

THE FIELD OF GEOINFORMATION WITHIN THE SYSTEMATICS OF SCIENCES

DZIEDZINA GEOINFORMACJI W SYSTEMATYCE NAUK

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Introduction

Although news of the appearance of a new scientific discipline should be treated with caution, as it often turns out to be a new para-science or an artificial separation of issues from an existing branch of knowledge, the development of informatics manifests itself in the arising of new branches of knowledge and disciplines of science. An example of this is geomatics, also called geoinformatics, of which Janusz Michalak wrote a few years ago: „Many facts show that we are dealing with a new discipline which has evolved in the area of interdisciplinary problems connected with GIS (geographic information system) in the point of contact between informatics and widely understood Earth sciences. This discipline (...) has its own scope of issues to solve, and its own methods of research and applications of its achievements” (Michalak, 2000).

The concept of geoinformation science was introduced in 1992 by Michael Goodchild. To describe this science other terms also appeared, such as geomathematics, spatial information science as well as geoinformation engineering (Longley, Goodchild, Maguire, Rhind, 2006). In Poland, as well as the terms geomatics and geoinformatics, a concept of geoinformation science and technology is used, where the word technology is used in the sense of the entirety of individual technologies concerning geoinformation (Gaździcki, 2006). However, in some of the literature concerning the field of knowledge connected with geoinformation (geographic information, spatial information) terms such as Geographic Information Systems (GIS) or Spatial Information Systems (SIP) are often used and sometimes simply geoinformation, which can lead to misunderstandings, because the term geoinformation describes just a kind of information.

This variety of terms in the literature to refer to the same concept, often used interchangeably and incorrectly, causes confusion, especially for a reader not entirely acquainted with the field.

This article attempts to order the geoinformation terminology by defining the terms, because quoting Tadeusz Kotarbiński, one can state that a highly valuable way to „fight the opacity of speech understanding” can be „constructing definitions, that is, determining language expressions” (Kotarbiński, 1929). Moreover, it also tries to determine the position of geoinformation science in the systematics of sciences.

The name and notion of the field of geoinformation

The term from which one should start considering the terminology is geoinformation (abbr. GI from GeoInformation; also described as geographic information, spatial information, information on land). This term is often used in recent years, when the problem concerns geographic information systems (spatial information systems). It is used, amongst other places, in the titles of scientific conferences; as a name of specialization within the studies in colleges; as a name of Internet portals; and even as a description of a society (GI society). Geoinformation, most generally, means information on the natural environment in which man has evolved and in which he develops, information on resources, as well as information on the development of our planet (Jachimski, Bujakiewicz, 2001). This is information gained via the interpretation of geospatial data, information concerning spatial objects connected with the surface of the Earth (Gaździcki, 2003). Thus, geoinformation is a kind of information having special features. A distinctive feature of spatial information that distinguishes it from other types of information is the fact that it refers to a specified ground position. Because of this, its necessary attributes are data determining the ground position expressed in some coordinate system. Taking into account what or who the information relates to, we can divide them into spatial, referring to the Earth or – practically most often – to the fragments of its surface, that is, explicitly geographically localized with coordinates or spatial references, as well as information concerning the subjects and moveable objects (Ney, 2005). The definition given by the Polish Normalization Committee determines geoinformation as a knowledge concerning objects such as facts, events, subjects, processes or ideas, including conception, which in a fixed context has definite meanings and determines the relevant object position on the surface of the Earth towards other objects (vortal geoinformacja.pl). Zbigniew Zwoliński, in turn, even describes it as a science redefining and developing the hitherto prevailing, acknowledged and received concepts, theories and notions of geographic sciences in informatics categories (Zwoliński, 2007).

Undoubtedly, in connection with the dynamic development of methods and technology concerning geoinformation, an urgent need arises to separate and determine a branch of knowledge focusing around this important type of information: however, the name of the science or scientific discipline should apply to geomatics, geoinformatics or the proposed geoinformation science and technology. The lexicon of geomatics (Gaździcki, 2003) defines geomatics (geoinformatics) as a scientific-technological discipline dealing with assembling, analyzing, interpreting, popularizing and practical application of geoinformation. Internet statistics (Gajos, 2007) shows that the term geomatics is far more popular across the world than is geoinformatics. The term geomatics appears more often in the areas of English language influence, and geoinformatics in German-speaking countries. Both these names are synonyms but are not commonly accepted in Poland; perhaps the Polish name for this discipline

should be the proposed geoinformation science and technology (Gaździcki, 2006). These sciences include basic issues connected with assembling spatial data, their processing and applying. Regardless of the name, their common feature is the subject of research, that is, spatial data processing with GIS software. Therefore, the name GIS occurs in the literature to refer to the field of geoinformation.

