

Program and Abstracts

18th International Conference



Geoinformation and Cartography



14-16 September 2022 Selce, Hotel Marina

Organized by the Croatian Cartographic Society and
the Faculty of Geodesy of the University of Zagreb

Endorsed by the International Cartographic Association

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18th International Conference on Geoinformation and Cartography



Croatian Cartographic Society



University of Zagreb, Faculty of Geodesy



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Organizers



Croatian Cartographic Society



University of Zagreb, Faculty of Geodesy

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Introduction

By organizing this conference the Croatian Cartographic Society and the Faculty of Geodesy of the University of Zagreb wish to contribute to the development of geoinformatics, cartography, geodesy, geography and associated fields with special emphasis on new achievements. A wide range of themes offered and renowned invited lecturers guarantee interesting lectures and a contemporary approach.

Suggested Themes

- AI, machine learning and robotics
- Big data visualization
- Education in cartography and geoinformation science
- Climate changes and risk management
- Covid-19
- Geodiversity
- Geoheritage and cartoheritage
- Geoinformation and cartography in education
- Geospatial technologies for local and regional development
- GIS and ecology
- Location-based services and web mapping
- Map projections
- Maps for autonomous vehicles
- Maritime, military and topographic cartography
- Remote sensing and cartography
- Satellite technologies in cartography
- Spatial data visualization and analysis
- UAV – unmanned aerial vehicles

The Organizing Committee is going to consider proposals of other themes from fields connecting cartography, geography, geodesy, geology, geoinformatics and associated professions.

Conference program and lecture abstracts are going to be published online and presentations are going to be published at the Croatian Cartographic Society website. Papers received by the organizer prior to October 15, 2022 are going to be reviewed and published in *Cartography and Geoinformation*, issue 38.

Keynote Speakers



Michael T. Gastner received his PhD degree in Physics from the University of Michigan, Ann Arbor. He held postdoctoral positions at the Santa Fe Institute, the University of Oldenburg and Imperial College London. After a lectureship at the University of Bristol, he was a Marie Curie Fellow at the Hungarian Academy of Sciences in Budapest. He is currently Assistant Professor at Yale-NUS College in Singapore.

He believes that mathematical and computational methods play an essential role in understanding the complex and interconnected world we live in. Through his research and teaching, he aims to contribute to our understanding of real-world data with mathematical modelling, statistics and visualisation. At Yale-NUS College, he initiated and supervised the development of the go-cart.io project, which aims to empower non-expert users to turn geographic data into insightful maps. He is a member of the International Cartographic Association's Commission on Map Projections.



Stefan Peters is a Lecturer in Geospatial Science the STEM unit at UniSA. His educational background is Geodesy, Remote Sensing, GIS, and Cartography. Before joining UniSA, he worked as a Senior Lecturer at the Department of Geoinformation at the Universiti Teknologi Malaysia, teaching and conducting research projects in the area of Digital Cartography. He obtained a PhD degree in Cartography from the Technical University of Munich, Germany, where he was also employed as a Research Associate at the Department of Cartography. During this time, he was the main responsible for building up as well as coordinating the joint international M.Sc. study program in Cartography. Before starting

his university career, he was working as a Cadastre-Information System technician for the Bavarian state agency of surveying and geoinformation in Germany.

With more than 20 years of working experience in the field of Geomatics and Geoinformatics, and a specialization in geospatial data analysis and geovisualization, he has been active in various geospatial projects related to agriculture, forestry, archeology, geology, atmospheric and climate studies, land cover, land use, cadaster, and city modeling. His main research interest is in the modelling and cartographic rendering of multidimensional spatio-temporal data, he loves to convert complex geographic data into meaningful digital map presentations. Thus his work is usually cross-institutional and highly interdisciplinary.



