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INFORMATION GEOGRAPHY AND INFORMATION GEOGRAPHIC LANDSCAPE

Jinming Sha[1], *Chunjiao Ye*[1], *Xiaomei Li*[2]

The internet, cloud computing, big data, spatial geographic information, and geo-information technologies play an important role in our information society. This article discusses current research issues of the information geography and the information geographic landscape. The information geography is a new multidisciplinary field of social geography that study the regional digital information resources, network links, new region's characteristics and time-space characteristics of the social and economic networks. The focus is set on the four main aspects: the idea of space – time, network relationship, big data and the idea of double – space (real and virtual space).

Keywords: Information geography, Information geographic landscape, Network relationship, Big data

ГЕОГРАФИЯ НА ИНФОРМАЦИЯТА И ГЕОГРАФСКИ ЛАНДШАФТ НА ИНФОРМАЦИЯТА

Джинминг Са, Чуняо Йе, Сяомей Ли

Абстракт: Понастоящем съществува все по-голяма необходимост географските изследвания да бъдат тясно обвързани със съвременното информационно общество и да се постигне тяхната по-голяма практическа насоченост и приложение. Информацията има различни аспекти, като регионално разпределение, многократно използване, изграждане на мрежи и др., които могат не само да определят икономическото развитие на даден регион, но и да бъдат иновативно средство, доминиращо при създаването на нови политически и икономически модели. Така например, социалните мрежи могат да оказват влияние върху политическите промени, финансовите мрежи могат да въздействат върху

[1] College of Geography, Fujian Normal University, Fuzhou, China; jmsha@fjnu.edu.cn,
[2] College of Environment, Fujian Normal University, Fuzhou, China; lixiaomei@fjnu.edu.cn

икономическите структури и т.н. Тези примери придават особено значение на географските характеристики на информацията. Въз основа на това географските изследвания на информацията придобиват важна практическа стойност. В представеното изследване се дискутират географските характеристики (географията) на информацията и географският ландшафт на информацията, като фокусът е насочен към четири основни аспекта: 1) идеята за пространство – време, 2) взаимоотношенията в мрежа, 3) работата с големи обеми данни и 4) идеята за две пространства (реално и виртуално). География на информацията е нова мултидисциплинарна област на социалната география, насочена към изследване на цифровата информация като регионален ресурс, взаимоотношенията между мрежите, новите социално-икономически особености на районите във връзка с информацията и пространствено-времевите характеристики на социалните и икономическите мрежи. Основен елемент на тази нова област е географският ландшафт на информацията, който обединява конвенционалния ландшафт със системите от социални мрежи и информационните системи и така придобива по-задълбочено социално, културно и икономическо съдържание. В статията се разглежда водещата роля на взаимоотношенията в мрежа по отношение на пространството и времето. Изтъква се, че наборите от данни обединяват реалното географско пространство и виртуалното пространство чрез овърлей и картографиране и по този начин се създава нова информация за географските характеристики и ландшафта. Дискутираните въпроси могат да допринесат както за обогатяване на географските познания, така и за разработването на съвременни географски, социални и икономически приложения.

Ключови думи: география на информацията, географски ландшафт на информацията, взаимоотношения в мрежа, големи обеми данни

INTRODUCTION

Nowadays there is a growing need to have a clear understanding about the role of geographical research in the current information society and how the research issues may be more practically oriented and applied. Information has many different aspects such as regional distribution, regeneration and networking and these characteristics may not only determine the development of regional economy, but can be also a revolutionary tool, which dominates the new formation of political and economic pattern in our country. For example, social networks have changed the political pattern, financial networks have changed the pattern of economy, etc. These examples are all highlight the geographical features of information. Hence, the research issues of the information geography have attained an important practical significance.

This study discusses the information geography and the information geographic landscape in detail, and gets a conclusion that the idea of space – time, network relationship, big data and the idea of double – space are the four main aspects. Furthermore, the network relationship plays the main role with regard to the space – time network, as well as dataset bring the real geographical space and the virtual space together by overlay and mapping and thus create new information about geographical characteristics and landscape. Discussed research issues may contribute to the enhancement of geographical knowledge and development of advanced geographical, social and economic applications.

INFORMATION GEOGRAPHY

Information Geography is a new cross subject, which study the features of information social geography (Sha et al., 1996; Ellison & Glaeser, 1997; Lehmann, 2003; Aiginger & Davies, 2004; Dunning, 2009). The main research issues include regional digital information resources, network links, new region's characteristics and time-space characteristics of the social and economic networks. The information resources play a key role in the information society (ITU, 2011). This is different from the agricultural society and the industrial society, which depend on matter and energy. In the information society, the information is the first important resource, it becomes a resource that is more important than matter and energy. The information economic activities are quickly expanded for the purpose of exploit and take the advantage of information resources. It replaces the industrial production gradually and become the main content of the national economic activities.

Information resources have become the important aspects of information geography research. The information is generated on the basis of a certain area, or the digitization of other resources, or with IP identification. Different regions have different status in politics, economy, culture, military, in the social development framework, and thus creates different information pattern of different regional characteristics. This is due to a different geographic origin, or different IP identification information. That is to say today's information represents the mapping of regional characteristics, social policies, and economic activities.

