.

The analysis we carried out (Social Sciences Citation Index) for the period 1980-2005 gave a possibility to reveal the following reasons of undevelopment of this problem.

First of all there are no theoretically and empirically grounded sets of proportions and functions, and second, the study of functions was not carried out at the level of concrete proportions. Using the system paradigm as a base, we developed the theory of correspondence for proportions and functions, the basic postulates and consequences of which are presented in this article.

### **Postulates of theory**

Traditionally the study of proportions obtained the widest propagation in art, and in particular, in architecture. Let us remember that the so-called system of the double square is successfully applied in architecture and unites

---

\* E-mail address: isras@isras.ru

<sup>1</sup> © Siberian Federal University. All rights reserved

the following proportions: 1; 1.237; 1.618; 2.236; 3.237; etc [16, 32]. Is it possible, however to apply these proportions to the social system? We consider that it is possible and for the following reason. First of all, proportionality is the general system property [28] and second, some proportions of the double square system are successfully used in various sociological theories, for example, “the theory of critical mass” [20, 22], mobilization of resources [17] thresholds of collective behavior [14], discretion [23]. We also believe that the proportions are bound up with certain functions of the social system, since it follows from the system principle of unity of the structure and functions [19, 25]. In accordance with the postulates of system analysis, we shall designate the correspondence between the proportion and the function as the social system functioning mode. It also follows from system concepts, that the social system is characterized by the two general functions - preservation and development [19, 25]. In this case an equal number of proportions corresponds to each function. This postulate follows numerous observations. For example, the equal ratio of sexes and population where the male performs the function of development, and the female the function of preservation, the equality of volume of cerebral hemispheres, each of which performs different functions [1] and so on.

When constructing the theory we used one of the system axioms, in accordance with which the possibility of the system development is decreased with an increase of orderliness [28]. This means that the higher the proportion value, the more likely it is to perform the system preservation function. In addition, we based our theory on the fact that the social system, like any other system, has three basic components: elements, properties and ratia, transitions between them being performed either from elements through the properties to the ratia, or vice versa from the ratia to the elements [31]. The above-mentioned preconditions were taken as fundamental to the theory, which is presented in Table 1 in the form of progressions. In Table 1 the parts of the progression are given in the form of decimal fractions, but they may be presented by integers. For example, the progression for the function of development of properties will correspond to the Fibonacci series (0,1,1,2,3,5,8, ...). It was determined that this set of numerical values represents the law of structural genesis of various systems [28].

Proceeding from the analysis problems it is sometimes much more suitable to deal not with relative values, but, for example, with percentage distributions. To calculate percentage distributions it is necessary to take a proportion which is typical for the concrete regime and to construct the geometrical progression for the required number of

Table 1. Correspondence of proportions and functions in social systems

Proportion (denominator of progression)	Members of progression	Function
1.237	1.237; 1.530; 1.893...	Development of elements
1.618	1.618; 2.618; 4.236...	Development of properties
2.236	2.236; 4.999; 11.179...	Development of relating
3.237	3.237; 10.478; 33.913...	Balance of functions of development and preservation
4.236	4.236; 17.944; 76.009...	Conservation of relations
8.434	8.434; 71.132; 599.930...	Conservation of proportions
16.857	16.857; 284.158; 4790.059...	Conservation of elements

parts. Let us assume that it is necessary to find the respective percentage distribution for three parts of the function of development of elements. First let us sum up the progression members:  $1.237 + 1.530 + 1.893 = 4.66$ . Then let us find the share of each member and multiply by 100 per cent ( $1.237 : 4.66) \times 100 = 26.5\%$ . As a result we obtain the following percentage distribution for three parts  $40.7 : 32.8 : 26.5$ , in which the ratio of large share to a smaller one corresponds to the denominator of the progression for the element's development function. The proportional relations for any function and numbers of parts are calculated in a similar way.

### Verification of theory

Verification of the theory was carried out by several methods. First of all we used the already known social proportions and respective functions, second, we studied the materials of national and international statistics for a long period and third, we drew on the already known general system proportions to prove it. Since the limited length of this article does not allow the possibility to demonstrate all the proofs obtained, we shall briefly note only four regimes: development of properties and relations; the balance of function of preservation of elements, which play the most important role in the constructing, functioning and development of social systems. Proportion 1.618 is a function of development of properties. This proportion is known in science and art as the golden proportion. It is proved in numerous papers that it characterizes the wholeness between the part and the whole in natural systems [28, 32, et al.]. Our studies showed that the golden section in social systems also reflects the origin of new system property - the wholeness [3,4,5,6,7,8,9,10]. Proportion 2.236 is the function of development of relations. The main argument here is the numerous theoretical and empirical investigations dedicated to monopolization of the