GIS are the effect of a revolution in geography that has happened in recent years, as well as, of course, the rapid development of informatics and databases (information collection) management methods. The rise of GIS is a result of combining works conducted in different fields: geography, cartography, geodesy, informatics, electronics (Wikipedia, article: Systemy Informacji Geograficznej). GIS, a synonym of spatial information system, land information system, is a system of gaining, assembling, verifying, integrating, analyzing, transferring and presenting spatial data. In broad terms it includes methods, technical means including hardware and software, spatial data base, organization, financial resources and people interested in its functioning (Gaździcki, 2003).

The scope of the name science and systematics of sciences

The term science is ambiguous and variously defined. Today science is most often understood as (Kryszewski, 2003):

- the totality of actions performed by scientists, that means that science is treated as a cognitive process, especially when it makes up a scientific discovery;
- the totality of products of these actions connected with practicing science, that is concepts, statements, hypotheses, theories, etc., that means a branch of knowledge meeting the criteria of scholarship, subordinated to fixed methodological norms;
- discipline practiced and lectured in colleges or scientific institutions, research & development units, etc.

The concept of science is considered in the following aspects (Siekierski, 2005):

- functional – when it refers to realization of research process, that is, it describes activity in a specified domain of scientific research, also as a sort of knowledge;
- subject & content-related – when the cognitive process is reflected in results of research, knowledge gained and information obtained, the result of these actions will be a determined scientific output in the given branch of knowledge, especially important in the case of a fundamental scientific discovery;
- pragmatic – connected with programming and technology of research, source of information and scientific documentation, finally applications (implementations);
- institutional – concerning a group of institutions within the framework of which science is practiced, which allows one to historically relate the disciplines of science in any discussion concerning the question which of them are sciences and which are not.

In different historical periods, starting from the ancient times, attempts were made to create a systematics of science in the form of full and partial classifications of scientific disciplines, using different features of these disciplines as the basis of the division (Chmielewska-Gorczyca, Sosińska-Kalata, 1991). The individual disciplines of science are “an invention” of the turn of the 18th and 19th century. They came into being as a result of a great number of changes and innovations. Disciplines are both systems of knowledge and

social systems. A discipline of science most often means a branch of knowledge lectured in colleges and practiced within the framework of a faculty or an institute. Scientific classification schemes are usually organized around disciplines. One can also distinguish topics signifying fields of knowledge which do not have their position in the classification schemes and which can appear in one or several disciplines (Kozłowski). Selected systematics of sciences are presented below.

Traditional systematics divides sciences into (Wikipedia, article: systematyka nauk):

- 1) formal sciences – exact sciences, that is mathematics, logic, structural sciences;
- 2) real sciences:
 - natural sciences, that is sciences dealing with the world perceived by a human: physics, chemistry, biology, the Earth sciences, astronomy, theoretical medicine,
 - engineering sciences;
 - humanities, dealing with human and human's cultural and spiritual products: history, cultural anthropology, philosophy, linguistics,
 - social-economic sciences, dealing with society, its organization, changes: anthropology, history, political science, international relations, economy, sociology, pedagogy, psychology.

Any formal-legal division of sciences distinguishes scientific domains. In Poland, according to the Act of the Central Commission for Professional and Academic Titles and Degrees of 24 October 2005 on defining fields within sciences and arts as well as disciplines of science and art, 17 fields of science can be distinguished (biological; chemical; economic; pharmaceutical; physical; humanistic; forest; mathematical; medical; physical culture; the Earth; legal, agricultural, technical; theological; veterinary; military) and 4 fields of art (film; music, fine arts, theatre) together with 81 disciplines of science and art being parts of them.

Another division into fields of science in Poland results from the faculty structure of the Polish Academy of Science and it includes the following sciences: social, biological; mathematical, physical and chemical; technical, agricultural, forest and veterinary; medical; the Earth and mining.

Taking into account the division into fields of science resulting from the faculty structure, one should also take into consideration the faculty structure of the Polish Academy of Learning, which is composed of six faculties: philological, historical-philosophical, mathematical-physical-chemical, nature, medical, creative activity.

The place of the geoinformation field in the systematics of sciences

Bogdan Ney in his article „Informacja przestrzenna w naukach o Ziemi” (Ney, 2007) writes about the role of geoinformation and geoinformation systems in the field of the Earth sciences, that is scientific disciplines such as: geophysics, geography, geology, oceanology. Through a close relation of the Earth sciences and related fields (biological sciences, physical sciences, humanities, technical sciences, forest sciences, agricultural sciences, technical sciences), geoinformation is also connected with scientific disciplines such as: ecology, (biological sciences), geophysics (appearing also in the field of physical sciences), archeology (humanities), forestry (forest sciences), shaping of the environment (agricultural sciences),

architecture and town-planning, building, geodesy and cartography, mining and engineering geology, environmental engineering and transport (technical sciences). Thus we can say that there are close relations between geoinformation science and technology (geomatics, geoinformatics) and the disciplines of science listed above. Geoinformation science and technology as a science, and especially technology, is undoubtedly connected with informatics (appearing both in mathematical and technical field of science).

