

THE CHANGING FACE OF CARTOGRAPHIC EDUCATION AND TRAINING

FRASER D.(1), ZENTAI L.(2), BRANDALIZE M.(3)

(1) RMIT University, MELBOURNE, AUSTRALIA ; (2) Eötvös Loránd University, BUDAPEST, HUNGARY ; (3) Universidade Federal do Paraná - UFPR, PARANÁ, BRAZIL

ABSTRACT

This paper discusses the issue faced by many cartographic departments and programs around the world. That is the weakening of cartography as a discipline in its own right and the dispersal of cartographic theory and practice into many and varied education programs representing allied disciplines.

The general public has little awareness of the connection between the study of cartography and the new spatial information technology that they use daily. The GISciences industry had become fragmented as it searched for identity in this rapidly changing environment. University programs were feeling the impact of these changes through the reduction in those seeking careers in cartography.

This paper first discusses the growth of digital cartography. Second, the impact of changes on the GISciences industry is discussed. Third, the impact of the changes on cartographic education and training is discussed and specific points are emphasised using case study examples for individual programs from Hungary, Brazil and Australia.

This paper

INTRODUCTION

Cartographic education in the last century grew out of either mapmaking, map production, geography or land surveying depending on which part of the world the program was based. Cartographers were seen as providing a service to these primary disciplines. As the discipline of cartography matured after World War II and then again, with the introduction of computer technology, it developed into a standalone offering in many countries.

Cartography degrees were established in many universities and some scholars went on to Master of Philosophy and Doctor of Philosophy studies. Cartography graduates were in demand as they were at the forefront in knowledge of new techniques and the use of the latest computer technology.

In Europe, the first independent cartographic courses were established in MIIGAiK, Moscow in 1923, but the most important institutes concerning cartography at that time were in Zürich and in Vienna. The first scientific organization of cartography, the Swedish Cartographic Society was formed in 1908 (Institut für Kartografie, ETH Zürich – 1925; German Cartographic Association – 1937) (Zentai, 2009).

In Brazil, the first undergraduate engineering degrees in surveying and cartography were only established in the late 60s. The duties of the surveyors and cartographers, along with the geodesists and geographers, were established by the referred Federal Council of Engineering and Surveying, only in 1973. During the growth periods many private companies flourished and cartographers found themselves part of multi-disciplinary decision making teams.

Today many universities throughout the world provide cartography and GIS studies as introductory courses only (Peters, Krisp & Meng, 2009). A few universities still provide complete, professionally recognised cartography degrees. The introduction of digital into cartography has seen a major and rapid change in the requirements of industry.

DIGITAL CARTOGRAPHY

The growth of digital cartography coincided with the development of digital spatial databases. A proliferation of databases occurred covering many different map scales and data themes. Originally the intelligence was primarily in the software used to manipulate, analyse and display the data. Frustrated users were faced with varying levels of data accuracy and formats. Governments and the large private organisations began developing standards which, by natural selection, were either adopted or rejected by the industry as a whole. Data sets became more standardised and versions of the same dataset, which in the past had been manipulated by third parties, tended to be less prominent. This was due, in part, to the increased reliability of the datasets supplied by the governments and larger private organisations. The users were still frustrated by the expense of these datasets and the restrictive licensing agreements. Government and industry attempted to recoup the cost of the creation, development and maintenance of these databases through licensing fees.

During the late 20th century and early 21st century, software development in the information technology and motion picture industry was moving forward rapidly. Entrepreneurial companies saw opportunities to exploit the ease with which the Internet and computing technologies provided access to spatial data. A number of products such as Google Maps and Google Earth became freely available and the Internet enabled population took to the new products and began driving improvement through the suggestion of, and development of, new applications. Industry competition in some areas was dissipated almost overnight as products that were previously only available at a fee suddenly became freely available over the Internet. One example is the Brazilian Institute for Space Research (INPE), which provides freely and through the Internet, software for digital image processing and GIS, along with satellite images from the CBERS program. (Brandalize, 2009) The intuitive interfaces and world-wide databases allowed users to combine vector and raster databases of most parts of the world and at an extraordinary array of map scales and resolutions.

