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Hellenic Foundation for
Research & Innovation

Description of the funded research project
1st Call for H.F.R.I. Research Projects to Support Faculty Members & Researchers and Procure High-Value Research Equipment

Title of the research project:
Cybercartographies: Developing Powerful Multimodal Geovisualization Instruments for Understanding & Communicating Geospatial Data

Principal Investigator: Professor Marinos Kavouras

Reader-friendly title: CYBERCARTO

Scientific Area: Engineering Sciences and Technology

Host Institution: National Technical University of Athens – NTUA (Greece)

Collaborating Institution: Research Centre on Interactive Media, Smart Systems and Emerging Technologies – RISE Centre of Excellence (Cyprus)

Project webpage: http://cybercarto.ntua.gr/

Budget: 186.250,80 €

Duration: 36 months

Research Project Synopsis (1/2)

Maps are not just lines, points and symbols assembled as pictures. Maps constitute one of the most powerful cognitive vehicles to explore and describe the world, but also to express ourselves metaphorically.

In recent years, we are more "map-minded" than ever before. The world of ubiquitous computing and "digital natives" is now full of enthusiastic "cartographers". The way people, especially the youngest, interact with technology, the shift from the "god's eye view" to any perspective in viewing space, the increase of crowdsourced geospatial data and the necessity of employing cartographic means to make sense out of big data, have introduced the need to shift the paradigm of cartography and geovisualization to cybercartography.

This shift involves, amongst others, the development of an innovative cartographic language, new visual variables, multisensory representations, multimodal interaction, and tools which help enhance spatial thinking skills and develop truly map-minded spatial citizens.

Research Project Synopsis (2/2)

CYBERCARTO addresses these research needs and meets its objectives in five steps:

1. evaluation of state-of-the-art cartographic cyber manifestations, online mapping tools, and ubiquitous geosystems and services,
2. analysis on how and if digital technologies and geoservices foster spatial thinking,
3. cybercartography multi-sensory representations and suitable multimodal interfaces,
4. implementation of new-generation cyber cartographic products,
5. development of theoretical and design principles for cyber maps and other visualizations, as a breakthrough contribution to cartography regenerated.

The project team, led by the NTUA Cartography Laboratory, has full capacity and expertise in Cartography, Geography, GIScience, multimodal interfaces, brain-computer interfaces, computer graphics, maps/interfaces for the visually impaired, artificial intelligence and cognitive science, while their smooth cooperation has been tested from previous projects. Finally, the extensive administrative/coordinating experience of the Principal Investigator and the team, ensures an unobstructed execution of the project.

Project originality (1/2)

CYBERCARTO produces scientific breakthrough along three axes, which have not been scrutinized thoroughly, separately or in combination:

1. **Evaluation of online mapping tools, geoservices, cyber maps and their effect on spatial skills of young users**
No complete analysis of such products, services and systems exists. CYBERCARTO surveys also address the question "if and how digital technologies and geoservices foster spatial thinking skills of digital natives", which has not been previously pursued.

2. **Formulation of cybercartography desiderata and development of exemplary representations**
Experts from various fields collaborate to formulate desiderata for cybercartography through a synergistic approach, which also constitutes a novel strategy. They seek to provide requirements and specifications focusing on:
a) multisensory representations, b) data multidimensionality, and c) interfaces suitability. Additional novelty lies in putting desiderata into practice, by developing prototype representations for cyber applications.

Project originality (2/2)

3.   Establishment of a new cartographic language for the digital era and users
CYBERCARTO will finally provide new theoretical and design principles for cartography and maps which (a) encompass different types and uses of maps and geovisualizations on the Web, (b) serve the needs of digitally skilled citizens, and (c) enhance the spatial dimension of almost every piece of web-generated data.

The research community has been watching the wide public of online "map makers" producing cartographic manifestations far from the established cartographic language. CYBERCARTO goes beyond the-state-of-the-art, by providing new principles, partly contributed by non-experts, tested and evaluated, to offer solid ground for implementing effective applications and tools, which draw on sophisticated geovisualizations, in a combination of multimodal interfaces and multisensory representations. These are not meant only for academia or future cartography practitioners, but also for mere internet users and geographic information online providers, with the objective to "educate" them into well-established cartographic principles, leading cartography to the challenges of our digital era.

Expected results & Research Project Impact (1/2)

Expected results: Public research deliverables of the project include:

- Academic publications and conference presentations on specific topics addressed by the project (evaluation of state-of-the-art, spatial thinking skills of digital natives, cybercartography desiderata, exemplary representations)

- International expert workshops, organized in collaboration with the Association of Geographic Information Laboratories in Europe

- Exemplary representations for cyber applications, developed by experts, as well as by non-experts in the framework of an international contest

- Digital volume on theoretical and design principles for cybercartography.

Results will be widely disseminated to target audiences (experts and practitioners in relevant fields, university students, map enthusiasts, map users i.e. the general public), at all geographical levels.

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Expected results & Research Project Impact (2/2)

Scientific impact: Cartography and related disciplines are highly dynamic; between 2007 and 2015, cartography master graduates increased by more than 40% annually and market demand for cartographers is expected to grow nearly 30% by 2024 (Wired, 2017). The project will provide both professionals and cartography, as a discipline, with a new cartographic language, to accommodate the needs and trends of the digital era in content, uses and technology.

Economic impact: Geoservices generate up to $270 billion in global revenue annually and the industry is growing rapidly (Oxera, 2013). The implementation of CYBERCARTO will launch a new era for geospatial applications and services, by making them more effective and more popular among users, as the new design principles for cyber maps will enhance their usability and friendliness, contributing to economic development.

Social impact: In addition to various other social benefits of cybercartography (public health applications etc.), the project will be beneficial for citizens, especially the highly digitally active youth, in improving their spatial thinking (a critical ability for both sciences and everyday life), by providing new, theoretically grounded and methodologically tested cyber maps, which best serve their needs and competencies.

The importance of this funding

HFRI funding supports innovative research by the host institution staff, creates new employment opportunities for young researchers, allows the transfer of experience between scientists in Greece and abroad, helps introduce non-experts to cybercartography via the realization of an international contest for exemplary representations and finally, permits the use/purchase of necessary infrastructures, as well as the communication of the project and its results.

It enables the research team to develop knowledge and skills in order to respond to - and even lead - international scientific and technological progress in the field of cartography, with multiplier benefits, on the one hand, for the young scientific potential of the country, through the teaching-research activities of project team members at NTUA and elsewhere, and on the other hand, for the broader geoservices sector, through the dissemination and exploitation of project results.

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