Kolloquium der Leibniz-Sozietät

aus Anlass des 75. Geburtstages

von Prof. Dr.-Ing. habil. Dr. h.c. mult.

Erik W. Grafarend

Contribution by **Evangelos Livieratos**, Thessaloniki

Evangelos Livieratos*
Aristotle University of Thessaloniki, Greece

Digital Analysis of the content of old maps

Invited for presentation at the Leibniz-Society Colloquium “Geodesy – Mathematics – Physics – Geophysics” honouring the 75th Birthday of Prof. Dr.-Ing. Habil. Dr. h.c. mult. Erik Grafarend, Berlin 13 February 2015

Summary

The great importance of multidisciplinarity in the contemporary advancement of sciences and technologies was illustrated recently, in a spectacular way, thanks to the discoveries of cells that constitute a positioning system in the brain (the “GPS of the brain” as was transliterated by the media), honoured by the 2014 Nobel Prize in Physiology or Medicine. It is obvious that one of the fundamentals in Geodetic Sciences, the Positioning issue and of course the Mapping issue, is now penetrating the domain of Medical Sciences producing thus a new field of study and research in excellence. The geodetic fundamentals of positioning and mapping introduced in the world of medicine are now stimulating new research agendas in Cartography, the ancient companion of Geodesy, concerning e.g. the cognitive processes and impact-oriented maps. The discovery of the brain’s positioning system represents a paradigm shift in our understanding of how ensembles of specialized cells work together to execute higher cognitive functions, opening thus, new fields for understanding other cognitive processes, such as memory, thinking and planning. This very recent example of the important contribution of geodetic fundamentals in modern multidisciplinary research is relevant (even less spectacular as it is the paradigm from medicine) to some other fields of multidisciplinary research coupling geodetic methods and techniques, even the most classical of them, with humanities, as are the also recent cases of approaching the geometric content of old maps, which until recently were a lettered subject solely for historians of cartography and maps. The massive introduction of the digital stream in Humanities gives Geodesy and Cartography new challenges in proving that those ancient derivatives of human intellect are still here, down to earth, contributing even in the domain of the humanities, something almost inconceivable before. In my presentation honouring Erik Grafarend’s innovative and (why not) futuristic ideas (as it was e.g. the introduction of animation in visualising error propagation in positioning, back in the far-distant 1972 at Graz, where I met him for the first time) I will show how fundamental geodetic concepts, e.g. coordinate transformations, spatial deformation analysis etc, even in their first approximation, could offer significant advances in the study and interpretation of old maps, enriching the research in Digital Humanities (the importance of which was strongly posed in the last issue of the official journal of our visionary supporter, the Alexander von Humboldt Foundation) and showing that Geodesy is still fresh and productive not only in its very own domain or in the neighbouring mathematical and physical sciences, but also in many other important fields of human intellect, which were seen until now by geodesists as irrelevant or standing far away from their established thinking.

*http://cartography.web.auth.gr/Livieratos

I met Erik Grafarend for the first time in Graz, where he presented almost four decades ago the then pioneering approach of animation in visualising the error propagation in trigonometric networks. It was a futuristic presentation relevant to Erik's way of thinking and doing science!

