

Global Society as Singularity and Point of Transition to the New Phase of Social Evolution

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In this article social evolution is considered as a process consisting of three phases: adaptive, structural and cognitive, which are separated by two phase transitions or by two singularities – the neolithic and the global. The mechanism of social evolution at these phases is different and is based on different institutional means of cognition and competition. At the current structural phase, competition of individuals leads to inequality, and competition of societies leads to extension of societies. Social inequality and exploitation of the periphery become institutional tools for the development. The expansion of societies and evolutionary limitations of its growth lead to life cycles of societies. The maximum size of society increases in the process of evolution and tends to cover all humankind. The Global Society is a final point of structural evolution, and transition to it is singularity. It will be a metamorphosis of the society's nature. The mechanism of further social evolution at the cognitive phase will rely directly on individual's need for cognition and self-realization, and not on the special social institutions. Mathematical model of the primary transformations dynamics at the structural phase is described by the equation $T(n) = -11214 + 1893n$, where $T(n)$ is the moment of evolutionary transformation, and n is the ordinal number of transformation. Global singularity is predicted by this model in AD 3930.

Keywords: social evolution, phase of evolution, singularity, global society, sociogenesis.

The notion of 'singularity' has different meanings. One is purely mathematical, in this case we denote discontinuity in a function where its value rushes to infinity and becomes indefinite. On the other hand, the notion of 'singularity' is used as a metaphor for the initial, final or trigger state of a process when its properties are also indefinite, e.g., 'Big Bang', 'black hole', etc. In this case, we are more interested in the nature of event, and not at what moment it happened. I apply the notion of singularity to social evolution in this metaphoric sense, although the article proposes a mathematical model of social evolution and explains how this process will come to a singularity not in a mathematical limit's sense.

Scientific trend in social studies leads to a wide use of the notion of singularity in the math sense. Indeed, modern society faces acceleration of changes. The extrapolation of some current trends indicates that the rate of changes has mathematical singularity.

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There are a number of its interpretations: technological singularity (Kurzweil 2005), demographic singularity (Foerster *et al.* 1960; Kapitza 2006), evolutionary singularity – a topic frequently touched on by Russian historians and evolutionists (Snooks 1996; Diakonoff 1999; Panov 2005; Nazaretyan 2016). Different estimates of singularity's moment give a similar result – the first half or middle of the 21st century (Nazaretyan 2016). For illustration, let us consider the interpretation of ‘planetary evolution’ by hyperbolic curve (see Fig. 1) known in Russian scientific community as ‘Snooks-Panov vertical’ (Panov 2005; Nazaretyan 2016). This is a chain of geological, biological, social and technological transformations presented as sequence of phase transitions (revolutions), which is described by equation

$$t_n = t^* - T / \alpha^n, \quad (\text{Eq. 1})$$

where t_n and n are the moment and the ordinal number of phase transitions (revolutions); α – coefficient of evolution acceleration, showing in what ratio the next interval between revolutions is shorter than the previous one; T – duration of the entire time interval; t^* – the point (moment) of the singularity at which period between phase transitions tends to zero. This singularity is interpreted either as a social catastrophe or as a transition of society into a new unknown quality (Nazaretyan 2016).

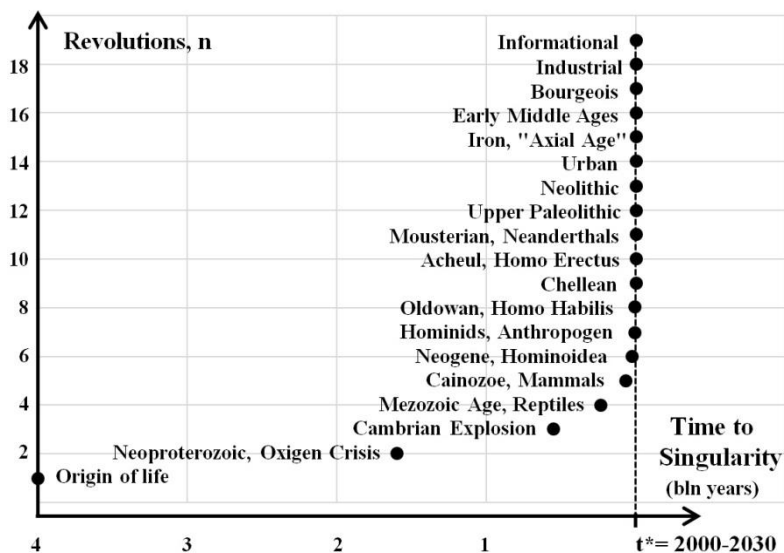


Fig. 1. Planetary evolution

Source: Panov 2005.

Yet, such an alarmist extrapolation is criticized. The Russian scientist Andrey Korotayev, who makes extensive use of mathematical methods in historical studies, argues (Korotayev 2009, 2015) that none of the real processes comes to a singularity. Processes tend to develop according to the S-shaped logistic curve, and we may better use the notion of a ‘singularity zone’ as a metaphor of a phase transition to a new state of process.

Mathematical interpretation of singularity requires a rigorous parameter, the same over the entire measurement range, for example, the *number* of people for demographic growth (Foerster *et al.* 1960) or the *number* of transistors per integrated circuit for techno-

logical growth (Moore 1965). The concepts of technological and planetary singularity do not satisfy this requirement of rigor, because they only technically measure time intervals, but in fact arbitrarily combine dissimilar transformations: the Cambrian explosion, the appearance of primates, the urban revolution, the appearance of electricity, the digital revolution, *etc.* Strict mathematical operations with non-strict values of events do not allow us strict formulation of mathematical singularity, neither biological, nor social, nor even technological. Besides, when calculating intervals this way, we exclude from consideration society itself and the nature of its transformation in a possible true singularity.

Recognizing the fact of technological changes acceleration, I will focus on the nature of social evolution and direction of social changes in attempt to understand *what* social novelty may arise in a singularity, rather than *when* it may happens. We need a better understanding of the comparative significance of evolutionary events (transformations), such as the Neolithic, Urban and Industrial revolution, which we are going to involve in mathematical speculation.

Singularities and Phases of Social Evolution

Let us first consider social events, which we could understand as singularities, revolutions, *etc.*

There is a question of whether we can use the notion of ‘event’ to characterize long and stepwise transformations such as emergence of *Homo sapiens* or Neolithic transition? Yes, we can. It is conditional. In fact, there are no events in nature; they are only our concepts of changes. The ‘moment of event’ is an ideal notion, the same as geometric notion of a point. We always have to provide a definition of what we consider as an event at this time interval. For instance, the appearance of *Homo sapiens* and the beginning of its social evolution can be understood as an event only within a larger scale process, *e.g.*, within the Big History perspective (Christian 2005). However this ‘event’ can be considered as a long process in the scale of the hominids' evolution.

Thus, singularity is a metaphor for the appearance of a process of a new nature or a transition from one process to another. We just should not mix the processes of different scales and maintain consistency between events and process of each scale. For example, the social evolution of humankind has only two singularities – the initial and the final. However, if we are able to distinguish between different subprocesses within this evolution, then we can understand phase transitions as singularities of these smaller scale subprocesses.

The *initial singularity* of social evolution is a ‘moment’ of a new phenomenon appearance – symbolic content of consciousness. Content development is a new type of evolution. One can localize separation of symbolic evolution from biological between 200,000 and 40,000 BC.

Human being, from this moment on, gets the ability to infinitely abstract and complicate ideas and accumulate knowledge. Human beings sequentially adapted more complex concepts to reality. Concepts have passed selection through practice and can be interpreted as ‘memes’ – gene analogs (Dawkins 1976). Evolution of symbolic content is a process of deeper and more complete understanding of reality and of human being place in it. To a certain extent, social evolution is identical to Cognition.