18th International Conference on Geoinformation and Cartography

First day program, Wednesday, 14 September 2022

Location:

Hotel Marina, Selce

9:00–10:00 Registration

10:00–10:30 Opening Ceremony

Singing Nightingale vocal group and welcoming words of distinguished guests

10:30–12:00 Keynote Lectures

Michael GASTNER	Teaching Data Visualization to Undergraduate Students
Stefan PETERS	Current Challenges in Geospatial Education and Possible Strategies to Counteract

12:00–12:30 Coffee Break

12:30–12:45 Golden Sponsor Presentation

12:45–13:45 Lectures and Poster Session

Miljenko LAPAINE	Basic Problem of Map Projections Teaching
Damir MEDAK, Mario MILER	Alternative Solutions for Encoding Geographic Information
Andrea MILETIĆ, Ana KUVEŽDIĆ DIVJAK	Assessment of the Croatian Open Data Portal Using User-Oriented Metrics



Poster

Dalibor BARTONĚK, Jiří BUREŠ, Ondřej VYSTAVĚL	Automatic Drawing in CAD Through Digital Sketch and Topological Encoding
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13:45–14:45 Lunch

14:45–15:30 Lectures

Ondřej VYSTAVĚL, Jiří BUREŠ, Dalibor BARTONĚK	The Role of BIM and GIS in the Life Cycle of Railway Infrastructure Construction
Josip ŠETKA	An Artificial Neural Network Approach to Predict the Future of Land Use and Land Cover of the Lower Neretva Region, Croatia
Ana BRUSAČ, Luka RUMORA, Mario MILER	From Sentinel-2 to Maps Using Cloud-Based Image Processing

Selce Guided Tour

17:00–19:00

Meeting point: next to the old tree, which is located in front of the Tourist Office in the centre of Selce





18th International Conference on Geoinformation and Cartography



Dinner at the Kruh i vino restaurant

19:00

Second day program, Thursday, 15 September 2022

Location:

Hotel Marina, Selce

10:00–12:00 Lectures

Michael GASTNER	Smooth Pycnophylactic Interpolation Produced by Density-Equalizing Map Projections
Miljenko LAPAINE	A Problem in “Basic Cartography“
Julijan SUTLOVIĆ, Josip FARIČIĆ, Tome MARELIĆ	The Contribution of Jacques Nicholas Bellin to the Cartographic Representation of the North-Eastern Adriatic Coast
Ludovico MAURINA	Historical GIS Applied for the Study of Old Watermills in the Province of Padova (Italy): Uncovering a Forgotten Territorial Network
Catherine Desiree POČKAJ, Mihaela TRIGLAV ČEKADA, Dušan PETROVIČ	Evaluation of OpenStreetMap, Wikimapia and OpenTopoMap Data Quality for Test Sites in Slovenia

12:00–12:30 Coffee Break

12:30–13:30 Lectures and Poster Session

Robert ŽUPAN, Stanislav FRANGEŠ, Adam VINKOVIĆ, Ermanno MOSCARDA	Interactive Web Map of Syrmia Diocesis
Adam VINKOVIĆ, Robert ŽUPAN, Stanislav FRANGEŠ	Creating a Cartographic Visualization of all Croatian Islands on a Poster Using Monochrome Mapping

Poster

Dalibor BARTONĚK, Jiří BUREŠ, Ondřej VYSTAVĚL	Automatic Drawing in CAD Through Digital Sketch and Topological Encoding
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13:30–14:30 Lunch

Novi Vinodolski Guided Tour

17:00–19:00



Novi Vinodolski, often also called *Novi* or *Novi Vinodol* is a town on the Adriatic Sea coast in Croatia, located south of Crikvenica, Selce and Bribir and north of Senj. The population of Novi is about 4000. The city area became a Frankopan property in the 13th century, marking the period to which the most valuable heritage is dated, including the Law codex of Vinodol. City hinterland is dominated by the Vinodol Valley, used for agriculture and winemaking. The city's economy is dominated by tourism, as Novi Vinodolski is well known tourist centre situated in an area largely unaffected by other types of industry and it offers a wide variety of tourist amenities. The Vinodol Valley is also the site of a hydroelectric power plant utilizing water collected in Gorski Kotar reservoirs. In Novi Vinodolski there is a well-preserved post placed by the Military Geographic Institute of Belgrade in 1933. It is a concrete post above the ground measuring $60 \times 60 \times 130$ cm, set on a concrete plinth. Thus, the astronomic point was stabilised as the extreme point of a chain of triangles set up to determine the halfway parallel, that is, the parallel corresponding to 45° latitude. Today, it is a 2nd order trigonometric point looked after by the State Geodetic Administration of the Republic of Croatia.