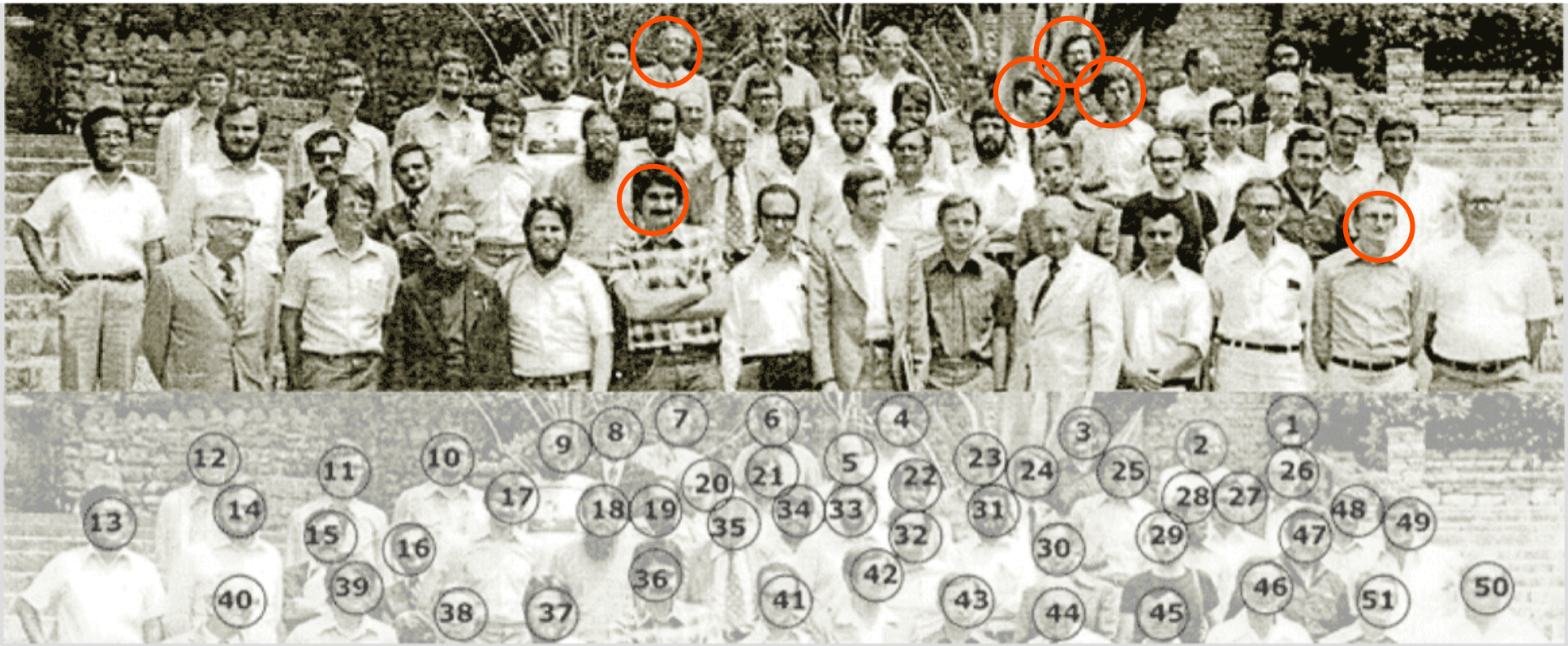
Then it came Uppsala where we established long lasting scientific ties and a friendship, both gests of Erik Tengström.

1972 Graz

1975 Uppsala

Livier

Since then we shared with Erik, and many other colleagues, important events in Geodesy…



Hotine Symposium, Assisi 1978 - With Antonio Marussi (44, front row in white jacket and tie): 1 Chiaruttini, 2 Groten, 3 Livieratos, 4 Leigeman, 5 Baehr, 6 Tscherning, 7 Moritz, 8 Talamo, 9 Grossman, 10 Kurkowski, 11 Gerstl, 12 Freeden, 13 Kozai, 14 Borre, 15 Buonocore, 16 Arca, 17 Cross, 18 Schaffrin, 19 Mather, 20 Bencini, 21 Boucher, 22 Bartelme, 23 Gurtner, 24 Grafarend, 25 Rummel, 26 Baarda, 27 Heck, 28 Noe, 29 Stangl, 30 Latka, 31 Boedecker, 32 Mueller, 33 Witsch, 34 Leick, 35 Krarup, 36 Sanso, 37 Dermanis, 38 prior Sartori, 39 Herrewegen, 40 Betsle, 41 Blais, 42 Krynski, 43 Schwarz, 44 Marussi, 45 Leclerc, 46 Chovitz, 47 Weightman, 48 Koch, 49 Blaha, 50 Nelson, 51 Suenkel - Courtesy Erik Grafarend