Social Evolution \equiv *Cognition*

Evolution of notions proceeds in all spheres of human beings activity – production and ideological, because all human interactions have symbolic component (Mead 1934). By the way, Marx' economic reductionism stems precisely from the fact that he ignores this symbolic component of all actions. For example, he relies on the idea that the main difference between humans and apes is ability to produce (Marx 1987), rather than ability to create new symbolic meanings. Of course, ideas are tied to material practices, especially in social (collective) form such as social consciousness, but in this way we can only explain conservatism of idea-practice bundle, but not their development.

Tools and technologies have not evolved by themselves; they are artifacts of people's representations or traces of ideas' evolution in these areas. Social relations also have not evolved by themselves. Relations are reproduced by people in the process of actualization of their representations about how to act. In order to change the actions, a person must first ideate a new action. Human being in all aspects of rational activity operates with meanings; thus social evolution is evolution of meanings that are materialized in artifacts and social structures (Dobrolyubov 2012a).

Relation between material and ideological sphere of human activity is not cause-and-effect; this relation is correlative. Technologies and ideologies correlate through cognition, which is common to them. People conceptually cognize and practically master reality. They not only improve material technologies (tools, weapons, building construction, *etc.*), but they also change understanding of reality and, most importantly, change their attitude to reality and attitude to their own place and role in it, *i.e.*, they change their values and evolutionarily elevate the status of a human being.

Human beings have sequentially displaced supernatural causality out of cognized phenomena; they complicate understanding of natural phenomena and representation of supernatural beings behind phenomena (spirits, totemic deities, gods, God). Along with that, they alter their own role in dealing with supernatural essence. The significance and value of a human being in his own understanding has increased in the course of evolution. Religious, moral and social concepts and, accordingly, social interactions became more humanistic and individualistic. The autonomy of human beings within society was gradually growing; means of social order maintenance were going through humanization; ways of coercion to labor gradually become less rigid (Dobrolyubov 2012a).

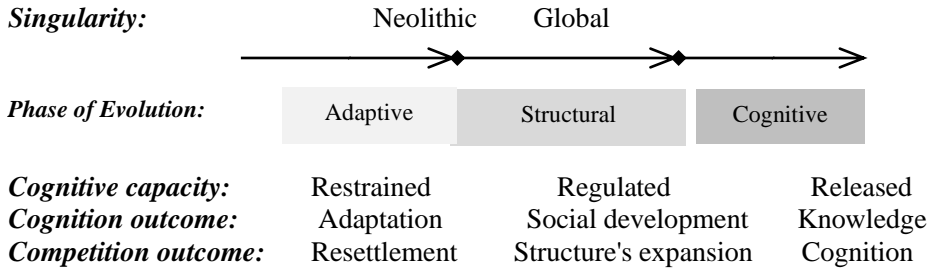
However, within this process we can distinguish different *social mechanisms* that have pushed forward cognition and changes in technologies and ideologies.

The individual desire for cognition is an aspect of a broader contradictory need for immediate self-realization. However, in a social (not individual) form, cognition is mediated by institutionalized social interactions that contain individual and group competition and cooperation. Institutional way of their realization is an evolutionary mechanism of cognition and development.

One may recognize three types of such evolutionary mechanism and three phases of social evolution – *adaptive*, *structural* and *cognitive*. These phases are separated by two singularities – the Neolithic transition of gatherers/hunters bands to a settled society and the Global transition of multinationals' social structure to a single society. Both phase transitions expel the previous mechanism of development and introduce the other. These mechanisms use different social means for competition-cooperation and different social means for cog-

dition. In fact, these are three different evolutions at these phases, in which course different features evolve. Put it simply, one can say that adaptive skills evolved in the first phase, social structure is evolving in the contemporary phase, and after transition to a single global society only knowledge and technology will evolve.

Singularity:



The Adaptive Phase of Social Evolution

The *Cognition* was not an explicit and conscious type of activity in gatherers/hunters bands; it was not demanded and not stimulated by social institutions. Moreover, there was an 'ideological' barrier in consciousness for change of practice. Beliefs, superstitions, taboos, rituals, *etc.* fixed in mind practices that already existed. Such fixation happened due to the weak role of rationality and instinctive reliance on the proven solutions. The weakness of rationality was expressed in an ensoulment (animation) and mystification of all objects of nature. The human being put himself in a servant position in regards to supernatural powers, which, as he believed, were behind objects and had a legitimate arbitrariness and power over events and human destiny. Human being should rather dread and respect this power than to better understand and explain the nature of the phenomenon. Each insight and change in practice happened rarely and required the overcoming of the relevant 'ideology'. Changes were based on their immediate effect rather than on rational analyze of phenomena. Thus, cognition was open just in the direction of diversification of attainments and techniques, their adaptation to different natural niches.

Competition had a specific mode at the adaptive phase of evolution. *Competition of individuals* within the group had no evolutionary consequences for the group, *i.e.*, did not lead to the development of the group structure, which human species inherited from the hominid pack. Only positions of individuals in the informal hierarchy can be changed. *Competition of groups* also did not have structural evolutionary consequences; it led only to adaptive variations in the size of a group, its predominant activity, its habitat, and so on.

Social evolution at this phase was similar to the natural evolution; better adapted groups displaced less adapted groups from the habitat and, therefore, this led to migration and extension of species habitat but not to social structure development. Until there were no obstacles for resettlement, evolution of cognition and understanding of reality was restrained, and evolution of society's structure did not begin.

The Structural Phase of Social Evolution

The Neolithic Revolution occurred about 10,000 BC as transition of group to neighboring community. We may define it as a point of singularity of adaptive evolution that introduced a new form of society and a new mechanism of its evolution. It is evolution of social structure's dimension and complexity. The contemporary structural phase of so-

cial evolution has begun since this 'moment'. Of course, modern society and Neolithic settlements have essential differences but they have the same mechanism of evolutionary changes. It combines a peculiar social form of individual and group competition and a peculiar social mode of cognition. Competition and cooperation now lead to structural consequences. The competition of *individuals* results in social stratification and institutionalization of inequality, manifested in the ruling elites, strata, classes. The cooperation of *individuals* leads to their consolidation into larger cohesive and solidary societies. In turn, the *competition of societies* results in their expansion (growth, merging, *etc.*).

Now different types of social structures (*e.g.*, political, economic, ideological) tend to expand. However, such expansion occurs in terms of evolutionary limitations of social structure's growth. For the integration of growing diversity in a wider social format the society requires more advanced (productive, effective) technologies and more advanced (universal, humanistic) ideologies. Society no longer restrains cognition but *regulates* it but still does not release individual cognition fully. Cognition and, accordingly, development are based not directly on human curiosity and initiative, *i.e.*, on natural need for self-realization, but on social mechanism of their regulation (promotion/limitations). This mechanism uses internal social inequality as a tool for the development through unequal exchange between society's members (*i.e.*, through exploitation of individuals). On the other hand, it uses external society's inequality for the development through unequal exchange between societies (*i.e.*, through exploitation of society's periphery or some societies by others). The competition of individuals and societies reproduces internal and external inequalities, but the successful exploitation of external inequality can mitigate negative consequences of the internal one.

At present, stratification of society has to occur for its development. Only elite can form demand for cognition and development of technologies. It is elite (ruler, royal court, nobility, state bureaucracy, priesthood) which demanded the development of weapons, monumental representation of cult and authority, elitist consumption, art, *etc.* Their objectives are strengthening of elite's internal status and the success of society in external competition.

