SOCIAL SIGNIFICANCE OF TRANSPORTATION SPEED

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ABSTRACT

The article assesses the influence of speed of transportation on formation and development of human society. It is shown that the emergence of modern high-speed transport has led to cardinal social changes, namely to acceleration of urbanization, intensification of interregional and intercontinental migration flows, improving the quality of life. It is noted that directions and intensity of spatial displacements of people can be regarded as a social indicator aggregating individual ideas about attractiveness of certain places of residence. To quantify the spatial and temporal accessibility, the concept of «territory of isochronous accessibility» was introduced, and for socioeconomic assessments it was suggested to use a set of indicators as population size, gross domestic product, and the volume of production of services within the isochronous availability territory. Further acceleration of transportation speed implies both an increase in speed of transportation by different modes of transport, and elimination of time losses at the «junctions» between them, which should be supported by the development of multimodal logistics.

Key words: transport communication, speed, society, humanity, urbanization, migration, space-time accessibility, territory of isochronous accessibility.

Background. *As noted in [1], the speed of transportation is an economic category, as it determines the most important components of efficiency of transport activities and the quality of transportation.*

With no less reason the speed of transportation can be called a social category.

Before we consider the social significance of speed of transportation, one cannot, however, ignore the fact that, as a result of widespread and not always justifiable use, the word «social» not only «increasingly appears in the role of the word «good» in the designation of all high moral» [2, p. 197], but is also associated with «distributive justice» that «is incompatible with the competitive market order, as well as the growth and even maintenance of existing population and the level of wealth achieved», that is, in fact, the «social» turns into an «antisocial» [2, p. 203]. In this regard, it should be clarified on what understanding of society and the «social» the following considerations will be based.

The author shares the approach to definition of society as of «unification of individuals for joint efforts» to achieve their goals on the basis of «cooperation and mutual assistance to each other», «division and union of labor» [3, p. 135]. Proceeding from this, the social significance of speed of transportation lies in the fact that it significantly affects the ability of individuals to achieve their goals through interaction with other people, because it expands the range of such interactions and increases their intensity, thereby contributing to division and cooperation of labor that are the key results of social development and the basis for improving people's well-being.

The growth of speed of transport links expands the spatial boundaries of human interactions, facilitates them and makes them more fruitful, which means that they expand the scale and increase the effectiveness of the whole complex of interpersonal relationships, which is called «society» [3, p. 135].

The speed of freight traffic, which determines the amount of working capital that is «frozen» during transportation, has primarily economic importance [4, 5]. At the same time, for inexpensive «mass» cargoes, it is not so much speed that is important in itself as the guarantee of delivery in a given time period: «urgency is more important than speed», as professor V. Myasoyedov-Ivanov formulated more than a hundred years ago [6, p. 77].

The speed of passenger traffic, that is, movement of people themselves, has a predominantly social significance, but it also affects economic development, because in the course of social interaction people pursue and achieve, among other things, economic goals.

Objective. *The objective of the author is to consider social significance of speed of transportation.*

Methods. *The author uses general scientific methods, historical-retrospective method, scientific description, comparative analysis.*

Results.

The role of speed of movement in human evolution

The very origin of modern man in the course of the evolutionary process, formation and development of human society significantly depended on speed of movement that our ancestors could have, and the distances they were able to overcome.

According to anthropologists, about 2 million years ago primitive people formed a «new valuable property – ability to run fast and long», so they were able to overcome the vast expanses of the African savannah in search of food and, thus, the first of the living beings, to adapt to the conditions of savannah, which at that time became the main type of landscape [7, p. 53]. Of key importance was combination of speed and duration of movement: «competitors were more like sprinters who could do short-term jerks, while quickly getting tired», so the man «took the upper hand in those cases when everyone decided to search for prey in the vast expanses of savannah» [7, p. 53].

Here we see the most important aspect of the social significance of speed which is interrelation of speed, time and space.

On the one hand, the increase in speed means an increase in the possibility of spatial movement (overcoming space) over a certain period of time – the space is «compressed», «compacted» [8]. On the other hand, increased duration of movement at a high speed expands the boundaries of available space, and therefore increases the number of options for using particular resources and opening new useful opportunities. (This is fully manifested in modern transportation, as for example, for a motorist it is important not to develop the maximum speed in any area, but to be able to move at a high average speed for a long time. For air flights, not only the «cruising» speed of an airplane is important, but also the duration of its non-stop flight).