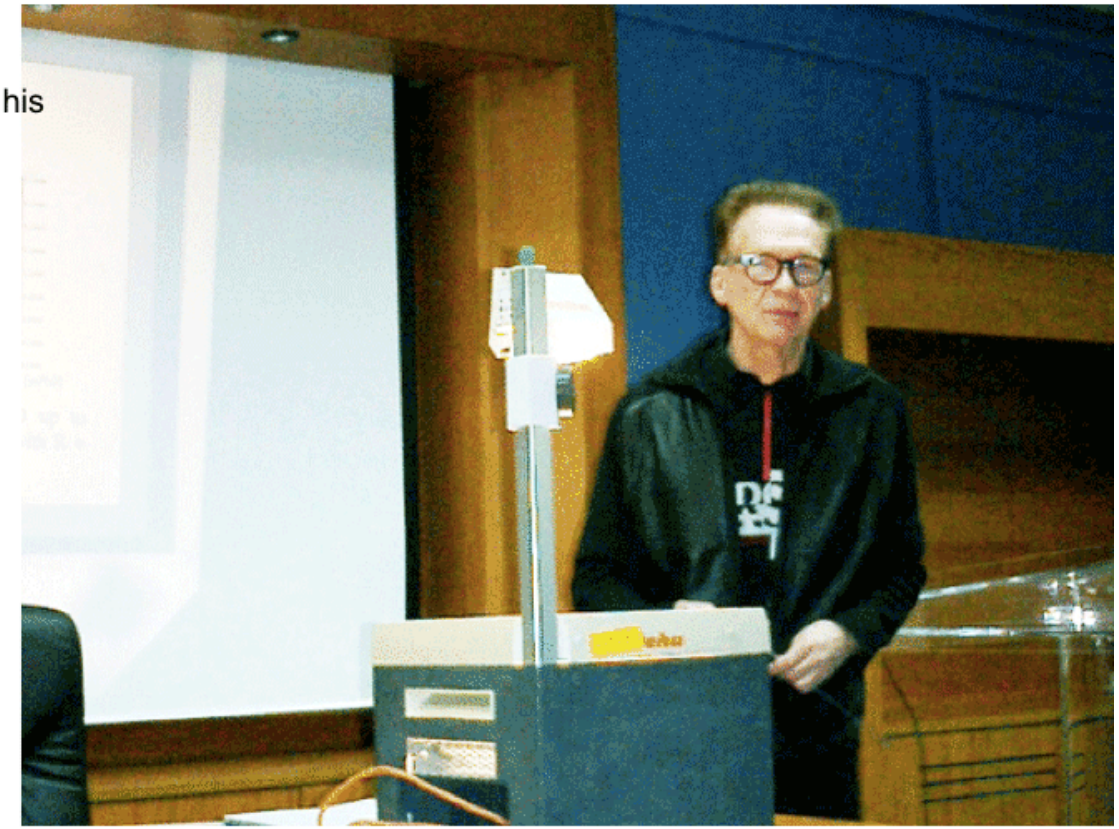
1978

In circle the colleagues present in the Leibniz-Society Colloquium celebrating Erik's 75th Anniversary

Livier

… and in the course of time Erik honoured our School at Thessaloniki in various ways!

This is a historic photo taken with Erik lecturing at the School of Rural & Surveying Engineering, University of Thessaloniki, very few days before his health adventure…



Thessaloniki, 2003

Livier

Here, ten years ago (February 2005), we recalled our thirty years of friendship with Eric with some *"Variations on the same motive"* based on artistic variants of mapping, projection and deformation

The Thessaloniki dedication in the occasion of Erik's 65th Anniversary!

2005

Livier

In this spirit, ten years after (February 2015), I am continuing the February 2005 *"Variations on the same motive"* with my presentation, in the…

Kolloquium der Leibniz-Sozietät zum Thema
„Geodäsie – Mathematik – Physik – Geophysik"

… on the

Digital Analysis of the content of old maps

Berlin, 13 February 2015

Livier

I am fully aware that, in hearing the title of the presentation…

Digital Analysis of the content of old maps!

…a first, spontaneous, thought of some groups of geodetic "orthodoxy" could have been this…

Livier

But, if you think deeper (or are informed) then you realise that the issue…

…it is Geodesy,

the oldies but goodies

of it …

and indeed useful !

in the interdisciplinary thinking of Science and Technology, as it is e.g. related to Medicine, Humanities and other disciplines, where geodetic principles, practices and know-how are already, or could be, implemented

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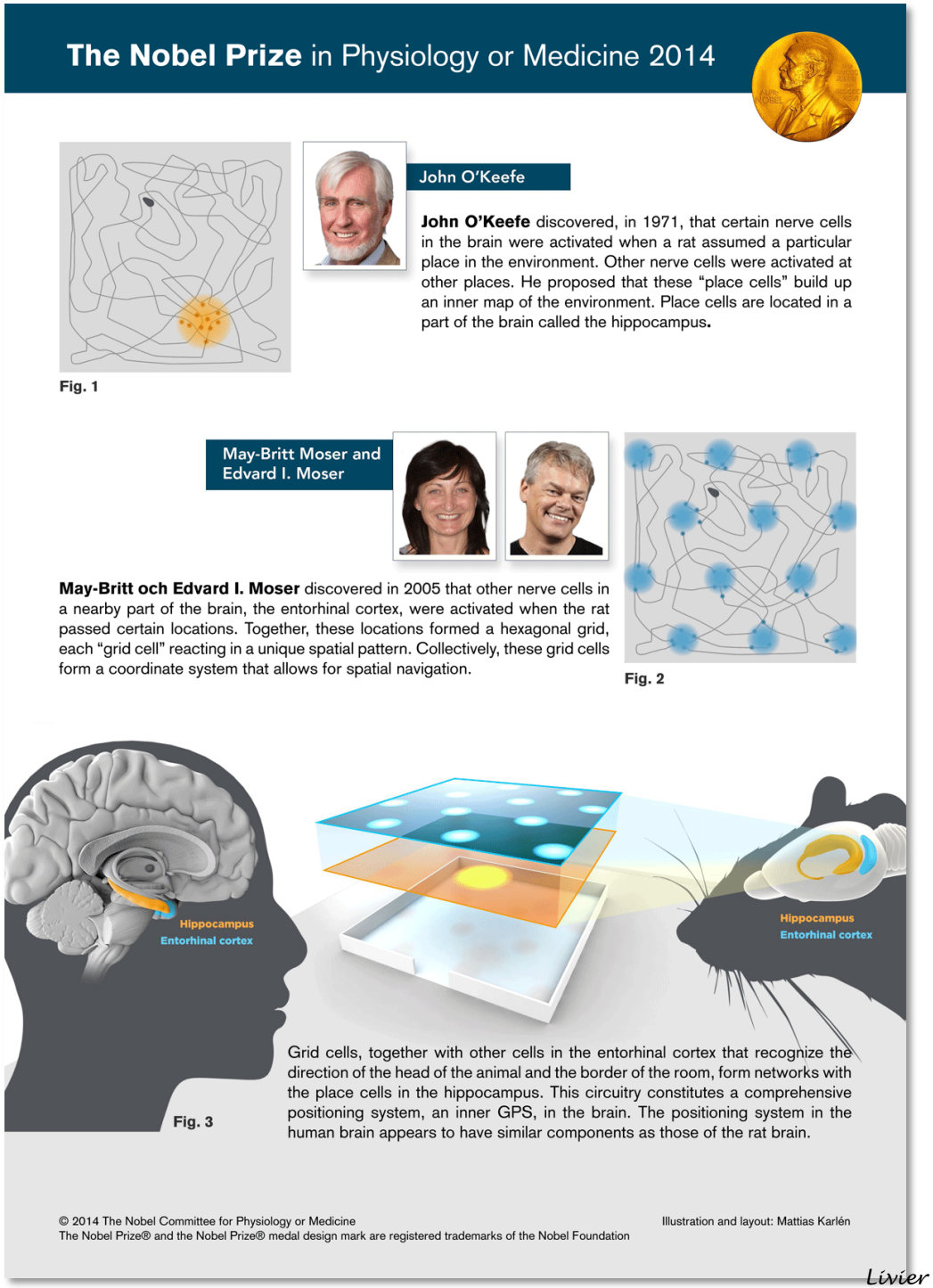
Examples:

The 2014 Nobel Prize in Physiology or Medicine honors the discoveries of cells that constitute a positioning system, an inner GPS in the brain.

These efforts are crucial for many research agendas in the cartographic community concerned with cognitive processes and impact-oriented maps.

For more, click here



The Nobel Prize in Physiology or Medicine 2014

John O'Keefe

John O'Keefe discovered, in 1971, that certain nerve cells in the brain were activated when a rat assumed a particular place in the environment. Other nerve cells were activated at other places. He proposed that these "place cells" build up an inner map of the environment. Place cells are located in a part of the brain called the hippocampus.

Fig. 1

May-Britt Moser and Edvard I. Moser

May-Britt och Edvard I. Moser discovered in 2005 that other nerve cells in a nearby part of the brain, the entorhinal cortex, were activated when the rat passed certain locations. Together, these locations formed a hexagonal grid, each "grid cell" reacting in a unique spatial pattern. Collectively, these grid cells form a coordinate system that allows for spatial navigation.

Fig. 2

Grid cells, together with other cells in the entorhinal cortex that recognize the direction of the head of the animal and the border of the room, form networks with the place cells in the hippocampus. This circuitry constitutes a comprehensive positioning system, an inner GPS, in the brain. The positioning system in the human brain appears to have similar components as those of the rat brain.

Fig. 3

Illustration and layout: Mattias Karlén

Livier

Examples:

The massive introduction of the digital stream in Humanities gives Geodesy and Cartography new challenges in proving that those ancient derivatives of human intellect are still here, **down to earth**, contributing even in the domain of the humanities, something almost inconceivable before.

See, for a first contact with
Digital Humanities
the AvH periodical "Humboldt**kosmos**"
No. 102, 2014

