WHAT IS TECHNICAL GEOGRAPHY

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DOI: 10.21163/GT_2016.111.01

ABSTRACT:
In this letter I try to outline a definition of Technical Geography as an emerging new branch of Geography. The first part presents personal views based on two fundamental concepts: spatial and temporal AUTOCORRELATION and FREQUENCY. In the second part I present viewpoints from literature, as Technical Geography, which relies on spatial techniques, statistical techniques and modern technologies, is seen as a branch serving the geo-informational management and the decision-making system. I anticipate that in the not-too-distant future, the thorough research and constant increase in the number of Technical Geography applications will make all fields of Geography become technical and will remain so in the future.

Keywords: *Autocorrelation, Frequency, Spatial techniques, Statistical techniques, Modern technologies*

I have noticed, as I believe the entire community of geographers has noticed, too, that over the last two or three decades, the geophysical and environmental sciences, as well as certain social and humanities sciences tended to interfere with, damage or impinge on the fields of Geography research and teaching.

The purpose of this letter, by which I address myself to the community of geographers and specialists or spatio-temporal analyses enthusiasts, even if they have a different background, is to express my belief that Geography as a science can still maintain its subject and proper place among other scientific disciplines.

In 2006 we launched the journal "*Geographia Technica"*, supporting and promoting quantitative and technical research in Geography because we noticed a new branch emerging from the Geography science, that of the *Technical Geography*. By our journal we are trying to accelerate this process and further on I will try to define what Technical Geography is, or rather, what it should be. I anticipate that over the following years the *Technical Geography* will strengthen and, after this period, probably over the next two decades, all the fields of Geography will become technical and will remain so in the future.

1. MY POINT OF VIEW

1.1. How do I define Technical Geography in terms of its basic attributes that are intended to reflect the time and space evolution of the geographical processes and phenomena?

In my opinion, Technical Geography is based on two concepts/attributes of the geographical processes and phenomena, i.e. AUTOCORRELATION and FREQUENCY.

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i) Tobler (1970) states that two geographical processes/phenomena could be correlated, but the correlation is stronger if the two processes/phenomena are near from the spatial point of view. The measurement tool is the *spatial autocorrelation*, which is a statistical and, at the same time, a technical method. However, *autocorrelation* is also a feature of the geographical processes/phenomena on the time axis. It is well known that all that varies in space also varies simultaneously in time. Similarly, we could say that two geographical processes/phenomena could be correlated and that this correlation is stronger if the two geographical processes/phenomena are closer on the time axis. The measurement tool is the *temporal autocorrelation* which is a statistical and a technical method at the same time. As Geography deals with the subject of variability and representation of the geographical processes/phenomena in a spatio-temporal reference system, it is not permitted and cannot avoid or elude the spatial and temporal autocorrelation technique.

ii) *Frequency* means, generally, the measure of the number of times a phenomenon/process occurs per unit time or the number of times the phenomenon/process reoccurs per unit area. Geography, which operates with the space-time reference system, should approach, by means of its new branch – Technical Geography – both the spatial frequency and the temporal frequency. The frequency analysis addressed both at spatial and temporal scale represents a statistical or technical method to study a series of data specific to a certain phenomenon/process, to define its probability of future occurrence. Prediction is based on defining and implementing a probability model that expresses the occurrence probability of an event of a given value. As in the case of autocorrelation, in that of frequency analysis we should also use a series of statistical techniques. This means that, parallel or corresponding to the fact that Geography deals with phenomena/processes in their space and time development, there are used statistical techniques which are adapted to reflect their spatio-temporal evolution. Consequently, the new branch or line of research and professional training entitled *Technical Geography* is justified.

1.2. How would I define Technical Geography in terms of the geographical data and information and in terms of its relationship to GIS/Geomatics

a) The current geographic information is digital or may be converted to digital format. Physical, Economic, Regional and Human Geography operate nowadays with digital information. The remote sensing images, photograms or photographs/landscape clichés are based also on "pixels", therefore they are digital, too. Obviously, the processing and analysis of these types of information should also be of the numeric or digital type, and, why not, the processing should be carried out by state-of-the-art methods. It inevitably results that Geography today should have a branch dedicated to digital processing of data and information, based on advanced statistics and on informatics methods, i.e. on certain technologies that give its character of "Technical Geography".

b) The temporal or spatial data series have neither the diversity, nor the speed to develop like the methods and models of present science and technology. The old or classical geographical approaches, methods or models that were used when analyzing the data series and the geographical information, lag behind the competition imposed by the emergence of the new techniques, of the information software packages based on advanced statistics methods.

The risk is that non-geographers mastering these methods analyze the spatio-temporal data and information better than the geographers. That is why the need to deal with competition induced by other sciences claiming the geographic space as their subject of study and research becomes a serious challenge for geographers. Geographers need to test and adapt to the new methods, models and procedures and implement them in all fields and development trends of Geography. By these also, the Technical Geography as a new line of research and professional training becomes a necessity.

c) The classical observation and recording procedures of field data and of data coming from the geographical phenomena/processes monitoring stations are enriched today by the high resolution remote sensing, by GPS precision, and, in addition, are enhanced and diversified also by the accuracy of laser scanning. In my opinion, spatial and temporal data and information achieved by such techniques and tools should be kept as data of specific technico-geographical character, even if these are used by other disciplines. It is well known that at the beginning GIS was used for geographical and spatial applications, but today this technology is claimed by other sciences. I consider that Technical Geography should be a line of study and research not to lose the paternity of GIS, then the subject of study and research of Geography to the detriment of other geophysical or social sciences.