The other side of this mechanism is the presence of low strata within society, exploitation of which allowed freeing up resources for thinkers, engineers, architects, artists, *etc.* More stratified societies evolved faster than low stratified, all other things being equal. Another consequence of this mechanism is the presence of inequality between societies. Society may exploit resources of other societies, what groups of gatherers/hunters cannot do. The most notable example is the classic Athens, which during its hegemony used resources of other poleis for weaponing, civil and cult building, development of art, theater, science, *etc.* Modern societies also use financial, economic and political hegemony, although in hidden forms of unequal exchange, for obtaining resources that allowed them to free significant part of population for fundamental science, technologies development, space exploration, *etc.* The *World-systems* analysis described the mechanism of such core-periphery interactions (Wallerstein 2004). Inequality in all its forms is a source and prerequisite for the development of society at the contemporary Structural Phase of social evolution.

Life Cycle of Societies at the Structural Phase

The phenomenon of rise and fall of large social structures – *life cycle* of civilizations – has emerged at this phase, since there are evolutionary constraints for their structural growth. Emergence, extension, sophistication and final decay of societies become a form of their evolution. Groups also emerge and decay but their life cycle has no evolutionary consequences for their internal structure. A neighboring community becomes initial social format that may serve as starting point of extended life cycles of societies.

Consolidation of individuals within societies and competition of societies lead to expansion of the socio-political structure. At each step of expansion, the society has repeatedly undergone two key transformations and relevant phases – administrative and universal (Dobrolyubov 2009). At the *Administrative Phase*, one of the competing polities (states) subordinates the others and unites them (coercively or voluntarily) into a single political structure. The interaction and communication of individuals based on common procedures leads to standardization of practices and values. Mental reflexing of one's own similarity with others leads to the formation of a collective consciousness and self-awareness. At the next *universal phase* this social consciousness carries group solidarity and ensures informal cohesion of society. The entire cycle of rise and decay of society integrity also contains the *preliminary phase* of the beginning of societies' competition and the *final phase* of group cohesion dissolution (see Fig. 2). The transition from the Administrative to the universal phase is related with the transfer of the border of *we-they* perception from the collective identity of one format to the collective identity of a wider format. This transition is accompanied by crises of traditional social identity, values and collective solidarity. It entails an aggravation of all kinds of group conflicts – social, ethnic, religious. After the crisis the society becomes a universal cohesive social subject that begins to compete in a broader social environment and repeats the cycle of expanding the formal political structure, and then consolidating the informal society in a wider format. The extension of social structure is accompanied by its complication.

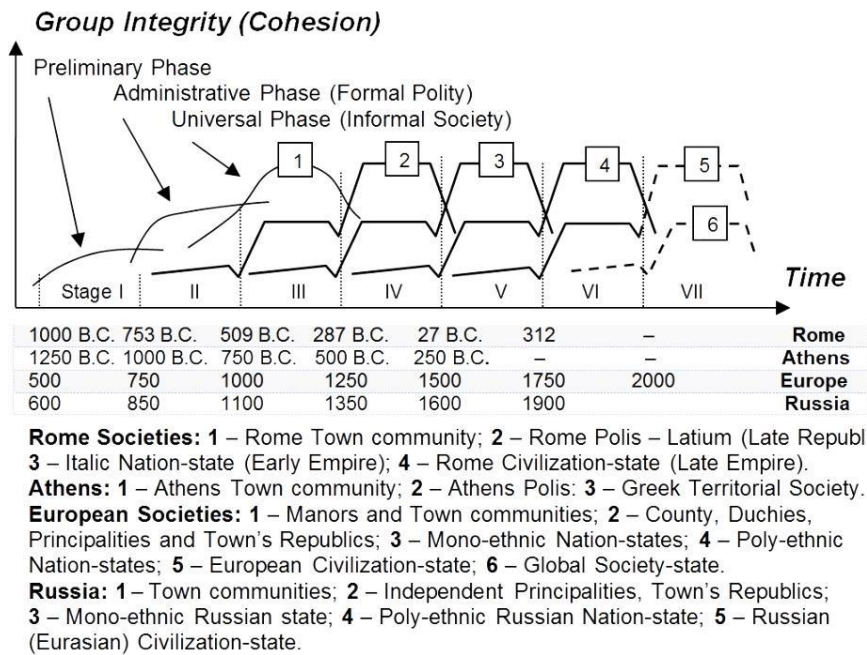


Fig. 2. Civilizational cycle of sociogenesis (Dobrolyubov 2009, 2012b)

Polity-Society may incrementally expand up to the maximal format, which is limited by the current evolutionary conditions – technological and ideological. Note that the ability of societies for political and especially military expansion increases faster than their ability to develop advanced values and ideologies that are associated with more stable and conservative culture, religion, traditions, *etc.* Therefore, even early states were able to expand the administrative structure through warfare up to large civilizational dimensions (*e.g.*, the Inca empire), but they were never able to universalize a society of this size.

When the growth of the social and political structure reaches an evolutionary limit, a social entity ceases further expansion and depletes the accessible periphery. This leads to a decrease in consumption and an increase in social tension. On the other hand, this entity attempts to integrate and universalize an over diverse social structure in a single society but does not fulfill it. As a result, political entity does not acquire broader collective identity and loses traditional collective identity and social solidarity of its core. For example, modern Western Europe had gone far in terms of informal social integration. This process is accompanied by the dissolution of the national collective identity as a main social identity of individuals. If someone attempts to turn back to nation-states, Europe risks not acquire the pan-European collectivity and at the same time lose national collectivity, and then lose any social basis for collective cohesion.

Any large political system, if it does not complete transition to a single universal society, with time loses system functioning and becomes an easy target of a less civilized but more solidary neighboring states, migrating barbarians, organized sects, radical movements. It can also become an easy victim of natural disasters, climate change, *etc.* The collapse of a large civilization leads to the emergence of many smaller social actors with a more primitive level of social development corresponded to invading societies. New enti-

ties inherit some technologies and ideologies, but they have their own cultural and social codes, and they begin their own cycle of expansion and development just with the better initial conditions that allow them to reach a wider size and greater social complexity in subsequent development.

The duration of the phase of maturation of collective solidarity in each of the formats is on average about 250 years (see Fig. 2). We can explicitly observe such phases of structural growth in a number of historical societies – Athens, Rome, Europe, Russia (Dobrolyubov 2009, 2012b). The average duration of the whole cycle of the society growth is: for growth up to complex chiefdoms – three phases or about 750 years, up to early states – about 1,000 years, up to territorial states – about 1,250 years, up to large civilizations – 1,500 years and more (Dobrolyubov 2012a).

The Macro-Evolutionary Diagram

All social structures eventually collapse, but the maximum size of society and the relevant level of social complexity increase in the course of evolution. Therefore, the social evolution at the structural phase can be presented as a macro-sequence of max social formats in the axes of technology and ideology complexity (see Fig. 3). This sequence begins with neighboring settlements and continues up to a global society. Certain societies recapitulate the path of growth from small to large formats and from lesser to greater social complexity, and finally collapse. In other words, we have to distinguish between the macro-evolution of the max structural formats and the meso-evolution through these formats of certain societies in their life cycles. Hereafter, I will use the concepts of macro and meso-evolutions in this specific sense.