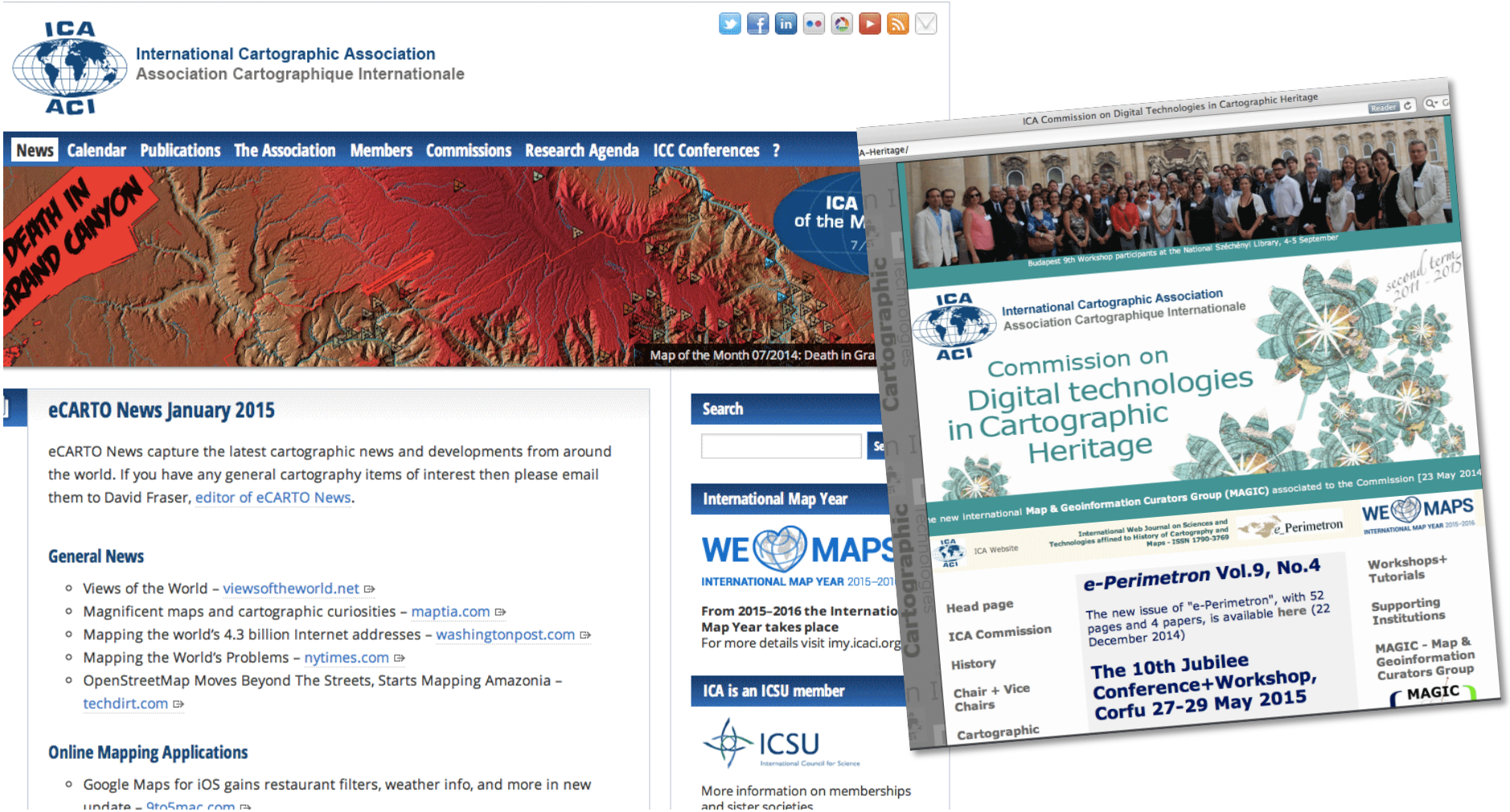
… and, for a first contact with the Cultural Heritage association of **history of cartography, mapmaking and maps** in the context of **Cartographic Heritage** and its links with **geodetic issues**, like the

-Geometric parametrisation of the old maps' content
-Projective properties of old maps
-Deformation analysis providing clues on theories of cartographic history and mapmaking
-…..

See:

E. Livieratos: Cartographic Heritage

See, for more, in web-pages of the sister Society ICA and the relevant Commission on *Digital Technologies in Cartographic Heritage*

