

Geo-Informatic Tupu——the New development of Cartography

Qin Jianxin

Ph. D. The Research Center of Geographic Information System (GIS), Hunan Normal University. Changsha, Hunan, 410081

E-Mail: qjxzd@sina.com Tel: 86-731-8872982

Liao Ke

Prof. Institute of Geography, CAS.

Add: Bulding917, Datun Road, Anwai, Beijing, China, 100101.

E-Mail: liao_ke@263.net Tel: 86-10-64888916 Fax: 86-10-64888916

Xiao Hong,

The Research Center of Geographic Information System (GIS), Hunan Normal University.
Changsha, Hunan, 410081

Abstract

“Tu”, in Chinese words, includes graphics, maps, and images. The Chinese word “Pu” means the well-regulated sequence arrangement of the congener things, such as spectrum, chromatogram. “TuPu” involves the characteristics of “Tu” and “Pu” at the same time.

The Geo-Informatic TuPu is an information analysis and display method that reflects the spatial structure characteristics and the spatial-temporal sequence variation law of things and phenomena through integrating. The difference between TuPu and maps lies in that through the spatial analyzing, geo-science cognizing, abstract generalizing of substantive geo-information, and computer visualizing, TuPu can dynamically and multi-dimensionally reveal the spatial-temporal distribution and evolvement laws of all kinds of phenomena in the world. TuPu is very helpful to recognize and summing-up the natural and social laws, to make the plan decision of economic and society development, to protect and beautify the environment, and to make the countermeasures for disaster-defend and disaster-reduce. With the rapid development of GIS, Geo-Informatic, Digital Earth, multimedia and virtual reality, Geo-informatic TuPu is the new development in the information era, and it can create a new format based on the traditional map and electronic map.

The paper preliminarily discusses the concept, meaning, characteristics, classification, and application of Geo-Informatic TuPu.

1. The challenges facing Cartography in the new era.

Along with the development of high technology in which the information and communication technology is its main component, the cartography is facing unprecedented challenge and chance. Cartography, cartographers, and the role of cartography are fallen under suspicion.

- 1.1 The traditional information representation model of cartography is facing unprecedented challenge.
- 1.2 For lack of theory construction in the past decades, the cartography may be substituted by GIS, RS, GPS and other information science.
- 1.3 The cartographer may lose their job in the era, in which ordinary person can make their own maps using the mapping software.

2. Geo-Informatic Tupu——the New development of Cartography

2.1 The Concept of geo-information Tupu

Tupu is series of graphics. These graphics include maps, images and graphs, which represents geo-referenced phenomena analytically or comprehensively. Geo-information, Tupu is a regular arrangement of these graphics, which reflect the regular pattern of spatial-temporal change of the geo-referenced phenomena and their spatial structure.

Geo-information Tupu is based on the spatial and understanding of vast quantities of geo-information by means of remote sensing, computer cartography, and geographical information systems. It describes the configuration, constituents, mechanism, and spatial-temporal variation of geo-system and related phenomena at macro, meso, and micro level. Geo-information Tupu is an effective tool to deduce, retrospect, and predict geo-referenced phenomena, which can facilitate the understanding of intrinsic characteristics of geo-related phenomena, and the discovery of regular pattern on geo-science. Geo-information Tupu is also an effective tool for comprehensive evaluation and prediction, which provide scientific basis for decision-making on sustainable development, disaster prevention, and environment management. Therefore, geo-information Tupu has both theoretical and practical significance.

There are other kinds of graphic series, such as spectrum, chromatogram, electromagnetic spectrum, and genetic spectrum. They are similar to Tupu in a sense. The study of spectrum, chromatogram, and electromagnetic spectrum has a long history, and has gained fruitful results. The research in the field of genetic spectrum came later and has made obvious progress recently. In the field of geo-science, maps are age-old tools for geographical analysis. But there are few maps made into Tupu.

2.2 The communication model of the geo-information Tupu

Geo-related phenomena are usually complicated. This results from two aspects. First, the process and mechanism of the spatial-temporal change of geo-referenced

phenomena is very complicated. Second, the change and development of the phenomena is affected by many factors. Tupu not only represents the distribution and regional difference of phenomena, but also reflects the intrinsic pattern to the configuration, mechanism and spatial-temporal change of phenomena. The communication model of geo-information Tupu is illustrated as Fig.1.