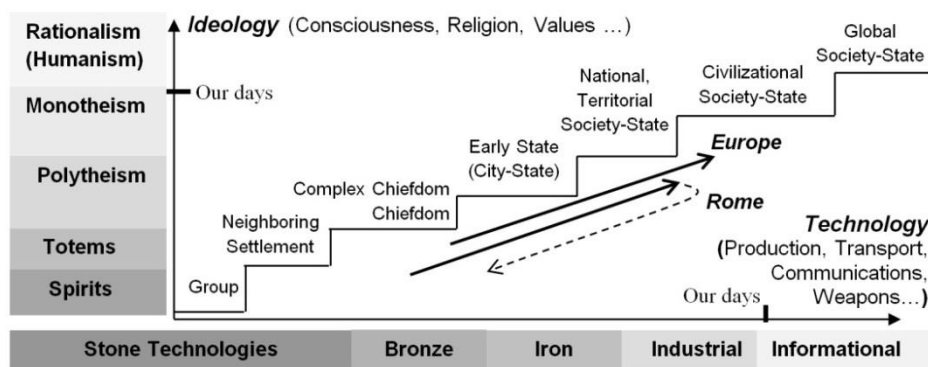


Fig. 3. Social formats in evolutionary ordinates

It should be noted that different classifications of societies between the settlement and the early state are being discussed. There are analogues and alternatives of the chiefdom, complex chiefdom and an early state (Kradin 2008; Grinin 2004, 2011; Grinin and Korotayev 2011). Besides, the role of tribal formations has not been fully clarified. Therefore, Grinin and Korotayev suggest using a more general classification: *medium-complex society – complex society – early state*. For our analysis, it is important that all alternative paths eventually merge in the state and that the same number of levels of complexity of analogs or alternatives exist along this way. The same is true of the early state. This is a broader concept than a city-state, but pristine states in the primary centers of civilization (Mesopo-

tamia, Egypt) emerged precisely as city-states. Therefore, in the future, we will use the concept of city-state as characteristic of this social format.

It should be also noted that the terms ‘territorial’, ‘national’, and ‘civilizational’ are used here in a specific sense. These social formats characterize internal social complexity that is going to be universalized in a single society. Territorial society unites a relatively homogenous and related (*e.g.*, mono-ethnic) environment, whereas a nation, as a rule, is a more complex multiethnic and multicultural entity, which, therefore, requires more ‘abstract’ and ‘artificial’ values and ideologies. In this sense, a mono-ethnic nation-state can be considered as a synonym for territorial society-state. In addition, national way of universalization is ultimately assimilation of cultures and languages (Romanization in Rome, Anglicization in Britain), whereas civilizational universalization supposes preservation of integrated cultures; that requires even more advanced values. Civilizational format is a supranational one. It characterizes multinational and often multi-confessional society. There can be both formal polity (state) and an informal universal society in these formats.

Macro-sequence of the max formats is objective and therefore linear. We can interpret the max formats and the relevant levels of material and ideological development as *evolutionary platforms* (Dobrolyubov 2012a). Nevertheless, each civilization recapitulates development up to its platform from lower levels and smaller formats, therefore societies with different evolutionary levels always coexist at the structural phase of evolution.

Despite alternatives and analogues (Grinin 2004) in the past and multiple modernities (Eisenstadt 2000) in our days, all lines of developments will inevitably merge into a single global society, which will mean completion of the structural phase of evolution.

One of the competing societies in its meso-evolution will finally make this global macro-transition. The further evolution of the global society will proceed in a stable format, as it took place at the Adaptive Phase in the stable format of the band. However, the global society will differ from bands and modern societies that it will not be able to have life cycles and will change the mechanism of further evolution and, therefore, its social nature.

It is obvious that the society requires more efficient technologies in the fields of production, communication, transport, weapon at each step toward wider format but it also needs a more sophisticated consciousness and more universal values which are often understood only as a result of changes in technologies or production, for example in the concept of social formations (Marx 1977) or in the concept of techno-humanitarian balance (Nazaretyan 2009). In fact, ideologies as well as technologies to the same extent are prerequisites for the integration of a wider social variety. For example, the transition from groups of gatherers/hunters to neighboring settlements and chiefdoms requires the development of religion from belief in spirits of objects to belief in totem deities that are the emblems of more universal supernatural powers representing larger social entities: clan, community, chiefdom. In its turn, the transition to the early state requires a more universal mythology, containing pantheon of gods. This allows integration of societies by collecting their sanctuaries in one center, for example the Acropolis in Athens or the Capitol in Rome. Moreover, gods have to acquire a human guise, or at least human behavioral traits, to facilitate formation of behavioral ideology, (*e.g.*, an ideology of heroism, of citizenship, *etc.*). Informal integration of larger polyethnic and multicultural societies, such as the Roman Empire, requires even more universal ideology – monotheism that understands a human being more personally and allows unification through values more universal than a kinship, ethnic or any cultural affiliation.

In terms of fragmentation advanced ideology of large multi-ethnic states becomes superfluous for more primitive successors. For example, at the beginning of the new life cycle of European civilization (see Fig. 2), Christian humanism and aspiration to human perfection were unclaimed in medieval societies and were reduced to formal practices – abstinence, prohibitions, asceticism. Of course, the universality of monotheism was politically beneficial to the barbarian rulers who contributed to the spread of Christianity. Only the *Renaissance* rediscovered humanism in Christianity and came to exaltation of human being, but then the *Enlightenment* liberated humanism from religious packing and introduced the secular and even anti-clerical ideology of individual freedoms and human rights.

However, at the beginning of *Modernity*, freedom is understood more as freedom of competition and, consequently, freedom of social stratification. The slogans of the French revolution – *Fraternité* and *Égalité* are Christian (and communist) and not at all liberal or bourgeois. Modernity's liberal ideology and values were aimed at formal status rather than the actual position of a human being in society. In our view, the integration of global diversity in a single society will require greater universality of values and more humanistic understanding of human being than liberalism provides as an ideology of formal rights and free competition in the market economy.

Modern societies are far from completing evolutionary macro-sequence (see Fig. 3). National societies should first undergo transformation to a society-state of civilizational format (Europe is trying to do it now) and only then transformation into a society-state of the global format (see Fig. 2). This path implies the crises of reformatting of existing societies. Thus, the social and political structure cannot have 'sustainable development' at this distance.

The forthcoming conflict has visibly shown its civilizational nature (Huntington 1996) when ideological opposition democracy – communism, which was historically accidental, has disappeared. The more the West acts as a solidary collective actor, the more other societies are self-aware at the same level of integrity and, therefore civilizational boundaries begin to show up where they did not matter before. In particular, the confrontation between Europe and Russia is growing as fast as Europe becomes a distinct social agent (Dobrolyubov 2012c).

The movement towards a global society contains contradictions also in terms of values; their development periodically is demanded in opposite directions. For example, the universality of the European consciousness aids to overcome national egoisms in the course of formation of a common European collective identity and collective agency. Achieving this goal, universalism makes Europe vulnerable to the influx of migrants who are foreign to this universalism and who bring rigor particularism to Europe (religious, cultural, and even clannish). Part of the problem is that European universalism exceeds the needs of local civilization integration; it is rather a cosmopolitan and globalist but not particular European. There is a contradiction here. If Europe does not acquire an explicit understanding of *We* as distinct from *They* and does not associate this collective identity with selfishness and even isolationism (which, incidentally, has American consciousness) that would be sufficient for leadership in civilizational competition, then Europe can simply disappear as a collective carrier of values. European consciousness is ready for global universalization, but does not have sufficient group solidarity and collective agency to lead such integration.

Nevertheless, catastrophic consequences of the collapse of large civilizations are mitigating evolutionarily, because their life cycles are not fully synchronized. At the same

time several civilizations which are the carriers of common achievements, are involved in the World-System. For example, the Arabic civilization became an intermediary between Greco-Roman and modern European civilization; this allowed restoration in Europe some of its own ancient achievements a millennium later. The collapse of civilizations cuts off the peaks of its development – the most artificial and refined elitist practice, science, engineering, the most advanced social institutions, the system of elite education, civility and so on.