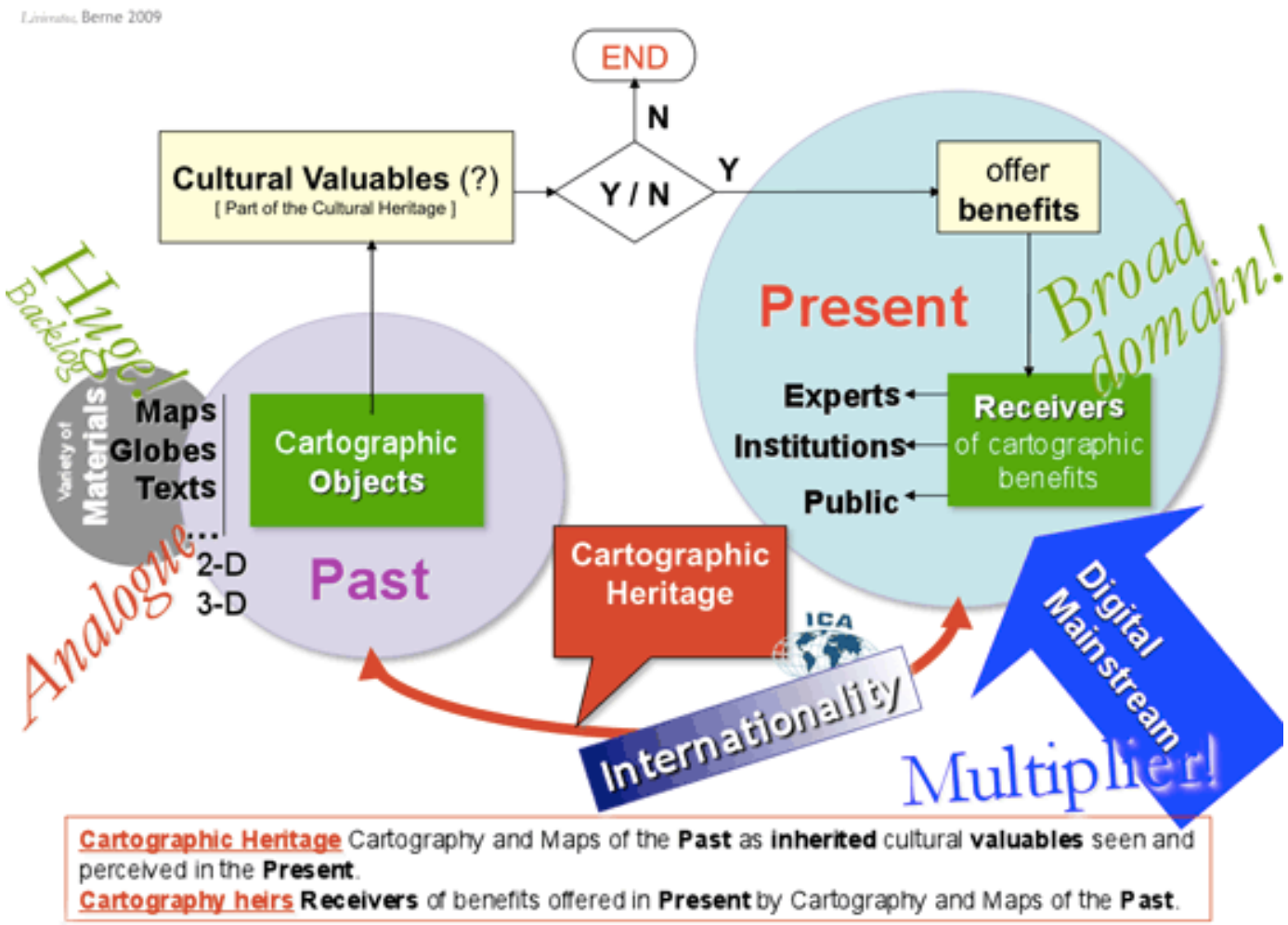


International Cartographic Association

ICA Commission on
Digital Technologies in Cartographic Heritage

Livier

The conceptual setting of Cartographic Heritage

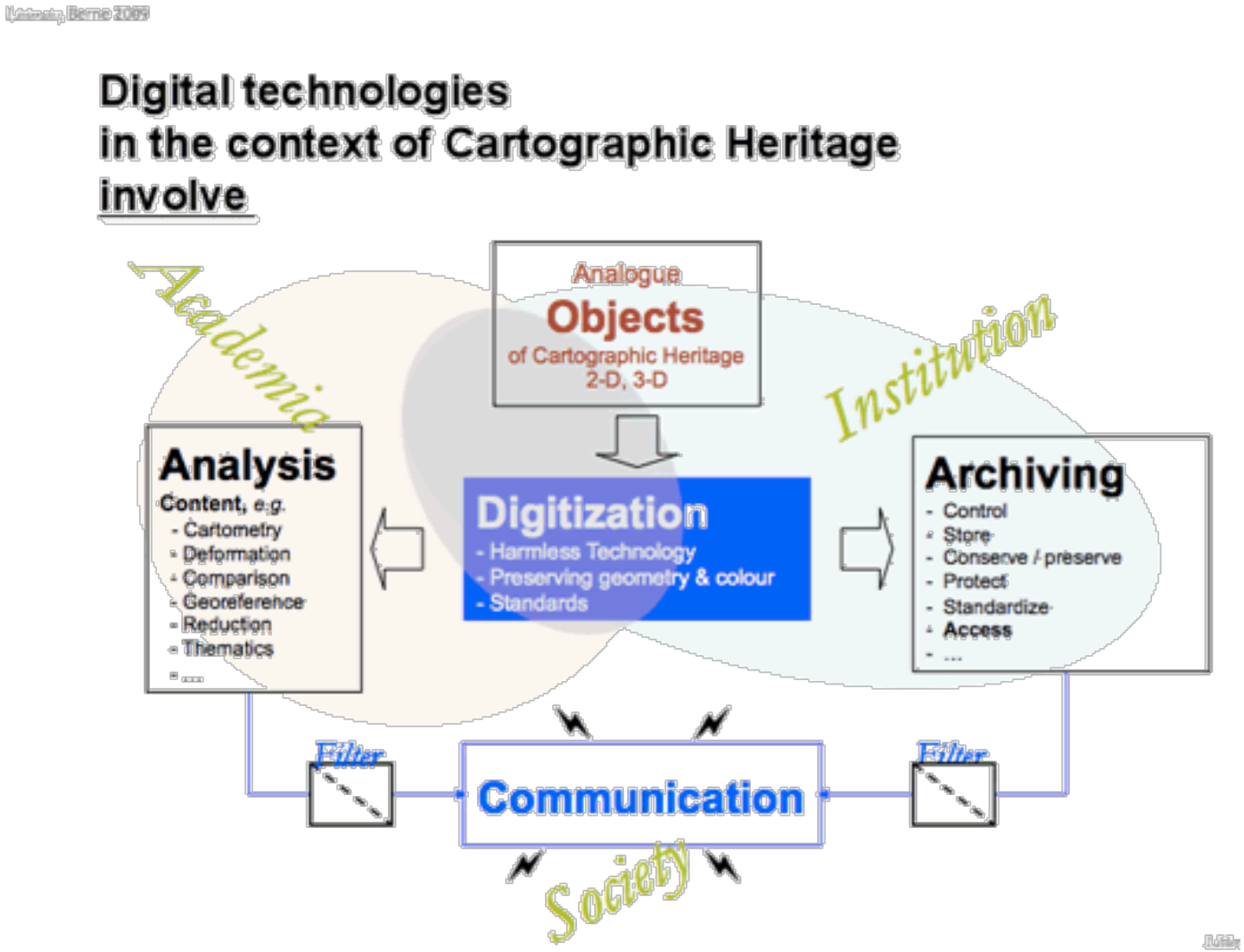


E. Livieratos, *50th ICA Anniversary*, Berne 2009

More on the issue

Livier

The *geodetic link* in the contextual scheme of Cartographic Heritage in the domain of Analysis



E. Livieratos, *50th ICA Anniversary*, Berne 2009

More on the issue

Livier

The *geodetic link* in the ToR of the ICA Commission on Digital Technologies in Cartographic Heritage

Next Workshop, Corfu 2015

ICA ACI

International Cartographic Association
Association Cartographique Internationale

second term 2011 - 2015

Commission on
Digital technologies in Cartographic Heritage

Head page

ICA Commission

History

Chair + Vice Chairs

Cartographic Heritage

Terms of Reference

Members

Commission Desk

Texts + Docs

Terms of Reference

The ToR for the 2011-2015 working period

- Theoretical deepening and broadening of the issue of Cartographic Heritage
- Development of methodologies and standards applied on proper two- and three- dimensional digitization of Cartographic Heritage objects, materials and documents
- Study and implementation of analytical tools applied on the comparative research concerning the geometric and thematic content of old maps
- Digital map libraries and map collections: Archiving, matching, management, networking and accessibility in-situ and in the web
- Modern information technologies and interactivity in attracting the general public to Cartographic heritage: Implementations in Museology and virtual map exhibitions.