As for acquisition of new opportunities for development and use of the surrounding space by

our ancestors, then at that time a «turning point in evolution» came: a new kind of man was born – homo erectus (right-browing man) [7, p. 54]. Erectus moved constantly in search of food, overcoming during the day, according to some estimates, up to 50 kilometers. The representatives of this species not only mastered all of Africa, but also went beyond it, into the expanses of Eurasia. Thus, «a man entered the threshold of a new era, which turned him into a being of global, and then of a cosmic scale» [7, p. 79].

During the development of Eurasia, isolated centers of evolution emerged that lost contact with the rest of humanity. These are the Sinanthropus who lived on the territory of modern China [7, p. 92–97], and relatively recently discovered on the island of Flores (Indonesia) Homo floresiensis [9, p. 182–200]. Isolation led either to an extreme slowdown in development, or to degradation. Such consequences of isolation are characteristic not only of the early history of mankind, but also of all its subsequent stages, including the modern one, which testifies to the existence of an empirically confirmed law of social development.

However, the trends of movement and interaction have always prevailed over stagnation and isolation. So it was in the early history of mankind.

In the Middle Pleistocene (a geological epoch that began about 400 000 years ago), due to the population growth and its mobility, the disunity and isolation of human populations was replaced by the expansion of contacts and the smoothing of interpopulation differences [7, p. 98]. In these processes, you can see the first signs of the proto-globalization of mankind.

And, finally, about 30–40 thousand years ago, the formation of a behaviorally modern man (unlike the anatomically modern one that appeared earlier), which became known as the «human revolution», occurred. Among the most important manifestations of this revolution was the «rapid expansion of the habitat, the exchange between different groups, often separated by large distances, the development of water spaces» [7, p. 169].

Here is an illustrative example that characterizes the scale of spatial displacements of people and material goods in that era, and perhaps evidences the existence of an exchange: «... some stone products found at the oldest Upper Paleolithic sites in Kostenki[1] were made of stone, which could be found only 100–150 km away from the place of stay, and the shells found there could be brought only from the Black Sea coast, located at a distance of 500 km» [9, p. 371].

As for overcoming of water spaces, the most impressive example is seafaring. Archaeological finds attest to the appearance of Homo sapiens on many islands of South and South-East Asia, separated from the mainland by considerable distances, more than 30 thousand years ago [7, p. 191]. And on the islands of Melanesia, located in the west of the Pacific Ocean, systematic communication was established with the purpose of delivering obsidian – material for the manufacture of tools [7, p. 269].

Thus, ability for long movements with high average speed acquired by our ancestors played an exceptional role in the biological and cultural evolution of man, formation and development of society. The appearance of the first water and land vehicles not only increased the speed of movement, but also made new territories accessible to people [10].

The value of speed of transportation for social development

The development of regular transport links and exchange prepared a transition to sedentary life, which became the basis of the producing economy [11]. Such an economy could exist only under the condition of sufficiently smooth transportation of goods and, accordingly, the appearance of people who are engaged in it professionally.

At the same time, the speed of transportation in antiquity and the Middle Ages was still very low [11, 12]. Therefore, the journey to some significant distance turned into a real journey. Thus, in ancient times, even with the presence of beautiful Roman roads, «the journey from Rome to Naples lasted from three to five days» [13, p. 318]. Movement to really long distances required several weeks to several months. Engaging into such trip meant that one should abandon for a long time his usual occupations, that not everyone could afford. Many people in their entire lives did not leave the neighborhood of their native city or village.

The low speed of transport links makes trips not only long, but also rare, severely limiting human mobility. A person finds himself tied to a specific place, which complicates self-realization, restricts social ties and allows society to «atomize» easily, to become an archipelago of self-sufficient economic «islets», as it happened in the late Roman era and the Middle Ages.

In Europe, when «a great network of Roman roads» almost disappeared [14, p. 165], travel became even more difficult. «The medieval road was depressingly long, slow. <...> The daily stages varied according to the nature of the terrain from 25 to 60 km» [14, p. 166]. Sea voyage could be much faster – with a fair wind the ship crossed up to 300 km per day. But «the rapidity of progress achieved by the will of chance could be brought to nothing by dead calm, headwinds and currents» [14, p. 167].

The situation radically changed in 19th century with the advent of steam transport. If «at the beginning of 19th century the speed of movement was about the same as in the Hellenistic era», «by the beginning of 20th century, thanks to steam locomotives, people could travel at a speed of up to 80 miles per hour» [15, pp. 411–412]. If in 1800 the journey from Paris to St. Petersburg lasted 20 days, then in 1900 it took only 30 hours [16, p. 567].

«The advent of cars, airplanes and space rockets left these achievements far behind, not only in terms of speed of movement, but also in terms of expanding the space available for movement and flexibility of selecting vehicles» [15, p. 412].

Thanks to this, people had a completely new, planetary worldview, and this is the most important component of social and economic globalization [17].