The technology enabled world population demanded and received instant access to spatial data and often in real-time. Smart phone, wireless Internet and location based services, such as in-car GPS navigation, freed users to access information wherever they were, whenever they required it. Costs were hidden in the price of the original product and the ongoing servicing of up-to-date data. In Brazil, like many other countries, spatial information and cartographic products are normally made available to the public at no cost or at a very low cost.

The developed nations are benefiting enormously from the information age, while developing nations are struggling to keep pace (Peterson, 2007).

THE GISCIENCES INDUSTRY

The GISciences industry as a whole is a service industry which provides technicians and professionals skilled in the use of particular technology that is capable of measuring, mapping or modelling geographical reality. The demand for people with these skills is very strong but advances in technology means that not as many individuals are needed now as in the past to achieve the same outcome. Do-It-Yourself cartography is commonplace (Rhind, 1999). Superficially many general users can create the map products they need by using a home computer and a colour printer (Keogh, Fraser, 2008). Near real-time applications, such as weather, mapping current traffic conditions or locating nearby restaurants, are parts of just a range of applications that a user can access. Behind all the simple, front-end interfaces sit the spatial analysis engine which drives the technology. According to Professor Michael Goodchild, there has been a move towards regarding GIS (and cartography as a sub-set of it) simply as another branch of the IT industry (Rhind, 1999). Many organizations have adopted a Geographic Information System (GIS) but their staff is comprised mostly of analysts of diverse disciplines and very few if any are cartographically trained (Murad-al-shaikh, 2007).

Professional organisations changed as the industry changed. For example, in Australia, the Institution of Surveyors Australia and the Australian Institute of Cartographers, existed side-by-side for many years serving their members admirably. In a search for unity a new professional organisation, the Spatial Sciences Institute (SSI), was formed. Recently the SSI changed to the Surveying and Spatial Sciences Institute (SSSI).

In Brazil, cartographers only begun to occupy privileged and recognized job positions in the Brazilian mapping industry with the recent socio-economic development of the country.

In many other countries, Hungary being one of the exceptions, the term cartography has all but disappeared or has been replaced by GIScience, geomatics or some similar term which has integrated cartography. In Brazil the profession of cartography does not have the same recognition as the other engineering degrees. One outcome of this is the low demand verified by the Universities. The increasing marginalization of cartography within the larger digital geographic enterprise (Goodchild, 1999) is of concern to professional cartographers.

CARTOGRAPHIC EDUCATION AND TRAINING

University programs have felt the impact of the changes through the reduction in those seeking careers in cartography. The development of the spatial sciences industry has been accompanied in academia by a natural evolution from specific discipline based degrees to more general, all encompassing, degrees. In Brazil this is true for some programs and institutions. Public universities have financial problems and are less accepting of curriculum changes that require, for example, large investments. "Professional organizations have called for graduates that are more able to operate collaboratively as team members within a broader group of professionals operating on complex problems not limited to one discipline." (Webb, 2009, p6)

In Australia the distinction between different programs has become blurred as different educational organisations attempt to label their programs using many of the terms that now exist to describe programs with similar content. The terms spatial science, geomatics, geoinformatics, geovisualization, spatial information science and geographical information sciences are not known outside of the GISciences industry and hence this leads to confusion. In Brazil there is a trend towards the unification of the terms. The Ministry of Education (MEC) has unified the terms for the engineering degrees, so, the tendency is to use the term “Cartography and Surveying Engineering”. The original term ‘cartography’ is still retained in Hungary at the Eötvös Loránd University, but of course the real content in the education is continuously changing depending on the progress of the industry. In general, the GISciences industry does not have many degree titles that are immediately recognised by the general public in terms of content and career path.