Principal concern of the Commission is the attraction of young researchers who are interested in cartographic and map heritage and are familiar with digital technologies or are willing to try such technologies.

Workshops+ Tutorials

Supporting Institutions

MAGIC - Map & Geoinformation Curators Group

MAGIC

Links+maps

Period I (2006-2011)

Web-page link

Livier

Some relevant references on the issue of the geometric content of old maps

Fiorini, M. **1881**. *Le proiezioni delle carte geografiche.* Bologna: Zanichelli

Reinhard, W. **1909**. “Zur Entwicklung des Kartenbildes des Britischen Iseln bis auf Mercatori Karten von Jahre 1564”. Dr. Diss. Univ. Leipzig

Tobler, W.R. **1965**. “Medieval distortions: the projections of ancient maps. *Ann. Assoc. Amer. Geographers,* 56: 351-360

Ravenhill, W., A. Gilg **1974**. “The accuracy of early maps towards a computer aided method”. *Cartographic Journal*, 11: 48-52

Livieratos, E. **2006**. “On the study of the geometric properties of historical cartographic representations”. *Cartographica,* 41, 2: 165-175

Boutoura, C., E. Livieratos **2006**. “Some fundamentals for the study of the geometry of early maps by comparative methods”, *e-Perimetron,* 1, 1: 60-70

…….

For dedicated publications on the issue see the International Web Journal on Sciences and Technologies Affined To History of Cartography and Maps e-Perimetron

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 1

16th c. Georgios Sideris

To see the relevant animation, click here

E. Livieratos, 2006

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 2

17th c.

Jan Vermeer

To see the relevant animation, click here

E. Livieratos, A. Kousoulakou, 2006

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 3.1

18th c.