The development of transport in 19th and 20th centuries, with ever increasing speed, led to drastic social changes. The emergence of steam transport has sharply accelerated urbanization. People got rid of the need to «settle next to the fields on which they work day in and day out, because of the lack of other transport, except their own feet». They became «free to live where they want ... for the most part ... in cities, where they are attracted by a broader labor market and various social benefits» [18, p. 277]. They had more opportunities to freely organize their lives and meet economic and social needs. But people did not just move from villages to nearby cities. They, in

[1] A complex of Upper Paleolithic sites in the territory of the present Voronezh region, where people had lived more than 40 thousand years ago for a long time.

search of new chances for self-realization, moved to other regions and even other parts of the world. And not only to cities, but also with a view to conducting more efficient agricultural activities.

A vivid example is intensive development of Siberia and the Far East in the late 19th – early 20th century, when the construction of the Trans-Siberian Railway was underway. Millions of people moved there, agriculture developed, existing ones grew up and new cities arose [19, 20]. Similarly, the development of the western territories of the United States was going on. «The construction of new railways, especially the transcontinental railways, facilitated a more active relocation to new lands of all those who could wish for it. In particular, this applies to 10 million new settlers who arrived in America in the last quarter [fo 19th century– D.M.] century» [21, p. 209].

And thanks to the development of steamship communication, intercontinental migratory flows intensified. First of all, from Europe to North America and parts of South America, Australia, New Zealand and South Africa [22, p. 937]. In 20th century, the vectors of such flows have undergone significant changes, but the goals and their meaning have been preserved.

Directions and intensity of migration flows and, in general, spatial displacements are an important social indicator. Just as capital moves to more investment-attractive industries and regions, people move to places that are more attractive to them from the point of view of not only earnings, but the whole complex of factors that determine the quality of life, and taking into account expectations for the future. Everyone is guided by their own subjective assessments, but the spatial movements of many people, being social processes, objectify these estimates, as the market objectifies a lot of subjective assessments of the utility and production costs of a product in the form of a fair market value.

And just as it is impossible to calculate the «right» prices based on statistical data (it is impossible to determine them only by a market mechanism), it is impossible also to correlate computationally various social and economic characteristics of different regions, cities and regions and determine where it is better to live, work, relax. And the directions and intensity of spatial movements of people, integrating many thosand, and sometines million individual assessments, give the correct answer to this question.

And we are talking not only about migration flows, but also about annual vacation trips, periodic trips related to training, treatment, etc. For such displacements, the speed factor is much more significant than for migration ones, since the speed growth substantially expands their spatial boundaries. Moreover, the speed growth can lead to replacement of migration trips to regular, including daily ones. If, for example, in 19th century (not to mention earlier periods) the desire to work or study in a big city located at a distance of even 50–100 kilometers from the place of residence, required «full-time» migration there, then modern speed, and particularly high-speed transport vehicles allow to make daily (and even more distant) «round trips».

It is with the growth of the speed of transport links that, in our opinion, the emergence of a trend towards de-urbanization in a number of the most developed countries, a reduction in the proportion of the population living in large cities is associated [23, p. 30]. This does not in fact mean «reversing the trend towards urbanization», but the expansion through the rapid transport of people's opportunities to «live where they want», working, as a rule, still in large cities. It is predicted that in the future the residence of the bulk of the urban population will move even further away from the city center, and the mobility of the townspeople will increase to such a degree that it will turn into «nomadic mobility» [24, p. 123].

The growth of speed of transportation made it possible to form one more feature of a modern, postindustrial society. This is «globalization of provision of services and international competition for clients, when educational and medical institutions compete not with neighboring schools and hospitals and not even with relevant institutions in their country, but throughout the world» [25, p. 10].

Thus, if the growth in speed and range of transportation of goods gives a global character to competition of commodity producers, then the growth in speed and range of passenger transportation will globalize competition in the sphere of essential services. Both of them mean expansion of freedom of consumer choice, contributes to the growth of the quality of life, social and economic development. «Economic development is unthinkable without freedom. One aspect of freedom is the diversity of goods and services that can be acquired in the economy, from small things to vital ones» [26, p. 146–147]. Another aspect is the variety of activities that a person can do and where he can carry out his activity. That is, there is an expansion of a really accessible space.

Estimation of space-time accessibility

The revealed social significance of increasing speed of transportation as a tool for expanding the boundaries of space accessible to a person for a certain period of time requires, firstly, development of methods for quantifying such space-time accessibility, and secondly, increasing it on the basis of a speed increase of transport vehicles. As for the first of these problems, as the most common measure of space-time accessibility, one can consider a territory to any point of which a person can get from a given (initial) point of space within a time not exceeding a given (1 hour, 2 hours, 3 hours etc.). In other words, this is the territory of isochronous transport accessibility[2]. (Along with the isochron method, there are other methods for assessing accessibility, their analysis is a scientific problem that goes beyond the topic of the article).