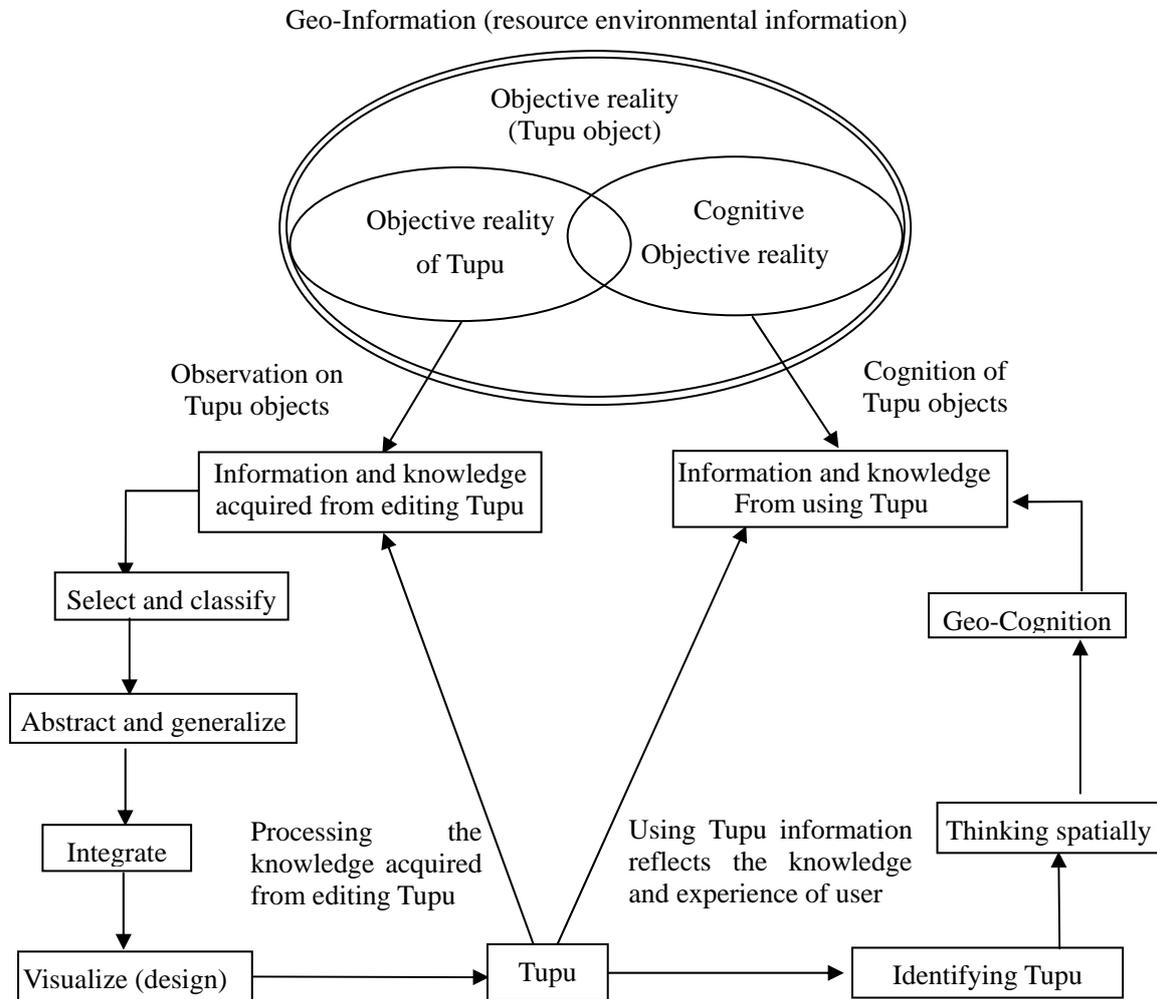


Fig.1 the Tupu information communication model

2.3 The standard model of geo-information Tupu

The standard model of geo-information Tupu includes classification standard, extraction model, modeling standard, and integration- application model.

a) classification standard including:

- classification by function: symptom Tupu, diagnosis Tupu, implement Tupu(Chnen shupeng, 1999).
- classification by geo- object:
 - geographic configuration, such as coastline, loess plateau configuration, water system configuration, urban inner structure.

- Geo- process, such as periodicity process, paroxysmal process, evolvment process.
- Geo- behavior, address selection, population transfer.
- Integrate characteristic.
- classification by application of resource and environment:
 - basic resource & environment condition Tupu
 - geo- locality Tupu
 - resource & environment evolvment Tupu
 - resource & environment countermeasure Tupu
 - the connection information Tupu between different economic zone.
- classification by generalization and extraction of geo-research objects.
 - Single element Single index information Tupu
 - Single element multi- index information Tupu
 - Multi-element and multi- index information Tupu
 - Geo-integration information Tupu
- b) extraction model including:
 - Single element information Tupu extraction model.
 - Multi-element and multi- index information Tupu extraction model.
 - Integration information extraction model.
 - The material geo phenomena information extraction model.
 - The abstract geo-phenomena information extraction model.
- c) modeling standard
- d) integration- application model

2.4 some typical geo-information Tupu

Tupu is different from conventional map. It provides 3-dimensional and dynamic representation of the configuration and spatial-temporal change of the Earth and related Phenomena by means of scientific computing visualization and virtual reality.

Some categories of geo-information Tupu are listed as follows:

a) **Geotectonic Tupu** It represents not only the content of conventional geotectonic map, but also the spatial-temporal change of geotectonic units The geotectonic categories can be generalized into several geotectonic patterns, and arranged regularly.

b) **Earthquake Tupu** It represents not only the distribution of the epicenter as conventional earthquake maps, but also their cause of formation and spatial-temporal change. The earthquake categories can be generalized into several patterns, and arranged regularly according to the cause of formation related to geological tectonic and active defaults.

c) **Drainage Tupu** It represents not only the drainage and its density, but also the structure and spatial-temporal change of drainage. Drainage categories can be generalized into several patterns, and arranged regularly.

Earthquake categories can be generalized into several patterns, and arranged regularly

according to the cause of formation related to geological tectonic and active defaults.

d) Tropical cyclone Tupu It represents not only the movement path of tropical cyclones in every month and the evolution of typical tropical cyclone, but also the spatial-temporal change of tropical cyclones. Various categories of tropical cyclones can be generalized into several patterns according to their formation conditions, evolution process and movement path, and arranged regularly.

e) Vertical structure Tupu It represents the vertical variation on landscape and ecological environment resulted from the variation of thermal zone, humidity zone, and landform. The vertical structure includes the variation in landform, climate, vegetation, soil, landuse and agriculture. All these zones can be generalized can be arranged regularly.

f)Vegetable Tupu It represents not only the vegetation in different thermal zone and humidity zone, but also the spatial-temporal change of vegetation, Different categories of vegetation are generalized into several patterns, and arranged regularly.

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