market. So, in world practice it is considered to be proven, that monopolist relations arise if the share of products of one firm in the market begins to exceed 31% [33]. Proportion 3.237 is the balance of development and preservation functions. The investigations show that the optimum share of small-scale and average-scale businesses - generators of innovational activity - are on average equal to 25%, and the share of large firms basically oriented to preservation of the achieved is equal to 75% [34]. The same proportion is observed in respect to the ratio of natural and social analogues of preservation and development, in various social indices, for example, traumatism [18], intellect [13], birth rate of gifted people [2], etc. Proportion 16.857 is a function of preservation of elements. Our study testifies that this ratio is typical for the optimum share of social minorities, for example: unemployed people, drug addicts, traumatics, those who are dismissed from enterprises, homosexuals, lesbians etc., who perform the function of keeping up the required variety of elements in the social system [11]. These and many other arguments we obtained in the process of verification testify convincingly that there actually is a correspondence between these proportions and functions. Thus our theory was confirmed.

### Applications of theory

The proposed concept gives a possibility to reveal the social system functioning regime. Our investigations of various social indices for various countries of the world for long periods testify that the proportion 1.237 is most frequently met in social systems. It corresponds to the function of development of elements. For comparison, in musical systems we observe the domination of function 1.618 [2], and in architectural systems - 4.236 [32]. We determined that different functions dominate in various subsystems of society. For example, the function of properties development

predominates in value subsystems, the relations development function dominates in demographic subsystems and the function of development of elements prevailed in Russia in 1985-1989. On the basis of this theory it is possible to forecast various events. For example, applying the Fibonacci series (0,1,1,2,3,5,8,13, ...) we succeeded (with an accuracy of up to 5%) in describing basic social and economic reforms in Russia for the period 1540-1985 and to forecast the approach of new reforms in 2005-2008 in further perspective [9]. It is also possible to forecast crises by some indices. Thus, for example, if the proportion of people satisfied and unsatisfied by labor comes to proportion 1.237, i.e. the share of satisfied people is equal to 55%, this testifies the crisis in a labor collective [12]. Applying the regularity of successive replacements of regimes in the social system we had discovered we succeeded in 1989 in forecasting shares of persons participating in voting in 1990 within a one per cent accuracy [7]. Using the theory of social proportions as a base, it is possible to determine exactly the optimal shares by various indices. For example, the share of women in the economically active population in the normal functioning of society will be equal to 38%, the ratio of general coefficients of birth and death rates is 2.618, the share of optimists is 30.9%[4], the share of male suicides 75%[10], the unemployment level is 7%[5], etc. Since the theory of social proportions is based on the limit general system principles, its conclusions may also be applied to natural systems. At first, the stable natural proportions receive the functional interpretation. For example, it was determined that the succession of preferable dimensions of rocks in a wide range of scales - from bodies in the solar system to quartz glass globules -forms a geometric progression with index 3.5 [26]. Let us remember that proportion 3.2 in our theory reflects

the balance of functions of preservation and development. In the second place, considerable progress may be achieved in the study of natural cycles. For example, the sun's activity has the following cycles: 11 years, 22 years, 55 years, 80-90 years and some other [30]. This succession is well coordinated with the initial fragment of the Fibonacci series (13,21,34,55,89, ...). Let us remember that in our theory the Fibonacci series, based on the proportion 1.618 corresponds to the function of development of properties.

Consequently the sun, as many other subsystems, for example the economic, functions in the same regime - the regime of properties development. Moreover, the results obtained allow us to propose that the sun's activity may have longer cycles, based on Fibonacci series, which cannot be observed at present due to lack of data. These are cycles with periods of 987 years, 1597 years, 2584 years and so on.

### Conclusion

The theory allows one to see the dominating function of the social system as a whole and functions of its subsystems, to determine the optimum proportions by various social indices and to forecast the approach of events which are of importance for the society. The results we obtained showed that the society is an open living system, characterizes by the correspondence of various proportions and functions. In general the mechanism of this correspondence does not cause doubts, since it is self-organizing due to feedback, determined by the process of adaptation to the surrounding medium and other subsystems of society. However, the concrete quantitative regularities, determining these processes of self-organization, shall be a subject for subsequent investigations.

