Journal of Research and Didactics in Geography (J-READING), 1, 7, June, 2018, pp. 123-126
DOI: 10.4458/0623-08

J - READING
JOURNAL OF RESEARCH AND DIDACTICS IN
GEOGRAPHY
homepage: www.j-reading.org

Geographic Knowledge. Paradigm of Society 5.0

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Received: March 2018 – Accepted: April 2018

Abstract

Thanks to the Digital Revolution, Geographic Knowledge (Geoknowledge) has enhanced its capacity and technologies, thus becoming a source of value creation in the ecosystem of knowledge. Through the development of ESRI technologies, which allow the integration of WebGIS with Artificial Intelligence, the Internet of Things and aerospace Big Data, the Science of Where is defining new ways of designing and experiencing the environment and the city. In this initial phase of the Digital Revolution it is essential to affirm the paradigm of a society, called "Society 5.0", capable of responding to the challenges of its own time, balancing economic progress with solutions to social problems. The enabling factor of this paradigm is the Science of Where and the thesis that the Science of Where is the enabling factor of the paradigm that implements Society 5.0 is fascinating, but has to be demonstrated. In order to prove this thesis, holistic experimentation is necessary, which involves all the actors present in the theater of society in order to demonstrate the benefits of this philosophy in this field through the exercise of good practices. For this reason, ESRI Italia recently set up a laboratory to conduct experiments at its regional office in Cagliari (Italy). The experimentation is scheduled in a project called Sardinia 5.0. The Laboratory is equipped with all the infrastructures, technologies and data necessary for specialists to perform the assessment of the social impact of existing initiatives and the construction of scenarios for a possible future.

Keywords: Geoknowledge, Digital Geography, GIS, Science of Where, Society 5.0, Digital Transformation, Digital Revolution

1. Geoknowledge

The Digital Revolution involves all disciplinary sectors creating a new ecosystem of knowledge.

Thanks to the Digital Revolution, the discipline of geographic knowledge (Geoknowledge) has enhanced its capacity for observation, modeling and calculation and at the same time has entered into new application sectors of non-traditional presence, but with a major impact on the development of society.

"*Technology today is not only more powerful than in the past: it is different. The possibilities opened up by the new technological paradigm are incommensurable compared to those of the past and demand new models of interpretation*" (Baban, Cirrincione and Mattiello, 2017).

Geoknowledge has always been a fundamen-

tal source of knowledge for man, since all natural and social processes take place in the space where man lives.

Man has always experienced material spaces – the physical environment – and virtual spaces (the representation).

In the various eras the reality model for the representation of geographical knowledge has been determined by the culture of society.

The Australian aborigines gave meaning and order to their material space and passed on their knowledge in songs – the Songlines – thus perpetuating the dream and culture of their ancestors.

The Romans represented the knowledge of the territory referred to the road network to allow its strategic exploitation.

Medieval maps corresponded to the need to give shape to the Christian symbolic space that dominated the medieval era in the West.

In the eighteenth century cartographic logic recognize the geometrical criterion to generate the "scientific" map that virtualizes the material space through the geometric sign.

Today we are witnessing the return to a holistic geographical metaphor realized by the WebGIS. We can say that for the millennials the web is an instrument and source of knowledge as was the song for the aborigines. Paraphrasing the statement "the Earth needs to exist as a mental category first. Then it has to be sung. Only then it is possible to affirm it exists" of Bruce Chatwin (1987): "The earth must first exist as a digital concept. Then it must be play on the web and only then it can be said that it exists".

Thus, in post-modern geography, the source of value creation is the knowledge enabled by Digital Geography.

It all started in the Harvard Laboratory for Computer Graphics directed by Prof. Steinitz, then the development passed to the ESRI (Environmental Systems Research Institute) laboratories, born as a spin-off of the Harvard group, upon the initiative of Jack Dangermond.

The progress of ESRI technology has benefited from the convergent development of ICT (Information & Communication Technology) and AST (Applied Space Technology).

The action of ESRI has broadened the boundaries of the geographic sciences that today are defined as the Science of Where.

"*The Science of Where is the science of digital transformation; the science of exploration and navigation; the science of commerce and ecology. It's the science of insight and innovation*", as Jack Dangermond said in the presentation of his company's new brand (http://www.esri.com/esri-news/arcnews/winter17articles/the-science-of-where-our-promise).

Through the ESRI technologies allowing the integration of WebGIS with Artificial Intelligence, the Internet of Things and aerospace Big Data and the Science of Where is defining new ways of designing and experiencing the environment and the city.

The Science of Where brings benefits in all the processes of knowledge because it combines the dimension of the Where with the traditional dimensions of the How, When and Why and allows to direct the focus of social development on individual needs.

2. Impact of the Digital Revolution

The Science of Where brings Geoknowledge into all the processes active on the territory, because with the Digital Transformation all the processes have become digital, therefore all the process owners enrich their processes of Mission Accomplishment or Business Implementation with the dimension of Where.

The rate of innovation introduced by the Digital Transformation has determined a real revolution, or the so-called Digital Revolution.

Today, we are at the beginning of the Digital Revolution and as in all revolutions, it is not possible at this stage to predict the social outcomes.

We can instead forecast the innovative products and services generated by the technologies making up this revolution.