Rigas Velestinlis

The implementation of geodetic methods (best-fitting coordinate transformations) and image processing (digital positive-negative transparency) lead, in 2008, to the discovery of the existence of two distinct versions of “Rigas *Charta*”, the 12 sheets monumental map of the Greek Enlightenment (1797), unknown to historians of cartography for 211 years

E. Livieratos, 2008

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 3.2

Rigas Velestinlis

The differences of the two versions of Rigas Velestinlis *Charta* (1797) detected using coordinate best fitting transformations (2008). A typical example of the use of geodetic methods in cartographic heritage

For more on the issue, click here

E. Livieratos, 2008

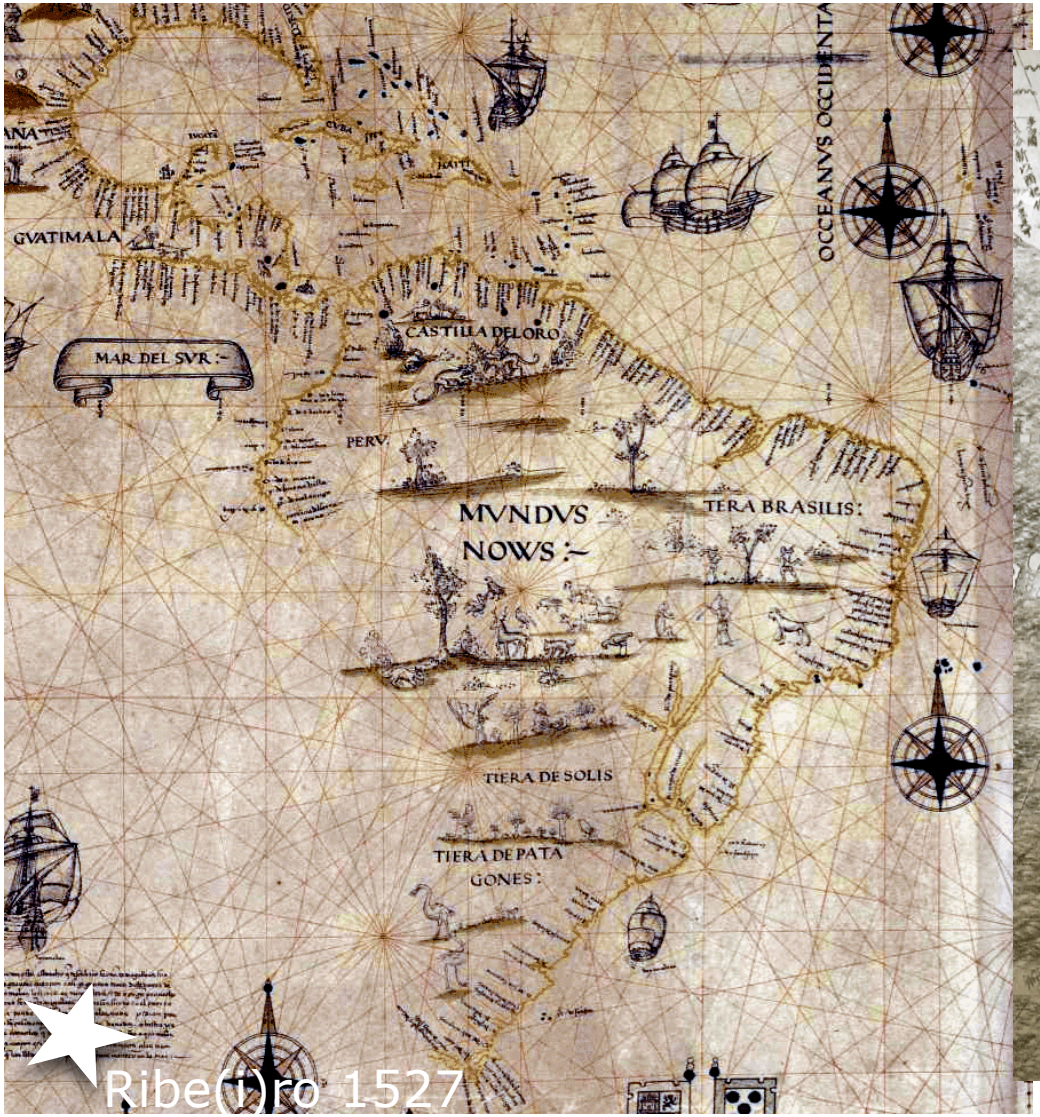
Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 4.1

The masterpiece of early 17th c. cartography, the Chinese World Map by Matteo Ricci (1602). In red circle the representation of South America, proved to fit best the relevant representation in the Ribe(i)ro World Map (1527) as shown in the next images 4.2, 4.3, 4.4

The issue presented in E. Livieratos' invited lecture **About East and West: the World Map by Matteo Ricci (1602-1604)** at the American School of Classical Archaeology of Athens (ASCAA) - Gennadius Library, Cotsen Hall, 11 February 2014

Livier

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 4.2



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Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 4.3

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Livier

Examples of applying geodetic methods and techniques in analysing the geometric properties of old maps and their spatial deformation – 4.4

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Livier

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Herzlichen Dank Erik!
Alles Gute für unser Freund!

Livier