The development of civilizations through rise and decay does not allow us to reconcile the concept of stadial (or unilinear) evolution shared by the founders of evolutionism (Lewis Morgan, Friedrich Engels, Herbert Spencer and others) with concept of multilineal evolution offered by neo-evolutionists (Leslie White, Julian Steward, Marshall Sahlins and others). The actual process is both progressively stadial and cyclic. Only the transition to macro-observation allows us to ignore evolutionary ‘failures’ and distinguish mature forms of local civilizations from the historical flow and interpret them in different ways: as social formations (Marx 1977), as phases of historical process (Diakonoff 1999), as world's civilizations (Yakovets 1999), as production principles (Grinin 2007), as evolutionary platforms (Dobrolyubov 2012a).

Acceleration or Cyclic Recurrence?

One can agree with the statement of the acceleration of historical time. However, when some researchers describe this acceleration by the hyperbolic curve (see Fig. 1), they are, in fact, artificially ‘hurry up’ evolution by ascribing higher evolutionary importance to current transformations.

There is no objection, when scientists distinguish different evolutions (Grinin *et al.* 2011), successive phases of historical process (Diakonoff 1999), world civilizations (Yakovets 1999) or otherwise classify periods of development. However, in order to construct a model for evolution's acceleration based on durations of these periods, one should first prove that the used phase transitions that break up the process into periods have equal significance throughout the considered interval. If we begin to consider social or even planetary evolution in more and more specific technological transformations, we equate the significance of these transformations, *i.e.*, recognize Neolithic changes in society equal to changes caused by invention of the Internet.

For example, the historians (Diakonoff 1999; Yakovets 1999) consider, with minor differences, the following sequence of historical phases: Prehistoric, Neolithic, Early-class, Antique, Medieval, Pre-Industrial, Industrial, and Post-Industrial, which Alexander Panov used in his model (Panov 2005). However, the last four ‘phases of world history’ according to Diakonoff, or ‘world civilizations’ according to Yakovets are historical phases of European civilization, *i.e.*, they are locally Western, and not world ones. Of course, Western achievements are diffused in the World-system as well as the Greco-Roman, Arabic or Chinese achievements in the past, but the evolutionary issue is whether these advancements are irreversible. Civilizations have life cycles and they lost civilization many times in past history. So, there is a reasonable question: which Western social and technological advancements will remain in non-Western societies in case of collapse of the leading Western civilization? We do not know for sure.

In fact, different civilizations are undergoing similar structural transformations. If we take a closer look at the Greco-Roman civilization, we will find transformations and de-

velopment phases, similar to European ones (see Fig. 4). Rome and Greece began their development from the 'dark ages', fragmented social entities with natural economies (it is an antique analogue of the Early Middle Ages in Europe). Then polity of city-state format appeared: poleis in Greece and Rome, and town republics, principalities, duchies in Europe. Then, the universal societies were formed in a city-state format, which was accompanied by a cultural explosion – the 'Axial Age' revolution (Jaspers 1953), manifested as the Classicism in Greece, the Hellenization in Rome, and the Renaissance in Europe. Finally, large universal societies have emerged with commodity production and market economy. Some historians define Roman society at this stage as 'proto-bourgeois' or 'capitalistic' (Semyonov 2003: 164; Vassiliev 2008).

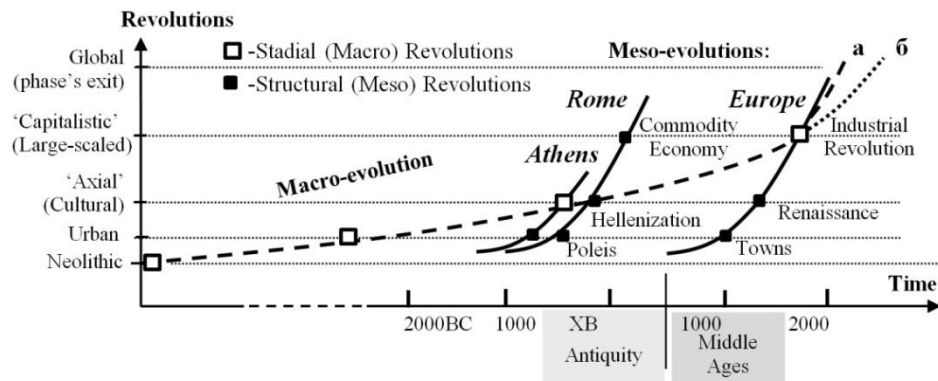


Fig. 4. Illustration of macro-evolution as a sequence of meso-evolutions

It seems that every large civilization follows the same path of structural development and, therefore, it has its own singularity, in fact – its own collapse. By applying the hyperbolic model to the events of antiquity Andrey Korotayev, as a sort of science joke, calculated the 'Korotayev-Archimedes singularity' in AD 115 (Korotayev 2015).

If we look at the historical process in terms of macro-evolution, we can state that the Urban Revolution occurred when towns first appeared in early civilizations. This statement is also true for other *stadial* revolutions. The following civilizations, including Greco-Roman and modern European, just repeat this way, starting with a lower level (complex chiefdoms), but at higher overall evolutionary level of the World-system. Each civilization has to recapitulate urban transition because towns and city-states are social formats that a growing society passes in the life cycle of its genesis. Other macro-evolutionary revolutions are also related with the new social formats, which are also the stages of the genesis of every specific society. Each civilization recapitulates the urban, then cultural transformation, and then the transition to a large universal society with a commodity economy. Thus, we describe different meso-evolutions of specific civilizations by the same 'revolutions' as the macro-evolutionary process, but we should distinguish *Stadial Revolutions* and ordinary *Structural Revolutions* of specific societies.

Note that the axis of 'revolutions' in Fig. 4 is not fully stadial in aspects which are different from the structural one. Indeed, the transition to the universal society in a seemingly same structural format may have different institutional appearance. Roman society of imperial period acquired large-scale economy with largest regional market that

demanded large-scale commodity production. This production required a large number of slaves, thus, their owners were predominant economic agents. However, we do not find industrial revolution in this ancient ‘capitalism’, though the Roman engineering and technological level, which was subsequently lost, was comparable with pre-bourgeois European (mechanisms, water actuators, mechanical mowers, steam turbine, *etc.*). The true European medieval invention is an *individual* economic agent, protected by the *institution* of private property, for which in fact the previous development cycle of Roman law and practices was required. Slaveholders demanded inventions to achieve mainly high-status and not economic objectives – for spectacular shows to impress a crowd, for monumental construction, weaponing, *etc.* Only an individual economic agent began to demand inventions for the sake of individual profit. As a result, the typical *structural* revolution of transition to the universal societies in Europe (in fact, ‘national’ and ‘capitalistic’) has acquired the features of a *stadial* revolution in all other aspects.

The universality of big societies gives them some similarities in social relations and consciousness. We can consider Roman society in a certain sense as a consumer society; this society gave individuals considerable autonomy, it had a large ‘proletariat’, it was cosmopolitan, *etc.* These signs are symptoms of *ancient modernity* that arose in the course of overcoming the traditional society. Later on, the society acquired *postmodern* signs of deconstruction, decadence, indifference and fatigue.

Linear stadial approaches, for example, Marxist ones, tend to exclude from consideration the entire chain of stadial transformations in each particular ancient society. They describe Roman civilization by the general stadial level, such as slavery, agrarian society, Antiquity, the ‘Axial Age’, *etc.* Although the historical phases of Roman society (monarchy, republic, and empire) have stadial differences in production and social intercourse. By the way, the World-system approach, unlike the Marxist one, notes this gradation (Grinin and Korotayev 2009).