### References

1. V.A. Geodakyan, "Sistemno-evolyutsionnaya traktovka assimetrii mozga", in *Sistemnye issledovaniya. Ejegodnik*, ed. by V.D. Gvishiani; V.A. Geodakyan., "System-evolutional interpretation of brain asymetry", in *System studies. (Yearbook)*, ed. by V.D. Gvishiani (Moscow: Nauka, 1986), pp. 355-376.
2. L.N. Gumilev, "Biosphere and consciousness impulses", *Prirode*, 12 (1978), pp. 100-110.
3. A.A. Davydov, "Is there a measure for social harmony?", *Social studies*, 5 (1988), 72-74.
4. A.A. Davydov, *Methodological manual on measurement of structural disharmony of social systems* (Moscow: ISAN, 1990).
5. A.A. Davydov, "Optimal level of unemployment in the USSR", *Social studies*, 12 (1990), 37-42.
6. A.A. Davydov and I.A. Sadovskaya, "How many happy people are in the World?" *Vestnik AN SSR*, 4 (1990), 89-93.
7. A.A. Davydov and I.A. Sadovskaya, "Perestroika and some peculiarities of public opinion", in *Social opinion under conditions of perestroika: problems of formation and functioning*, ed. by V.G. Britvin (Moscow: Institute of Sociology of the Academy of Sciences of the USSR, 1990), 60-68.
8. A.A. Davydov, "On wholeness of social systems", in *Wholeness of social systems*, ed. by A.A. Davydov (Moscow: Institute of Sociology of the Academy of Sciences of the USSR, 1991), 6-26.
9. A.A. Davydov, "Periods of cycles in social systems", in *Wholeness of social systems* ed. by A.A. Davydov (Moscow: The Institute of Sociology of the Academy of Sciences of the USSR, 1991), 26-41.
10. A.A. Davydov, "Suicide, sex and golden section", *Social studies*, 5 (1991), 99-102.
11. A.A. Davydov, "Optimum share of social minorities", *Social studies*, (In press).
12. A.A. Dragunsky and V.Ya. Krasnikovsky, "On measurement of social tension at the enterprises of coal industry", *Methods of social studies*, ed. by Yu.N. Tolstova (Moscow: Institute of Sociology of the Academy of Sciences of the USSR, 1989), 8-11.
13. N.P. Dubinin, L.L. Karpets and V.V. Kudryavtsev, *Genetics, behaviour, responsibility* (Moscow: Politizdat, 1989).
14. M. Granovetter, "Threshold Models of Diffusion and Collective Behavior", *J. of Mathematical Sociology*, 9 (1983), 165-179.
15. A.F. Hanken, *Cybernetics and Society: An Analysis of Social Systems* (Tunbridge Wells: Abacus Press, 1981).
16. A.V. Ikonnikov and G.P. Stepanov, *Fundamentals of architectural composition* (Moscow: Art, 1971).
17. J.C. Jenkins, "Resource mobilization theory and the study of social movements", *Annual Review of Sociology*, 9 (1983), 532-544.
18. M.A. Kotik, *Psychology and safety* (Talinn: Valgus, 1981).
19. N. Luhmann, *Soziale Systeme: Grundrifi einer Allgemeinen Theorie* (Frankfurt a. Main: Suhrkamp, 1984).

20. M. Markus, "Toward a "Critical Mass". Theory of Interactive Media", *Communication Research*, 14 (1987), 491-511.
21. M. Marutaev, "Harmony as the nature regularity", in *Golden section*, ed. by I. Sh. Shevelev, M.A. Marutaev and I.A. Shmelev (Moscow: Stroiizdat, 1990), 130-233.
22. G. Marwell, O. Pamela and P. Ralph, "Social Networks and Collective Action: A Theory of Critical Mass III", *American Journal of Sociology*, 94 (1988), 502-534.
23. R. Mayntz, "Social discontinuity", *Interdisciplinary Science Rev.*, 14 (1) (1989), 4-15.
24. I.V. Mokin, "Integrity in dynamics of Soviet society", in *Integrity of social system*, ed. by A.A. Davydov (Moscow: Institute of Sociology of the Academy of Sciences of the USSR, 1991), 50-60.
25. T. Parsons, *The Social System* (New York: Academy Press, 1951).
26. M.A. Sadovsky and V.F. Pisarenko, "Similarity in geophysics" *Priroda*, 1 (1991), 13-23.
27. M.I. Serov, *Principles of organizing social systems* (Kiev-Odessa: Vyshaya shkola, 1988).
28. E.M. Soroko, *Structural harmony of systems. Science and technology* (Minsk: Nauka i tekhnika, 1984).
29. J.N. Warfield, *Societal Systems: Planing, Policy and Complexity* (New York: John Wiley, 1976).
30. Yu.I. Vitinsky, M. Kopetsky and G.V. Kuklin, *Statistics of sportforming activities of the Sun* (Moscow: Nauka, 1986).
31. A.I. Uemov, *Things, properties, relations* (Moscow: Izd-vo AN SSR (Publ. of the Academy of Sciences of the USSR), 1963).
32. I.Sh. Shevelev, I.A. Marutaev and I.A. Shmelev, *Golden section* (Moscow: Stroiizdat, 1990).
33. V. Tsepelik and A. Yakovlev, "Quantitative characteristics of monopoly", *Problems of Economy*, 6 (1990), 38-46.
34. J. Zoltan and B. David, *Innovation and Small Firms* (Cambridge, Mass: The MIT Press, 1990).