Dinner at the Pavlomir Wine House

19:00

Third day program, Friday, 16 September 2022

Bakar Guided Tour

The tour will start at 9:30 AM in front of the Marina Hotel. The bus will take us to the city of Bakar. Bakar, 13 kilometres from Rijeka, is one of the oldest towns in the northern Adriatic and was granted the status of royal town by Maria Theresa in 1779. It was built like an amphitheatre on a hill and its historical nucleus was declared a cultural monument in 1968. In Bakar we will visit the tide gauge that was set in 1929 and since then it has been recording sea level at the same point, till today. Andrija Mohorovičić, a world known scientist, lived and worked as a professor on Naval Academy (today Pomorska škola) from 1882. For the beginning of his scientific career his stay in Bakar was decisive. He founded a Meteorological station there. We will visit the Bakar Nautical School, Turkish house, Roman house and many other landmarks. The lunch will be served at the Vidikovac restaurant. The return to Selce is expected around 5:00 PM.





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Abstracts

Teaching Data Visualization to Undergraduate Students

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Abstract

Communicating data is a valuable skill in an increasingly complex world. Because industry, public service and academia depend on a data literate workforce, many colleges and universities encourage students to enroll in introductory data science courses. There is broad agreement that such courses should teach basic skills in data visualization. However, there are few undergraduate-level textbooks that equip students with hands-on practice. Aiming to fill the gap, I am in the process of collating my teaching material on data visualization into a textbook.

In this talk, I will reflect on the experience I have gained from writing the textbook and teaching data visualization to students who do not have prior familiarity with statistics or programming. I use the data visualization package `ggplot2`, which is an implementation of Leland Wilkinson's Grammar of Graphics for the programming language R. I will explain how `ggplot2` allows students to break up graphs into semantic components such as scales and layers. I will also demonstrate how the R package `tmap` implements a 'grammar of thematic maps' that helps students to learn essential cartographic skills.

Keywords: teaching visualization, undergraduate students, `ggplot2`, `tmap`



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Current Challenges in Geospatial Education and Possible Strategies to Counteract

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Abstract

Higher education in Geospatial Science requires a regular review of curriculum, learning strategies and outcomes. The ever-evolving technology behind geospatial solutions re-defines frequently the industry expectations on Geospatial university graduates. Within each component of Geospatial Science - including Geodata acquisition, Data management, Spatial Analytics, and Visualization – university graduates can pursue a range of different specializations and career pathways. In this regard, the challenge for GI-Science curriculum designers is to choose the appropriate theoretical and practical learning content, feasible strategies to review and habitually update curricula and design effective learning sessions to equip students with suitable required skills. Beyond that, Covid-19 has turned our teaching concepts upside down, introduced new challenges, but also opened up new possibilities. At the same time it caused changes within job requirements, e. g., hybrid work models.

This keynote will reflect on current challenges in Geospatial education and will discuss several strategies and suggestions to address these. The talk will shed some light onto how the GIS&T Body of Knowledge could be utilized to map and update GI curricula. Moreover, benefits of online or hybrid teaching & learning concepts will be discussed and experiences from a Work Integrated Learning module will be shared.

Keywords: Geospatial Education, Body of Knowledge, Hybrid Teaching and Learning, Work Integrated Learning

Basic Problem of Map Projections Teaching

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Abstract

The theory of map projections was once called mathematical cartography. The name mathematical cartography derives from the fact that it is an area of cartography with a large application of mathematics. In recent years, instead of mathematical cartography, there has been talk of map projections because mathematics has entered other areas of cartography, such as thematic cartography, map generalization, etc.