Until recently Western societies repeated structural transitions that have already taken place in the past societies (see Fig. 4). Of course, modern society faced new phenomena – the digital revolution, Internet and social networks, genetic engineering, *etc.* However, we can place these ‘phase transitions’ on the sequence where the Neolithic, Urban and other stadial revolutions are located, only if the Western civilization completes the structural phase of evolution. Then, indeed, the meso-evolution of Western society will coincide with the macro-evolution of society ‘in general’ or of humanity as a whole (curve **a**, Fig. 4). However, in the event of Western civilization collapse and social primitivization, as was the case with all previous historical civilizations, future observers of the process will assign less importance to the transformations of Western society, as we do now with regards to Roman society. Future observers will smooth out the course of evolution (curve **b**, Fig. 4) and assign the averaged characteristics to the societies that existed before them.

Linear-stadial evolutionary approaches assign a single evolutionary level to the Greco-Roman civilization in order to artificially inflate stadial level of the Early Middle Ages. In reality, ancient society was highly civilized and technically advanced. Its decay has led to societies' return to the ‘dark ages’, to the pre-state level of social organization, to the loss of culture, knowledge, technologies, *etc.* Of course, at this time feudalism began to form as unique system of legal relations. The feudalism in the course of its long evolution gave birth to modern society. However, one cannot attribute evolutionary perfection of the modern society to its medieval embryos.

The macro-evolution of social formats shown in Fig. 3 as a sequence of stadal revolutions is a slower process compared with meso-evolutions shown as civilizations' development cycles. Even the leading European (Western) civilization, after it becomes politically unified state-society (this process is delayed for a while), will need at least one more 250-year phase for political unification of the global society and for its values universalization (see Fig. 2). This is a long historical period, even if we assume that under present conditions the phase's duration might be reduced.

The very idea of infinite growth of evolution rate seems doubtful. For example, changes in biological evolution cannot go faster than life span of organisms (generation of organisms) – a kind of *biological 'quantum'* of evolutionary time. Evolution at a higher rate is physically impossible. Of course, organisms can change faster, but only in ontogenesis; and such changes are not evolutionary. The concept of social evolution also loses its meaning when we begin to consider the changes that occur faster than the *social 'quantum'* of evolutionary time. This is the period of existence of conservative carriers of social structures, institutions and values, such as a mature individual, generation of people, solidarity communities (societies), *etc.* At the structural phase of social evolution, such a quantum of time is the phase of sociogenesis, lasting for about 200–300 years (see Fig. 2).

An unjustified transfer of evolution 'arrow' from socio-structural changes to technological changes leads to too optimistic assessment of the evolution acceleration and of the 'moment' of its singularity with an error of at least several centuries, if not thousands of years. Technological singularities change neither the nature of society, nor the role of human beings in it. Singularity of social evolution is possible, but it will be a social, not a technological event; it will not be caused directly by technological changes, no matter how impressive they are, but will be caused by their organic link to social phenomena.

The Rate of Social Evolution

The question of social evolution rate remains. But how can we measure it?

If the growth of the maximum format of society takes place at the structural phase of evolution, then it is logical to use this structural step as a measure of evolutionary progress of society. I once again remind here that we are talking about the format of informal *society*, and not about the format of a *state* structure that can run far ahead. Though history gives us information mainly about political structures (conquests, centralization of states, *etc.*), and not about informal society as a cohesive community with common collective identity. In fact, each case of a large state or empire formation testifies to the appearance of a cohesive core of a smaller format. For example, the Macedonian, Mongolian or Incas' expansion rather speaks about the existence of relatively narrow ethnic cohesive social core on which the rulers relied than about informal societies of civilization format emergence. Most empires remained formal and fragile political structures, and never became universal societies of such wide format. We should take this into account when determining the moment of the actual evolutionary transformation.

Besides one should use only the first cases of the structural formation to universal societies, which are true or pristine evolutionary transformations. The subsequent recapitulation of these transformations by other societies is not actually a macro-evolutionary one, but is an ordinary structural transformation in their life cycle. The first cases of the primary formation of universal societies in each format are summarized in the table.

Table

First transition to universal society in format of	T	Year	Events that indicate this transition
Band	T ₀	40,000 BC	Hunters/gatherers bands
Settlement	T ₁	10,000 BC	Late Natufian Neolithic settlements in the Middle East 10,800–9,500 BC (Munro 2003; Barker 2009)
Chiefdom	T ₂	8,000 BC	Walls and tower of Jericho 8,350–7,370 BC (Kenyon 1981)
Complex Chiefdom	T ₃	5,000 BC	Urban revolution 5,000 BC (Childe 1950); Eridu at Ubaid period in Schumer 6,500–4,100 BC (Mallowan 1970)
City-State	T ₄	3,000 BC	Political centralization of Egypt 3,000 BC
Territorial Society-State	T ₅	1,500 BC	‘World power’ in Egypt – the New Kingdom (1,549–1,069 BC)
National Society-State	T ₆	27 BC	Romanized Italic national core within Rome Empire, 27 BC
Civilizational Society-State	T ₇	–	Universal Society-State of Europe at the universal phase (2,000–2,250 AD)
Global Society-State	T ₈	–	Global Universal Society-State

These data require explanations. Let us comment through some points.

Homo sapiens inherited the initial format of society – a *band* from a flock of hominids, and the first structural transformation was, in fact, a Neolithic transition to agriculture and permanent *settlements*. Therefore, we will not use the starting point of social evolution (T_0) as it is not a structural transition. Evolution at the adaptive phase had a different mechanism and occurred more slowly than at the structural phase. Of course, the rate of evolution at the adaptive phase can be a separate subject of study.

Chiefdom and complex chiefdom were studied using the examples of societies of Polynesia, Oceania, America, *etc.* that are closer to our time. We know practically nothing about chiefdoms and complex chiefdoms (or medium-complex and complex societies) in the primary centers of civilization in Mesopotamia and the Middle East. The archeology provides us a predominantly urban line of their development. Nevertheless, we may relate the development of their political center with a certain level of informal organization. One can correlate the appearance of the first city-like settlements (Jericho) with the formation of the chiefdom (T_2) and the urban revolution in Mesopotamia, which occurred around 5,000 BC with the universal societies within complex chiefdoms (T_3).

Why can we state so? We know that maturation of universal and cohesive society in a certain format leads to the attempts of its administrative expansion. This fact is represented in the scheme of sociogenesis (see Fig. 2) as imposition of two phases – the universal phase of one society and the administrative phase of society of the following format. We can use it as the markers of successful completion of previous transition. When a cohesive collective identity is formed in complex chiefdom, it inevitably attempts to seize other chiefdoms' capitals and build political superstructure of the city-state format, which leads to political formation of urban policies, *nomes*, *etc.* Thus, we can use it as an

indicator of completion of universal and cohesive society formation within complex chiefdom.

The same applies to the next transformation (T_4). The centralization of the territorial format of the state reveals that the society in the previous format of the city-state has already been universalized and has acquired common identity and collective cohesion. This indicator, perhaps, slightly shifted to the right along the time axis, but not more than for the 250-year phase of sociogenesis which is not so significant for the evolutionary scheme. By the way, the phase of existence of social identity and cohesion of a certain format (200–300 years) proves to be a period of stability for excessively large states that exceed the size of their own informal society, after which they disintegrate, for example, Akkad (2,316–2,137 BC), Assyria (1,353–1,000 BC), *etc.* The periodic collapse of territorial states led to oscillation of the sociogenesis around the city-state format. It simply means that macro-evolution is getting stuck. The short periods (200–300 years) of large states' existence indicate that the societies of city-state format still remain the actual actors at this time.