By using the Schumpeter model, we can in fact predict the possible impacts on society, but we have no answer to the question of whether

the progress of technology will lead to a society that is oblative to human needs or will generate a society polarized only on production efficiency. We can only say that everything will depend on how the process of change is governed.

3. Society 5.0

It is essential to affirm the paradigm of a society that, by leveraging new technologies, is able to better respond to the challenges of its time, such as the protection of Creation, the safety of natural and man-made disasters, the preservation of the natural and cultural heritage , The socio-economic development and the education of new generations; that is, "*a society, with man at the center, balancing economic progress with the solution of social problems, through a system that strongly integrates cyber space with physical space*", defined as Society 5.0 in the Japan's 5th Science and Technology Basic Plan for 2016-2020 (https://www.tillvaxtanalys.se/download/18.36a7c6515478fc61a479ce2/1463050071286/Japans%20fem%C3%A5rsplan.pdf).

With Society 5.0, the vision of Industry 4.0 is extended, going from the optimization of production processes to the treatment of social problems, with the aim of achieving a complete collaboration between Technology, Artificial Intelligence and Man.

In order to implement the Vision of Society 5.0, a paradigm is needed that starts from the mapping of needs and solutions in terms of C2B (citizen to business), i.e. starts from the needs of citizens.

The enabling element of this paradigm is the Science of Where because everything starts from *Where* human needs are.

The development of Society 5.0. will take place in the various geographical areas with different methods and timescales because it depends on the meeting between government actions and industry and research initiatives which takes place in the territories.

4. The Laboratory

The thesis that the Science of Where is the enabling factor of the paradigm that implements Society 5.0 is fascinating but must be demonstrated.

To prove this thesis holistic experimentation is necessary, involving all the actors present in the theater of society, in order to demonstrate the benefits of this philosophy through the exercise of good practices on the field.

To manage this experimentation, it is necessary to create a Laboratory with specific territorial and cultural characteristics.

The Laboratory must be established in an area that possesses:

- geographically defined borders;
- governance sensitive to innovation;
- prestigious university;
- high-level research institutes;
- active non-profit sector;
- communities sensitive to the addresses of Laudato Si'.

Sardinia possesses all these characteristics, for this reason, ESRI Italia recently set up a laboratory at its regional office in Cagliari to conduct the necessary experimentation.

The experimentation will leverage the "charisms" of Sardinia and the skills of the ESRI Italia, which are complemented by the action of GEOsmartcampus (www.geosmartcampus.it) for Open Innovation, and throught its Academy of the Geoknowledge Foundation (www.geoknowledgefoundation.it).

5. The Sardinia 5.0 Project

The experimentation is scheduled in a project called Sardinia 5.0, the name deriving from the place and purpose of the project. The primary objective is to demonstrate the essential contribution of the Science of Where to the advent of a society, where the ethical, social and economic values of Society 5.0 are rooted.

The project plan initially includes a survey of initiatives, which are either under way or planned in the Region of Sardinia, where the Science of Where plays a decisive role in guaranteeing its success. The results will then evalu-

ated for further developments.

These results will also be used to carry out simulations in terms of What if (there would be: more data, more resources, more actors, more services) with Futurecraft methods, "*the art of building the future: hypothesizing future scenarios examining the consequences and needs and share the results, to allow an exchange of ideas and open a public debate*", as Carlo Ratti writes in his book "The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life" (2016).

Through the survey and analysis of the results, a method will be defined to calculate the R.S.I. (Social Return Index) of the initiatives. This index will constitute an important contribution to the definition of the social evaluation criteria for future projects.

For the experimentation, ESRI Italia provides the ArcGIS platform and the appropriate GIS analysis skills necessary to support specialists (Technologists, Researchers, Data Scientists, Administrators) who will work in the laboratory for the evaluation of the applications currently in place and for the construction of future scenarios.

A complete installation of ArcGIS Enterprise is made available with all the server functionality useful for the activities envisaged by the projects (GIS Server, GeoEvent, GeoAnalytics, Raster Server). Furthermore, the entire suite of apps from the ArcGIS platform is made available, such as the GeoPlanner fundamental tool for the conception, modeling and dissemination of territorial scenarios.

The living atlas map data (satellite images, orthophotos, traffic map, road accident map, etc.) and all the socio-economic information contained in the worldwide database of ArcGIS Online are also available. The ESRI platform allows the use of augmented reality applications, Building Information System (BIM), indoor routing and algorithms of deep learning and Artificial Intelligence to verify the future scenarios devised by the different working groups.

Finally, the new ESRI product called GEO HUB is made available. This product includes a rich set of templates of data models, webmaps and storytelling tools aimed at the biunivocal management of communication between Government and Citizens and therefore important for the evaluation of initiatives that will have as their goal social inclusion, protection of the territory or improvement of public services.

As an example of the use of GEO HUB, it is interesting to mention the project called "Geo HUB LA City" conceived by the mayor of the city of Los Angeles in 2016. The project promoted the creation of a geographical HUB of the entire City, through which citizens can consult both the present and future plans of the administration on issues of economic and social interest (transport, air quality, crime, public green, etc.), and the public Open Data available (street trash map, map of the parks, map of the traffic lights, etc.) but above all they can verify in real time the "work in progress" in the city (http://geohub.lacity.org/).

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