In Australia universities changed the names of their programs in an attempt to attract students but this may have had the opposite effect when marketing was not successful. The variety of names that have eventuated has led to confusion more than clarification. For example, the RMIT University in Melbourne, Australia, has provided a cartography degree since 1976. Over the years, the program has changed in both form and content, from a four year Bachelor of Applied Science (Cartography) to a three year Bachelor of Applied Science (Cartography), then to a three year Bachelor of Multimedia Cartography, and then a three year Bachelor of Cartography and Geovisualization. Finally it was determined that the numbers entering the program were no longer enough for the program to remain viable in its present form and it was closed at the end of 2009.

This has not happened in Brazil. The term Cartography Engineering has been in existence since 1965, when the first degree was implemented in the state university of Rio de Janeiro. The same occurred with Surveying Engineering, which is the same since 1963, when the first degree was implemented in a private institution of São Paulo State.

In Hungary the special cartographic programme started in 1955. For a long time it was a joint programme for Earth sciences (2 years joint programme plus 3 years specialization in cartography). After 1986 the programme became totally independent (5 years). Due to the Bologna process the structure of the course has changed (but it has effected every course in most of the European countries), so there was a change back to a system which is similar to the previous one (3 years BSc on Earth sciences – after one year there is an opportunity for specialization in cartography + 2 years MSc in cartography).

The name changes in many countries, both within the industry and for university programs, have not helped cartography to establish itself as a “brand”. Hungary is one of the few exceptions where the industry respects the brand ‘cartography’ and students are still accepted because industry understands that their knowledge is up-to-date. In many other countries, there is a problem in the industry with there being too many ways of describing the industry and too much use of acronyms. Anyone from outside the industry has little chance of knowing what the terms all mean.

While there is still a need in the industry for cartographic specialists, those involved in cartographic education and training must face reality and change with the times, while still retaining an identity for cartography, through the delivery of the core cartographic theory and practice. This is not an easy task. In Brazil, for example, the academic community, especially those related directly with the cartographic science, are struggling to maintain their disciplines and update them according to its evolution. This is difficult, once the curricula are being unified. The tendency is to conciliate formative disciplines in the cartographic sciences with those in the surveying and geodetic sciences.

Cartography is present in more educational programs than ever before but, as mentioned previously, it is often integrated with the study of other aspects of the GISciences. Specific cartography programs have made way for programs such as the Bachelor of Geospatial Sciences, Bachelor of Geomatics, which provide education and training across many subject areas to do with the GISciences. Both Hungary, with a bachelor level specialisation in cartography and a two year MSc in Cartography and Brazil with bachelors in engineering (cartographic, surveying, or cartographic and surveying) are among the exceptions.

Cartographic studies are present in geography, urban planning, environmental science, landscape architecture, engineering, earth sciences, social science and even business degrees. Contemporary cartography is embedded in many disciplines. This is good for cartography but not for undergraduate courses specialising in cartography. In Brazil, the science of cartography is studied in depth only by cartographers (engineers).

The low awareness of the GISciences and subsequent low student numbers in the GIScience programs around the world, places the whole discipline in a precarious position. The loss of many cartography

degrees and low numbers in the GISciences degrees means that gradually the diversity that was available in many programs has diminished. “The challenge of curriculum design at university level is to adapt programmes within structural constraints to respond to the incremental theoretical and practical developments to enhance the education of tomorrow’s Mapping Science and GIS professionals.” (Webb, 2009, p10) In Brazil, the number of undergraduate courses in this area is increasing, because there is still a gap in this area. However, with the increasing number of places available in the higher education institutions with respect to other degrees (thanks to the programs of expansion of the current federal administration) the demand for the degree on Cartography, although seasonal, has diminished when compared with the demand of two decades ago.

THE WAY FORWARD

There is no magic potion, but based on past experience, to remain viable an academic discipline area needs to consist of many interlinked components such as: program diversity at both the undergraduate and postgraduate levels; multiple research degrees; research grants and projects; staff being on industry boards and institutions; an industry advisory panel; active alumni group; publications, key national and international conference involvement; industry recognition through peer reviewing of journal papers, examiners for theses, active marketing and publicity; and representation on university committees. The complex relationship between activities can provide a defence against any attempt to diminish the existence of a discipline group.