Only the appearance of large multi-ethnic empires which have been stable during two or three phases of their genesis (500–600 years) and which have projected power to remote periphery for a long time, indicates that they have a cohesive ethnic core that can be understood as the universal society and collective identity of territorial format (T_5). The new Kingdom of Egypt (1,549–1,069 BC) for the first time formed a single universal society and overcame internal competition of nomes, which persisted throughout the Old Kingdom (2,686–2,181 BC). It was the first stable 'world power' with unprecedented prosperity and stability (Shaw 2000).

The next evolutionary transformation (T_6) is the formation of a universal national society. The emergence of the first nations is usually associated with the modern Europe. In our opinion, the first nation was Romanized Italy as metropole of the Roman Empire during the Principate. It had the structural features of the European nations and possessed sufficient degree of 'artificiality' and 'abstractness' of ideology, which included a kind of Roman nationalism based on the ideas of Roman exceptionalism, superiority over 'others', contrasting themselves with barbarians, *etc.* This core was originally multi-ethnic and composed of the Latins, the Italics, the Etruscans, the Gauls, *etc.*, who were Romanized. After more than a century of national crisis, including the Gracchi reforms, allied and civil wars between parts of Italy, this society was universalized and acquired a single social identity and internal cohesion. After the political structuring of the Empire in 27 BC (T_6) this community became a nation and a collective metropole for the subordinate provinces. Italy as a part of the Empire had universal citizenship and retained republican institutions – the Senate, the court and the rights of the individual, self-government of cities, *etc.* The strength and cohesion of this national community allowed the Empire to exist for about five hundred years. Although it should be noted that this national community failed to universalize the imperial society of the civilizational format.

European societies have retraced the structural path from complex chiefdoms to nations that have already been passed by others (see Fig. 2) but with a new technological and value quality. Europe is just preparing for the most important step of its structural genesis – transition to the universal society of civilizational format (T_7), *i.e.*, to a single European state-society. Such a step has not yet been made by any of the societies. This evolutionary transformation may occur (of course, may not occur) during the current

250-year civilizational universal phase. Accordingly, the last structural evolutionary transformation (T_8) will be the transition to a single universal global society within the global state.

Now, we have the data points, and we can try to mathematically interpret the course of structural evolution. The best approximation shown in Fig. 5 is described by the linear equation

$$T(n) = -11214 + 1893 n, \tag{Eq. 2}$$

where $T(n)$ is the moment of evolutionary transformation, n is the ordinal number of transformation.

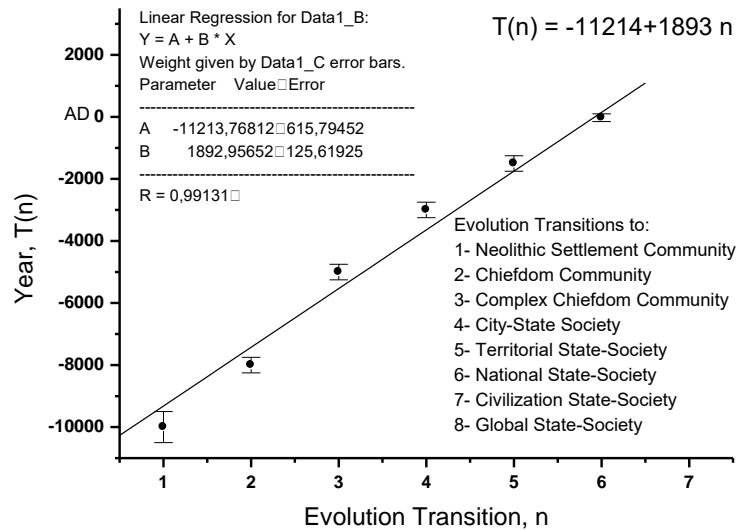


Fig. 5. Approximation of social evolution at the structural phase

If we plug the number of the next civilizational transformations in the equation, we get that Europe should make transition to the universal society in $T_7 = 2037$. Of course, we can only use this as an illustration because the error is ± 125 years, since the dates used are time intervals and not the points.

However, some interesting results can still be obtained from this interpretation. For example, the rate of *structural* evolution at the contemporary phase is constant and is around $V = 1,893$ years per transition, which obviously follows from the data used. Indeed, evolutionary transitions to the new social format take place approximately every two millennia.

Even if we shift the dates and use other examples of societies, for example, take the Old Kingdom of Egypt (2,686–2,181 BC) as the first transition to the territorial format society, or European nations as the primary formation of nations, it will not have significant impact on the rate of macroevolution. This is likely to affect the degree of correlation. Only the total number of transformations can significantly affect the rate of evolution.

The result obtained for a global transition $T_8 = AD 3930$ is strange only at first glance. In fact, it follows from the assumption that the global transition will be completed by another, rather than by modern Western, civilization. That assumption is based on the previous cases of sociogenesis. None of the civilizations of the past has made two macro-

evolutionary transitions (*i.e.*, primary) in the same cycle of genesis, although each of them passed through a chain of meso-evolutionary transformations (in fact, secondary) from the chiefdom to the wide formats.

Numerous processes in modern society may have singularities in the mathematical sense (demographic, economic, and technological) that can destabilize social system. Nevertheless, until social evolution completes the structural phase, the society will have a simple response to the growth of any parameter in blow-up regime and even of a number of parameters – it simply collapses and rolls back along the evolutionary scheme (see Fig. 3) without transition in any new quality. That always happened in the course of past social evolution.

In the event of the collapse of Western civilization due to the new migration of peoples (today, it seems, these are migrants from non-Western countries with prevalence of intolerant, and clannish, authoritarian social consciousness and values), we may face a new genesis of a new civilization, which in full cycle can take around 1,750–2,000 thousand years (see Fig. 2). However, it is just an assumption. Western civilization may continue to lead the process of globalization and complete the structural phase of evolution, but even in this case it will take one or two phases of genesis – 250–500 years.

The Nature of the Global Singularity

The formation of a universal global society will become a true singularity related to the *metamorphosis* of society's nature. The conditions for a transition towards the global society and its new characteristics are a very interesting subject of a separate study. We only briefly denote them. The global society will have new features due to the fact that it will be *single* and will have *no periphery*, which will not allow using the present evolutionary mechanisms for further social development.

At the current structural phase, the competition of societies, social and core-periphery inequality as well as the presence of the upper class are necessary elements for the development. Global societies' sustainable development is impossible with these institutions. It will have to overcome social and regional inequalities, conflict forms of competition, consumer orientation of consciousness, stop the depletion of the world's natural resources and enter into symbiosis with nature. The society will have to liberate a human being from wage labor, which is a form of forced labor, and give an individual opportunity of voluntary, *i.e.*, completely free activity.

Such society looks like a Marxist utopia only at the modern level of technological development and universality of value system. And if technologies are able to develop progressively, then the values can reach a new level only through the crisis of existing value system and existing rationality.

Meanwhile, evolution has enough time and can wait. Sooner or later the society will come to its new social nature. Human being's desire for self-affirmation and self-realization in cognition will move forward further evolution at the cognitive phase. The social changes will be more rational, whereas now they are unintended outcome of societies' competition. The responsibility for the continuation of evolution, which was previously transferred from biological selection to the competition of societies, will now be transferred directly to human rationality. However, evolution will remain an objective and inevitable process, since cognizable reality is objective and evolutionary purposes of reason, human or artificial, in reality are also objective.

Conclusion

The article proposes division of social evolution into three phases: adaptive, structural and cognitive. The period of the structural phase is about 10,000 BC – 4,000 AD. The dynamics of primary structural transformations at this phase is described by the equation $T(n) = -11214 + 1893n$, where $T(n)$ is the moment of evolutionary transformation, and n is the ordinal number of transformation. The rate of structural evolution is $V = 1,893$ years per transition. Global singularity as the completion of the structural phase of social evolution and the transition to the universal global society-state is predicted by the model for 3930.