It is clear that within a given time a person can reach only a certain point on the territory of isochronous accessibility, and not all possible points in the aggregate that an individual has the right to choose. And here we go from the field of transport geography to the field of praxeology – the science of human activity, in which the choice made by man is one of the dominant categories [3, p. 7, 46]. Proceeding from the interests of human activity, space-time accessibility is not important in itself, but as an instrument for achieving the individual's goals in interaction with other people. For a person located in the taiga access to a larger forest area is unlikely to be very important. Access to places where he could get services and impressions missing in the taiga is more important for him.

Of course, each person has his own set of desirable places for quick access and his priorities for this desirability. But in general, since the achievement

[2] Isochron of transport accessibility is a line connecting the points of equal temporary accessibility.

of individual goals is usually associated with the need to interact with other people and to use the results of economic activity, indicators such as the population size in the territory of isochronous accessibility (social accessibility) and the gross product of this territory (economic accessibility) are suitable for assessing the spatial and temporal availability.

From here at once one can see the difference between the geographical and social dimension of space-time accessibility. For a person located, for example, in Yakutsk, even with equal speeds of transport communications and accordingly equal territory of isochronous accessibility, social and economic accessibility will be significantly lower than for a person in Moscow or St. Petersburg. Therefore, high speed of transportation is especially needed for regions with low population density and low intensity of economic activity.

From the point of view of the need for certain types of services, it is possible to use such indicators of space-time accessibility as the volume of trade, medical, educational and other services on the territory of isochronous accessibility. Again, for a particular person, it is not the total population and not the total gross product of the accessible territory that is important, not even the total volumes of certain types of services, but the availability of people with whom he could profitably interact and services of a certain quality, access to which he would like to get. Of course, the more people are in accessible space, the higher is the total volume of production or the volume of production of a certain type of services, which this subject is directly interested in, the other things being equal, he has more opportunity to achieve his personal goals. But still from this reasoning the limited use of aggregated (macrosocial, macroeconomic) indicators is quite clear. While they are undoubtedly useful, this limitation must always be borne in mind, and the analysis of aggregated indicators must be supplemented by analysis based on the logic of human activity, the logic of individual choice.

Prospects for further growth in speed

Whether we consider the space-time accessibility from the point of view of the individual or relying on aggregated indicators, to increase it, in any case speed of transportation must be increased. The solution of this problem requires both an increase in speed of transportation by certain types of transport, and elimination of time losses at the «junctions» between them. After all, any trip is carried out most often using two or more types of vehicles. Therefore, to increase the overall speed of such a trip, it is necessary to build intermodal (multimodal) process logistics and to ensure the connectivity of different modes of transport or different displacements using the same modes. The provision of connectivity becomes the basis of the so-called «seamless» transportation [27, 28].

As for mean route speeds achieved by certain modes of transport, they reached the limits of technical and technological restrictions at the end of 20th century [29]. However, now, as a response to the public request for cardinal acceleration of transport links, new technical ideas and solutions appear both in the field of land transport (projects of vacuum-levitation transport systems capable of reaching speed of 1 200 km / h, and even higher in the future) and air transport (new supersonic aircraft ready to accelerate over 2300 km / h, as well as the idea of futuristic aircrafts with even higher speeds).

Hybridization of vehicles can play a special role in increasing the speed of transport communication [30, 31]. In particular, we are talking about creating models that provide the synergy of land and air transport. They include a variety of projects of «flying cars» (some of them can be implemented in the short term), and (though it is still at the stage of idea) of a «train-plane», combining the speed of the aircraft with the flexibility of rail transport [31].

Such hybrid vehicles connect different modes of transport directly in themselves, thereby effectively solving the problems of time loss at the «junctions» between modes of transport and increasing the overall speed of transportation.

Conclusion. *Thus, increasing the speed of movement followed by expanding the size of the available space with various resources and the possibilities of using them has played a very important role in the evolution of mankind, the formation and development of society. The growth of speed and space-time accessibility contributed both to the emancipation of the human personality and to social and economic globalization.*

At present, there is a serious social and economic request for further cardinal growth of speed of transportation, in response to which the inventive and innovative activities in the field of high-speed and ultra-high-speed vehicles and systems are developed. The implementation of such projects will help to create a technical and technological basis for an even greater integration of mankind, on the one hand, and the expansion of opportunities for the self-realization of each person, on the other.

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