Within a university a discipline needs to reach out to other academic disciplines so that the successes of each can be shared by the other. For instance double degrees, and to a lesser extent service teaching for other disciplines, reinforces the importance of the programs run by each discipline and demonstrates the collegiate strength of the disciplines within a university. Brazil, does not have double degrees in this field, but recently there has been change to information to try for an agreement for a double degree between the cartographic engineering of UFPR (Universidade Federal do Paraná in Brazil) and the surveying engineering of UNL (Universidad Nacional del Litoral in Argentina). The double degrees can raise the awareness of the GISciences within a university. This awareness can lead to other opportunities such as joint cross-disciplinary, cross sector research grants which are highly favoured.

An academic discipline, such as cartography in the GISciences, within a university needs to offer expert opinion on current issues in which their expertise is valued. This can be in the form of press releases, letters to the editor, symposium or conference presentations, radio interviews and the like. The International Federation of Surveyors (FIG) in its program description for the 2010 conference in Sydney states that “FIG will look at the hot issues of the global agenda and of our profession: namely the big challenges – climate change, disaster risk management and good land governance; spatially enabled society; and different aspects of the technological futures.” A discipline must consist of experts who are willing and able to speak out on such topics. Such comment may not reach the ears of prospective students but it may do so for their parents who influence the choices made by the prospective students.

CONCLUDING COMMENT

The message is that for a discipline to survive and thrive it must supply a broad curriculum while focussing on a specialised area of research. The industry now requires a demand driven, learner-centered and process-oriented approach to education and training (Resl, 2009). With universities being driven by financial imperatives and program viability by key indices, it is clear that programs with small numbers, such as those in the GISciences, will continue to be threatened.

Goodchild contends that cartography is being marginalized by a world that needs cartographic principles and skills more than ever (Goodchild, 1999). The challenge is to acknowledge that change is inevitable and yet the opportunities are ever present. The clever education and training establishments must change in a way that exploits these opportunities so that the future of professional cartographers is ensured.

REFERENCES

- Brandalize Maria Cecília Bonato, 2009, The Pedagogical Experience in Teaching Cartography and GIS Using Public Data and Software, ICC2009 proceedings, Santiago, Chile. Viewed Thursday, <http://lazarus.elte.hu/cet/> Academic papers, Viewed 12 October 2010
- Goodchild Michael F., 1999, Cartographic Futures on a Digital Earth, Proceedings of ICC1999, Ottawa Canada
- Keogh Amanda. & Fraser David, 2008, Contemporary Map Products and Their Origins, Unpublished paper, <http://lazarus.elte.hu/cet/academic/df-2008-1.pdf> Viewed Thursday, 12th October 2010
- Murad-al-shaikh Makram, 2007, Challenges in Cartographic Training, Proceedings of ICC2007, Moscow, Russia

Peterson M, 2007, Maps and the Internet: What a mess it is and how to fix it, Proceedings of ICC2007, Moscow, Russia,

Peters M, Krisp J & Meng M, 2009, Development of an International Master Program in Cartography and Geoinformatics, Proceedings of ICC2009, Santiago, Chile

Resl R, 2009, , UNIGIS in Latin America 1999-2009: Experiences of a Distance Education Program for GIS in Latin America, Proceedings of ICC2009, Santiago, Chile

Rhind David, 1999, Business, Governments and Technology: Inter-linked causal factors of change in cartography, Proceedings of ICC1999, Ottawa Canada

Webb Robert, 2009, Curriculum Mapping of the Spatial Science Program, QUT: What was the Cartography Journey?, Australian Map Circle/Mapping Sciences Institution Australia Conference 2009 16-18 March, 2009 Brisbane Australia.

Zentai László, 2009, Change of the meaning of the term 'cartographer' in the last decades, ICC2009 proceedings, Santiago, Chile. http://icaci.org/documents/ICC_proceedings/ICC2009/html/nonref/18_4.pdf, Viewed Thursday, 7 October 2010

The project is supported by the European Union and co-financed by the European Social Fund (grant agreement no. TAMOP 4.2.1/B-09/1/KMR-2010-0003)