References

- Barker, G. 2009.** *The Agricultural Revolution in Prehistory: Why did Foragers Become Farmers?* Oxford: Oxford University Press.
- Childe, G. 1950.** The Urban Revolution. *Town Planning Review* 21: 3–17.
- Christian, D. 2005.** Macrohistory: The Play of Scales. *Social Evolution and History* 4(1): 22–59.
- Dawkins, R. 1976.** *The Selfish Gene.* Oxford: Oxford University Press.
- Diakonoff, I. M. 1999.** *The Paths of History. From the Prehistoric Man to Modern Times.* Cambridge: Cambridge University Press.
- Dobrolyubov, S. V. 2009.** Theory of Society's Genesis. *Social Evolution and History* 8(1): 221–255.
- Dobrolyubov, S. V. 2012a.** Sociogenesis vs. Marx Evolutionary Determinism: The Anthropic Mechanism of Social Dynamics. *Social Evolution and History* 11(1): 82–123.
- Dobrolyubov, S. V. 2012b.** Polis, National and Civilizational Cycles of Russian Society's Genesis. *Mir Rossii* 2: 116–143. In *Russian* (Добролюбов С. В. Полицный, национальный и цивилизационный циклы социогенеза российской общности. *Мир России* 2: 116–143).
- Dobrolyubov, S. V. 2012c.** Collective Agent and Collective Subject: Some Basis for Conceptualizing. *Sotsiologicheskii zhurnal* 2: 53–80. In *Russian* (Добролюбов С. В. Коллективный агент и коллективный субъект: некоторые основания концептуализации. *Социологический журнал* 2: 53–80).
- Eisenstadt, S. N. 2000.** Multiple Modernities. *Daedalus* 129(1): 1–29.
- Foerster, H. von, Mora, P. M., and Amiot, L. W. 1960.** Doomsday: Friday, 13 November, A.D. 2026. *Science* 132(3436): 1291–1295.
- Grinin, L. E. 2004.** The Early State and Its Analogues: A Comparative Analysis. *The Early State, its Alternatives and Analogues* / Ed. by L. E. Grinin, R. L. Carneiro, D. M. Bondarenko, N. N. Kradin, and A. V. Korotayev, pp. 88–136. Volgograd: 'Uchitel' Publishing House.
- Grinin, L. E. 2007.** Production Revolutions and Periodization of History: A Comparative and Theoretical-Mathematical Approach. *Social Evolution and History* 6(2): 75–120.
- Grinin, L. 2011.** Complex Chiefdom: Precursor of the State or Its Analogue? *Social Evolution and History* 10(1): 234–275.
- Grinin, L. E., and Korotayev, A. V. 2009.** Social Macroevolution: Growth of World System Integrity and a System of Phase Transitions. *World Futures* 65(7): 477–506.

- Grinin, L. E., and Korotayev, A. V. 2011.** Chiefdoms and their Analogues: Alternatives of Social Evolution at the Societal Level of Medium Cultural Complexity. *Social Evolution and History* 10(1): 276–335.
- Grinin, L. E., Korotayev, A. M., and Markov, A. V. 2011.** Biological and Social Phases of Big History: Similarities and Differences of Evolutionary Principles and Mechanisms. *Evolution: A Big History Perspective* / Ed. by L. E. Grinin, A. V. Korotayev, and B. Rodrigue, pp. 158–198. Volgograd: 'Uchitel' Publishing House.
- Huntington, S. P. 1996.** *The Clash of Civilizations and the Remaking of World Order*. NY: Simon & Schuster.
- Jaspers, K. 1953.** *The Origin and Goal of History*. New Haven, CT: Yale University Press.
- Kapitza, S. P. 2006.** *Global Population Blow-up and After. The Demographic Revolution and Information Society*. A Report to the Club of Rome. Moscow – Hamburg.
- Kenyon, K. 1981.** Excavations at Jericho. Vol. 3. *The Architecture and Stratigraphy of the Tell* / Ed. by T. A. Holland. London: British School of Archaeology in Jerusalem.
- Korotayev, A. V. 2009.** New Technologies and Future Scenarios, or is the Singularity Near? *History and Synergetic* / Ed. by S. Yu. Malkov, and A. V. Korotayev, pp. 183–191. Moscow: URSS. *In Russian* (Коротаев А. В. Новые технологии и сценарии будущего, или сингулярность уже рядом? *История и синергетика* / Ред. С. Ю. Малков, А. В. Коротаев, с. 183–191. М.: УРСС).
- Korotayev, A. V. 2015.** *Singular Points of Megahistory*. Report at 2nd Symposium of 'Megahistory and Global Evolution', October 27–29. Moscow.
- Kradin, N. N. 2008.** Early State Theory and the Evolution of Pastoral Nomads. *Social Evolution and History* 7(1): 107–130.
- Kurzweil, R. 2005.** *The Singularity is Near*. NY: Viking Books.
- Mallowan, M. 1970.** The Development of Cities from al-'Ubaid to the End of Uruk 5, Chapter VIII. *The Cambridge Ancient History*. 3rd ed. Vol. 1, part 1: Prolegomena and Prehistory / Ed. by I. E. S. Edwards, C. J. Gadd, and N. G. L. Hammond, pp. 327–462. Cambridge: Cambridge University Press.
- Marx, K. 1977 [1859].** *A Contribution to the Critique of Political Economy*. Moscow: Progress Publishers.
- Marx, K. 1987 [1846].** *The German Ideology*. London: Lawrence and Wishart Ltd.
- Mead, G. 1934.** *Mind, Self, and Society*. Chicago, IL: University of Chicago Press.
- Moore, G. 1965.** Cramming More Components onto Integrated Circuits. *Electronics Magazine* 38(8): 114–117.
- Munro, N. 2003.** Small Game, the Younger Dryas, and the Transition to Agriculture in the Southern Levant. *Mitteilungen der Gesellschaft für Urgeschichte* 12: 47–71.
- Nazaretyan, A. P. 2009.** Technology, Psychology and Catastrophes: On the Evolution of Non-Violence in Human History. *Social Evolution & History* 8(2): 102–132.
- Nazaretyan, A. P. 2016.** *Non-Linear Futures: The 'Mysterious Singularity' in View of Mega-History. Between Past Orthodoxies and the Future of Globalization*. Leiden, Boston: Brill.
- Panov, A. D. 2005.** Scaling Law of the Biological Evolution and the Hypothesis of the Self-Consistent Galaxy Origin of Life. *Advances in Space Research* 36: 220–225.
- Semyonov, Y. I. 2003.** *The Philosophy of History*. Moscow: Sovremennye tetradi. *In Russian* (Семенов Ю. И. 2003. *Философия истории*. М.: Современные тетради).

- Shaw, I. (Ed.) 2000.** *The Oxford History of Ancient Egypt*. Oxford: Oxford University Press.
- Snooks, G. D. 1996.** *The Dynamic Society. Exploring the Sources of Global Change*. London and New York: Routledge.
- Vassiliev, L. S. 2008.** Factors of History. *Istoricheskaya psikhologiya i sotsiologiya istorii* 1: 169–195. *In Russian* (Васильев Л. С. Факторы истории. *Историческая психология и социология истории* 1: 169–195).
- Wallerstein, I. 2004.** *World-Systems Analysis: An Introduction*. Durham, NC: Duke University Press.
- Yakovets, Y. V. 1999.** *Cycles. Crisis. Forecasts*. Moscow: Nauka. *In Russian* (Яковец Ю. В. *Циклы. Кризисы. Прогнозы*. М.: Наука).