2. POINTS OF VIEWS IN LITERATURE

The syntagm *Technical Geography* occurs in literature increasingly frequently over the last few years. I do not intend to reproduce the definition or the history of Geography, nor its stages of development, but, in the simplest possible way, to highlight what other geographers understand by the syntagm *Technical Geography*.

In 2009 the *Geography* encyclopedia was completed in the form of two volumes published by UNESCO in cooperation with EOLSS (editor: Maria Sala), where this syntagm occurs several times, which means that some geographers accept *Technical Geography* as a topic or a field of Geography. I will further discuss the manner of defining *Technical Geography* and the content of this field of Geography, as it is seen within the encyclopedia. From the very beginning, in the introduction, Sala (2009) shows that the topic of the encyclopedia entitled *Geography* was divided into four main parts: *Foundations of Geography*, *Physical Geography*, *Human Geography* and *Technical Geography*. The aim of the fourth component would be to provide essential tools for research, teaching and practice. Technical Geography is built by the reunion of the following classical or modern technical disciplines: geodesy and topography, mapping and atlas production, remote sensing, GIS, modeling of geographical systems. The newer components are grouped under the name of *Geomatics.* In this encyclopedia it is also mentioned that *Applied Geography* is not included as a *specific topic*, because it refers to all the fields of Geography. Therefore, in the view of this encyclopedia there is no equality between Applied Geography and Technical Geography.

Ormeling (2009a) sees Technical Geography as a natural and modern consequence of the evolution of Cartography from map production to spatial information capable of supporting decision-making procedures. This progress was conditional on the influence of the information theory, on the digital revolution, on the emergence of visualization

techniques (Ormeling 2009b) and on the actual informational boom on the World Wide Web. The traditional map production was gradually diversified by means of the digital revolution, reaching a more advanced stage which included geo-informational management and capacities to meet the needs of various users, as well as systems to assist/support decision-making. The map has always been a tool for any geographer, but it is also a product of Geography as a science, it is the result of an elaboration process that implies also technical constructive elements. We could say that a geographical paper or application ending with a map follows a path similar to a technical production cycle. At least from this point of view, an application or a paper ending with a new map is a work of Technical Geography.

One could also speak of a work of Technical Geography when the statistical methods are used to support the spatial analysis of quantitative, even qualitative data. Geodesy, Photogrammetry and Remote Sensing are also considered disciplines or techniques that serve the aims of Cartography, respectively the aims of the geo-informational management and of the decision-making system in the geographical space. Ormeling also says that, by mapping a phenomenon, extra information is generated, because it is put in a spatial context; and that generalization reduces the volume of data, but, on the other hand, it presents new, more overall patterns and trends. Hence, the digital map is only a means and not the final purpose of Cartography.

Geography should not be understood as a science that deals only with the geographical space or the interaction between man and society. The temporal aspect and the variability of geographical phenomena/processes, at various temporal scales, respectively, are very important. The analysis of the time series is not a very familiar working procedure among geographers, either due to the fact that it is claimed by other geophysical, economic or technical sciences or just because few geographers master such methods properly. Here is Baker's definition of Geography *"Geography can be defined as the study of the organization of spatial form, the explanation of process, and how both of these change over time"* (cited from Baker, 2009). Of course, here it is not only about landforms, as the spatial forms can be 2D or 3D representations of many geographical, physical or human phenomena/processes. In the cited paper Baker states that the present modeling and scientific methods undergo a quantitative revolution: "*The evolution of modeling in the twenty-first century therefore has to show how theoretical relationships can be tested against robust data"* (cited from Baker, 2009). The affirmative answer I give to this scientific undertaking is based on the Technical Geography, on exploring the applicative possibilities of the spatial and temporal autocorrelation, as well as on the frequency analysis, and these should be used in any field of Physical, Human, Economic or Regional Geography. In our opinion, other modeling methods and procedures with different names in literature (O'Kelly, 1999) also result largely from attributes related to autocorrelation or frequency, provided that, as O'Kelly says, the modeling geographers understand the mathematical language and, of course, the required software.

Nowadays, Geography is characterized by an integrative approach (Gerber, 2009; Da Cunha, 2006) which makes use of spatial techniques, statistical techniques and modern technologies (GIS, GPS, RS), thus highlighting the trend towards the development of the technical component of Geography. Being aware of this perspective, Reinfried and Gerber (2009) suggest that education and professional training in Geography must adapt to the new

trends and challenges. I would mention here that these are the challenges imposed by the upgrade of spatial statistics analysis techniques and by the progress of space technology; in short, it is important to show interest for training in Technical Geography.

In conclusion, I anticipate that in the not-too-distant future, the thorough research and constant increase in the number of Technical Geography applications will make all fields of Geography become technical and will remain so in the future.

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