If we accept the fact that understanding map projections requires a certain knowledge of mathematics, then we cannot be satisfied with the practice that map projections are usually or very often interpreted without mathematics or with its application in traces. The reason for that is the fear of students refusing to enrol in subjects in which there is a lot of mathematics. So, to keep the number of students, we need to avoid formulas and equations?! But that is only one of the possible reasons. There are probably more of them. We see another reason in the fact that future geographers at the university level do not take mathematics courses. Therefore, if geography teachers are not well versed in mathematics, it is clear that they will avoid interpreting to their students what they themselves are not strong enough at.

Furthermore, the reasons for inadequate education on map projections may be aversion to change, proactive interference, lack of critical thinking, etc. However, the basic problem of teaching about map projections is the non-correlation with education in mathematics.

This lecture will show how to approach teaching on map projections at the level of secondary education. That is, not to avoid any application of mathematics, but to apply that level of mathematical knowledge and skills that students at that level of education have.

Keywords: map projections teaching, fear of students, non-correlation with education in mathematics

Alternative Solutions for Encoding Geographic Information

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Abstract

Traditional approaches to accurate encoding of locations on the surface of the Earth always include coordinate systems, precisely defined by cartographers. Usually, location has been described as a point with two coordinates with values dependent on a coordinate system and the cartographic projection used to map the shape of the Earth to a plane. The discipline of cartography emerged around the rules of mathematics and graphical design, aiming to provide useful information to a map user in an optimal way. With the advent of computers and the world wide web, cartographic experts adapted the methods of map-making, exploiting the new medium to provide variety of maps, preserving the traditional coordinates.

This presentation discusses alternative approaches which are based on the division of space, having certain advantages over two-dimensional coordinate systems. We focus on passing the location information from one person to another in real-life situations and on the ability of the system to manage spatial information of different granularity within the same dataset. An overview of similar ideas developed in the past is given as well.

Keywords: encoding locations, coordinate systems, geohash

Assessment of the Croatian Open Data Portal Using User-Oriented Metrics

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Abstract

Open data portals are the central access point for datasets, both spatial and non-spatial. They are web-based interfaces that facilitate access, reuse, and discovery of public sector information. Open data portals are an important element of most Open Data initiatives led and founded by the government with the primary goal of making their datasets public. Thanks to these Open Data initiatives, a large amount of high-quality government data is now available on portals.

However, data quality is not the only aspect that should be considered when publishing data. To improve the reusability of data and its availability to a wide range of users, it is also important to consider various aspects of portal management, discovery, and use of data (e.g., organizing the portal in a user-centric way, providing accurate metadata, using a standardized and open data format, etc.).

The European Data Portal has published a report entitled "The Future of Open Data Portals", which presents ten principles that open data portals should implement in terms of sustainability and added value: organise for use, promote use, be discoverable, publish metadata, promote standards, co-locate documentation, link data, be measurable, co-locate tools, be accessible. This report was followed by a study "Open Data Portal Assessment Using User-Oriented Metrics" which provides metrics and methods for assessing these user-oriented principles.

In this paper, we adopt the methods and metrics of the above-mentioned study to assess the Croatian Open Data Portal's compliance with the 10 user-oriented sustainability principles.

While preliminary results show government's efforts in publishing data, some aspects such as better collaboration with data providers and other data portals, offering different visualization tools, etc. need to be improved to achieve active use and impact. We compare our findings with the performance of other European portals and propose recommendations to improve the overall user experience of the Croatian Open Data portal.