Network dominates in national economy of the information society, and it forms the material basis of social informatization. The information technology revolution, which mainly contains computer techniques, micro-electronics, and communication technology is the source and power of social informatization. The advancement of web technology, scientific research and education, health care, enterprise and government management that are widely used by the society have influenced the economic and social development greatly and profoundly. It has changed people's life style, behavior and values fundamentally as the web contributes to great innovations, integration abilities and prosperity. Therefore, to reveal the characteristics of network relationship is an important research issue in the information geography.

Information geography study the rules of generation, delivering and application of information in different regions under a web environment. Information is based on a certain area (or industrial system), so different regions realize different information efficiency. This reflects the differences of information force in the regional system. Information force can reflect the new characteristics of regional information society perfectly. It consists of the following several aspects: (1) the ability of regional system to create a digital information network; (2) the network system's ability to capture and spread an information; (3) the ability of region to generate, gather and process an information; (4) the level of region's network equipment construction.

Information geography is based on information economic, internet economic and human geography, and aims at emphasizing how the information generation, processing, delivering, accumulation, function and feedback in internet environment at different location, rank, and size of urban system, at a view of the network feature, can solve the regional economy problems, contribute to the regional development policy and promote the continued and coordinated development of a region.

The introduction of new production factors such as information resources and modern technologies (computer technologies, network communications, etc.) in the information society causes the revolutionary changes in society, so the old ideas are replaced by new ones. Thereby, it should be putted forward the four important principles in information geography:

(1) *The idea of space - time.* The information revolution accelerates the rhythm of the social life, reforms the social economic and delivers more benefits. On one hand, the time-space distance of different regions shrinks, but the online service time and reachable space extends, on the other hand. The internet supports more intensive regional cooperation and the new technologies such as cloud computing and big data accelerate delivering and processing of information (http://baike.haosou.com/doc/580575-614558.html). The timeliness and instantaneity of information brings the efficient and fast rhythm of current society and reduces the influence of the central place theory and the location theory in traditional geography.

(2) *Network relationship.* The internet and transportation network stimulate the relationships between different regions to become a convenient freely crisscross network relationship. The network integrates all resources, produces new demand, puts forward the new technology constantly and delivers a large number of spillover benefits (Xu et al., 2015). Thus, the natural environment is not destroyed and the economy is on the way of sustainable development that is informatization and networking. Currently people live in two worlds, the real world (geographic world), and the virtual world. Based on the real world, people produce and trade more in the virtual world. All these activities are based on digitalization, informatization and networking. The economic pattern (domestic and international) has also made a major adjustment and reconstruction along with the establishment of the increasingly network relationship. Thereby, the communication information network, computer network and transportation network both national and international have spared no effort to be built, have transformed the traditional social economic relations, and also have changed the decisive role of regional natural resources in social economy.

(3) *Regeneration capacity of data.* Digital data for social, political and economic resources have indicated the main characteristic of social change. Data and information resources have become the most valuable resources. Data present a regional ownership characteristics since they have been taken by each department and region. In addition the data should have a clear point belonging to, or IP address to play a precision role. Mapping the social reality as a virtual world through digital data has accelerated the pace of informatization. One of the main advantages is that the information resources have an ability of regeneration, accumulation, reprocessing, distribution and reuse, and thus create a big data. Data have already become the important resources in the information society, but based on the cloud computing and data mining they can obtain great social and economic value.

(4) *The idea of double-space.* Our living space contains two different spaces, thus the real world (geographic world) and the virtual world. The geographic world mapping approximates to the virtual world, and the virtual world contains cyberspace and information space. The geographic world is the cradle of information and also gives a knowledge about the reasons for availability of different information in different regions. The generation of regional information is based on the differ-

ent ability of regions to use and distribute the information, which result from the market, science, technology, and cultural level on the basis of the original industry. Double-space structure causes significant changes in the social structure. The social flattening, the time-space compression, and the virtual space extension to the geographical space makes our society to run more smooth with rhythmical speed, and higher efficiency.

INFORMATION GEOGRAPHIC LANDSCAPES

The main element of information geography is the so called "Information Geographic Landscape" that is resulted from generating an overlay through next elements: Land, represented by: $L_1, L_2 \ldots L_n$;

Society, represented by: $S_1, S_2 \ldots S_n$;
Network, represented by: $N_1, N_2 \ldots N_n$;
Information, represented by: $I_1, I_2 \ldots I_n$;

Therefore, the information geographic landscape can be expressed in matrix:

$$\text{Info R} = \begin{bmatrix} L_1 & L_2 & \cdots & L_n \\ S_1 & S_2 & \cdots & S_n \\ N_1 & N_2 & \cdots & N_n \\ I_1 & I_2 & \cdots & I_n \end{bmatrix}$$

The structure of the matrix shows that the information geographic landscape is based on the traditional society and in addition this landscape is combined with the network system and information system compared with the traditional landscape. It can be consider that the farming community geographical landscape is primary and not perfect, its neural network system is not well developed (here network elements replace the neural system). But the industrial society should have a complete neural network system as it is matured gradually. Thus, a society that does not have network and information is not active and mature enough. But a society that have network is smooth, mature and developed, and a society that have information is smart, active, animated, and also full of economic benefits.