The author of this article also proposes that geoinformation is related to the humanities discipline of bibliography. It is not a direct relation, nevertheless methods used in bibliography can be used for investigating terminology, sources of geoinformation, users' needs, and access to geoinformation.

A Geoinformation Commission was established within the IV Nature Faculty of the Polish Academy of Learning in 1998. Its main task is the exchange of experiences between experts from different disciplines in the field of geoinformatics, stimulating development of this science and propagating its findings (Polish Academy of Learning, Faculties and Commissions). The existence of this Commission shows the need to isolate geoinformatics as a separate science.

Can geomatics (geoinformatics) be treated as a separate science? The subject of this article is not a detailed analysis whether geomatics is a science and discipline of science, because this would require defining the subject, purpose (function), method, structure and genesis (Pongowski, 2007). However, the elaboration of the thematic scope of the geoinformation field as a science and technology (Gaździcki, 2006) aiming at, among others, creating a separate specialization in Poland, has resulted in isolating a separate discipline of science.

Conclusions

The range of problems comprising the subject of geomatics has been so far treated as interdisciplinary and connected especially with the Earth sciences. Although many applications of geoinformation systems are not often connected with traditional notion of geography, geographers have devised the majority of methods of spatial data analysis in the last over forty years. Not all scientists see geoinformation systems as a main stream of informatics (Longley, Goodchild, Maguire, Rhind, 2006).

What position then should geomatics (geoinformatics) take in the systematics of science? Should we consider it as a separate discipline of science: a science used by other sciences or technology and more and more often used in every day life?

Should it be treated as a discipline of science within the Earth sciences or technical sciences, or maybe both?

The answer to these questions will undoubtedly depend on the nomenclature of fields and disciplines of science as well as on tendencies in their division.

As Bogdan Ney writes: „At present two contradictory tendencies function within this question. The first one is the more and more detailed division into numerous disciplines, sub-disciplines, specialties and subspecialties, also reflected in the growing number of specializations in advanced studies. The multitude of collected knowledge and more and more detailed specialization of the researchers having more and more numerous methods and techniques

of research support it. The opposite tendency is supported by a growing conviction that the most interesting research problems, promising achievement of creative successes, appear on the borderlines of interrelated to a large extent disciplines, and even fields of science. This tendency causes smaller number of fields and disciplines of science. It is expressed in grouping scientific problems into three mega-fields, including the following sciences: humanistic and social, biological and medical (life sciences) and exact and technical” (Ney, 2007).

For the name of the science concerning gathering, analyzing, interpreting, distributing and using geoinformation, the author of this article is willing to opt for two names – geoinformation science and technology (stresses both scientific and technological aspects of geoinformation) and geoinformatics (shows explicitly the relation with geo, that is the Earth and informatics). Because of conciseness of the term, the name geoinformatics seems to be easier in reception.

However, the problem cannot be viewed statically, it should be presented in the light of development which lasts. That ensuing “terminological mess” is a result of the dynamics of development and the interdisciplinary nature of the field of geoinformation.

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Abstract

In connection with the dynamic development of methods and technology concerning geoinformation, an urgent need arises to separate and determine a branch of knowledge focusing around this important type of information. In Poland, next to the concepts geomatics and geoinformatics, a name geoinformation science and technology is also suggested, defined as a scientific-technological discipline dealing with assembling, analyzing, interpreting, popularizing and practical application of geoinformation. In connection with the evolution of a new discipline, a kind of terminological "disorder" prevails. This article attempts to order the terminology concerning the field of geoinformation, by defining the terms. Moreover, it also tries to determine the position of geoinformation science in the systematics of sciences.

Streszczenie

Niewątpliwie w związku z dynamicznym rozwojem metod i technologii dotyczących geoinformacji powstaje pilna potrzeba wyodrębnienia i określenia dziedziny wiedzy koncentrującej się wokół tego ważnego rodzaju informacji. W Polsce, obok pojęć geomatyka, geoinformatyka, proponowana jest też nazwa nauka i technologia geoinformacyjna, definiowana jako dyscyplina naukowo-techniczna zajmująca się pozyskiwaniem, analizowaniem, interpretowaniem, upowszechnianiem i praktycznym stosowaniem geoinformacji. W związku z kształtowaniem się nowej dyscypliny panuje też pewien „nieporządek” terminologiczny. W artykule podjęto próbę uporządkowania terminologii dotyczącej dziedziny geoinformacji, poprzez zdefiniowanie terminów. Ponadto podjęto również próbę określenia miejsca nauki dotyczącej geoinformacji w systematyce nauk.

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