Keywords: assessment, open data, portal, user-experience

Automatic Drawing in CAD Through Digital Sketch and Topological Encoding

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Abstract

Documentation is an integral part of the construction life cycle. One of the most used methods is the terrestrial surveying of the building (3D object) using a total station. The disadvantage of this method is 1. the complex preparation of the sketch and 2. the hard work and time-consuming drawing of the documentation in the CAD system. The goal of this contribution was to propose a method that would automate both of the mentioned processes as much as possible and reduce the amount of manual work in these processes to a minimum. The main idea of the sketch automation method is to reduce the dimension from 3D to 2D (a series of 2D images of a 3D object), creating a so-called digital sketch with information about the topology of a 3D object. The topology is created in a suitable CAD/GIS software by inserting points connected by lines into a series of images. Then a special script is run that generates a list of point coordinates, inserts topological codes (information about the connection of points and lines) to each point and saves the list to a text file. This file is then supplemented with geometry information after surveying the object in the field, and the resulting list of points with coordinates is transformed into the valid S-JTSK (National Grid of the Czech Republic) coordinate system. This file with a list of points is then imported into the appropriate CAD/GIS software and the construction documentation is automatically drawn using a special script. The proposed method was verified on two buildings: 1. The station building in Stařeč and 2. The Brethren Church in Husinec - both buildings are in the Czech Republic (CR). The practical application of the method demonstrated a 30% time saving, a reduction in manually work and error rate in the entire process of 3D object orientation. The proposed method is in accordance with national strategies in the Czech Republic: Digital Czech Republic and GeoInfoStrategy.

Keywords: life cycle of structure, geodetic surveying, digital sketch, topological encoding, automatic drawing

Note: poster presentation

The Role of BIM and GIS in the Life Cycle of Railway Infrastructure Construction

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Abstract

Building Information Modelling (BIM) is a modern approach to the management of the process of preparation, realization and operation of building objects, including their documentation throughout the entire life cycle. The first part of the paper describes the role of BIM and GIS in the construction life cycle. Both approaches are compared and evaluated on the process of transforming the as-built documentation of a transport infrastructure construction (reconstruction of the railway station in Šumice – Czech Republic) into a BIM and GIS model. The use of cartographic features for special railway objects is studied in terms of their intuitiveness.

Keywords: life cycle of structure, railway infrastructure, BIM, GIS

An Artificial Neural Network Approach to Predict the Future of Land Use and Land Cover of the Lower Neretva Region, Croatia

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Abstract

The use of simulation models has become increasingly important in the field of spatial planning, management, and scientific research. The purpose of this study was to develop a simulation model for 2035 based on land use and land cover changes in the Lower Neretva Region between 1990 and 2020. The simulation model was developed using cellular automata and artificial neural networks and implemented with QGIS's MOLUSCE plugin. Furthermore, a test simulation model for 2020 was developed, which was validated and proven to be highly accurate. Quantity was also shown to be better predicted than location. Input variables for the final simulation model included the digital elevation model (DEM), slope, population density by settlement for 2011 and 2021, distance from water bodies, and distance from built-up areas. Study findings predict that forests and grasslands will expand in size and occupy almost 45% of the area. Built-up areas and agricultural land are expected to increase slightly, while swamps and water bodies are expected to decrease. If such trends continue, it could have long-term negative implications for biodiversity and swamp habitats.

Keywords: artificial neural networks, land use, land cover, simulation model, MOLUSCE, Lower Neretva Region

From Sentinel-2 to Maps Using Cloud-Based Image Processing

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Abstract

In the last few years, more and more importance has been given to satellite missions for Earth observation. The traditional way of processing satellite data includes the use of commercial and open-source software which includes various tools for processing and analysis. With the increasing number of users, more efficient solutions were considered to avoid download of large amounts of data, and thus the limitation of hardware. Therefore, platforms for processing large satellite data via cloud have started to appear.

This research is based on Sentinel-2 satellite images which are processed using Sentinel Hub platform and EO Browser as one of the web applications of the Sentinel Hub platform which provides free access to Earth Observation satellite data. This research provides an overview of the possibilities of processing and analyzing satellite images on the platform. It also presents limitations compared to the traditional way of processing which includes downloading raw footage. The platform serves as an excellent tool for simple analysis and creation of visualizations, while experienced users will likely remain loyal to software that requires downloading data for some time to come.