With the development of information society the information geography attains greater importance. In addition, the information geographic landscape is emerged as a new landscape that contains an enhanced social, economic and cultural content.

THE FORWARD FIELD OF INFORMATION GEOGRAPHY RESEARCH

The Figure 1 below clearly shows that the social and economic regional resources are digitized and mapped to the information space and become the useful

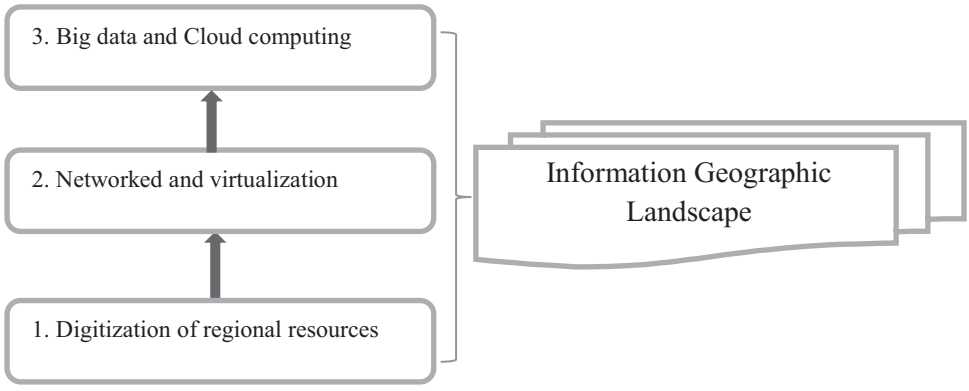

Fig.1. Resources for the Information Geographic Landscape

resources through the regeneration and re-distribution. They are used and combined in the network, and form a new law of time and space.

Hence, the hotspots of information geography research are as follow:

1) Big Data and Information Resources

Nowadays, the information is among the most important and the most useful resources of society. Based on the huge flux of data and user relationship, it can be considered that the flux of big data is the basis of information society. Furthermore, the owners of big data will "own" the future. Big data refers to the datasets that cannot be fetched and managed with conventional software tools in a certain period of time. In view of the fact that the information is result from the digitization of social economy, the mapping of economy in information space has a characteristic of regionalization, generation, reuse, and distribution just like big data. The daily browse of webs, using a smart phone to surf the internet, the business data of different industries, these all contain the information of spatial location, potential customers and future development. How to analyze these big data that include the digital process – the expression of the nature of the digital world and digital economy, becomes more and more important. It is also the important way for mining and using the resources of information geography more deeply.

2) Network Relationship

The network has become the neural system of society and marks the level of maturity. More full access to the internet and development of the mobile internet indicates that the internet has become one of the main characteristics of the society. In this sense the geographical space has been overlaid by a kind of network. There is a new time-space characteristic comes into being for the region and data (information) are all networked. Expounding the network relationship from the information geography – the characterization of transportation networks, internet, mobile network – means that the internet objects will become an important research content of information geography. It may have a profound influence on social, political and economic pattern and related policies.

3) Spatial Characteristics

The fusion and relying of the offline space and the online space is the coexistence of mobile-space and geographical space. The internet manages the spatial location through GPS – GIS. For example, a postal address forms the complete offline space and the online space is formed through the cooperation with social networks, maps, local information search, etc. Network sovereignty is relying on the geographical administrative boundary that is the traditional household registration and everyone can go to anywhere of the world using the virtual network world. But there is a geographical attribution, so the information society exist such a geographical feature: *"virtual space + geographical space = mobile space with regional characteristics"*. Therefore, spatial analysis that is based on geographical information, analysis of the hidden location information, spatial information and information for the ownership of big data have become the hotspots of information geography research.

4) Smart Cities

The internet, cloud computing, big data, spatial geographic information, and other information technologies shape our world to smart society and smart city through the network connection, data production and management and the automatic control (Occelli, 2001). As Wu Jichuan pointed out: "The construction of smart city makes the technology upgrading in different kinds of business and replaces and innovates the management and development of social economy, improves the efficiency of the informatization and operation of society, changes the lifestyle of people." The geographical phenomenon or geographical landscape, which contains distinctive information characteristics is another hotspot of information geography research.

5) Virtual Feature

Nowadays, the people survive in two worlds: geographic world (real world), and virtual world. The internet has realized the full connections between people – objects and has formed a virtual world, which reflects the real world through the real world virtual mapping. Analyzing the virtual world is an accurate analysis of the real geographic space.

CONCLUSION

From the above discussion two important points should be noted. Firstly, the Information Geography has changed organizational relations and methods of social production, since the information resources have become very important social resources, as well as the information economy has increased in GDP year by year becoming the main industrial economy.

Secondly, the Information Geography has re-structured geographical space through reflection of the world into real space and informational space – two spaces that greatly have changed decision making systems and operational systems. In connection with these systems the Information Geography has become more important in social economy comparing to other geographical theories.

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