Keywords: Sentinel-2, EO Browser, Sentinel Hub

Smooth Pycnophylactic Interpolation Produced by Density-Equalizing Map Projections

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Abstract

A large amount of quantitative geospatial data is collected and aggregated in discrete enumeration units (e.g., countries or states). Smooth pycnophylactic interpolation aims to find a smooth, nonnegative function such that the area integral over each enumeration unit is equal to the aggregated data. Conventionally, smooth pycnophylactic interpolation is achieved by a cellular automaton algorithm that converts a piecewise constant function into an approximately smooth function defined on a grid of coordinates on an equal-area map. An alternative approach, proposed by Tobler in 1976, is to construct a density-equalizing map projection in which areas of enumeration units are proportional to the aggregated data. A pycnophylactic interpolation can be obtained from the Jacobian of this projection. I will describe a software implementation of this method. Although solutions are not necessarily optimal in terms of predefined quantitative measures of smoothness, our method is computationally efficient and can potentially be used in tandem with other methods to accelerate convergence toward an optimal solution.

Key words: pycnophylactic interpolation, cellular automaton algorithm, density-equalizing map projection

A Problem in “Basic Cartography“

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Abstract

In cartographic literature, map projections are usually interpreted by mapping to auxiliary development surfaces, and then these surfaces are developed into a plane. The so-called secant projections, i.e. projections in which the auxiliary surface intersects the Earth's sphere or ellipsoid are especially emphasized. It is stated and taken as a fact without proof that the parallels in which the auxiliary surface intersects the sphere are mapped without distortions. An example of such an approach is the publication Basic Cartography, published several years ago by the International Cartographic Association. This paper, based on a theoretical consideration with an illustration on several examples, concludes that explaining cylindrical projections as mapping on a cylindrical surface is not a good approach, because it leads to misunderstanding important properties of projection. Furthermore, it turns out that the widely accepted facts about secant and standard parallels, which can also be found even in the most recent literature, are wrong and need to be revised. Standard parallels and secant parallels generally do not match.

It is always difficult to introduce changes when long-established custom has created a rut. Namely, it is common to find in the literature on map projections that the basic idea of a secant projection is that the sphere is projected to a cylinder which intersects the sphere at two parallels, say φ_1 north and south. Clearly the scale is now true at these latitudes whereas parallels beneath these latitudes are contracted by the projection and their (parallel) scale factor must be less than one. The result is that deviation of the scale from unity is reduced over a wider range of latitudes. Unfortunately, almost none of the above is true.

Since the various normal aspect cylindrical projections have differently spaced standard parallels, remaining unchanged distances when bending, it is clear that there will generally be no matching of the secant and standard parallels.

Conversely, suppose a cylinder is positioned so that it intersects a sphere in two parallels. Once we develop the surface of the cylinder into a plane, the spacing between the images of the intersecting parallels will not change. If by developing the cylinder surface the secant parallels became standard parallels, then all projections with the same secant parallels would have equally spaced standard parallels. That, of course, is not true.



Only for some cylindrical projections are the distances between the intersecting parallels on the sphere and the standard parallels in the projection plane equal. This is, for example, Gall's stereographic projection or some modification of it, such as those to be presented in this paper.

We conclude that explaining cylindrical projections as a projection on a cylindrical surface is not a good approach, as it leads to misunderstanding important projection properties. Standard and secant parallels are often considered identical, but this paper shows that widely accepted facts about these parallels are wrong and need to be revised. This requires a critical approach to the established customs in teaching and researching map projections. In order to prevent misunderstandings in the theory of map projections and their teaching, we recommend avoiding the use of developable surfaces as intermediate surfaces, and thus secant parallels and projections.

Keywords: map projection, standard parallel, secant parallel, cylindrical projection, Basic Cartography

The Contribution of Jacques Nicholas Bellin to the Cartographic Representation of the North-Eastern Adriatic Coast

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Abstract

Jacques-Nicolas Bellin was the chief cartographer of the *Dépôt des cartes, plans et journaux* of the French Ministry of the Navy (*Ministère de la Marine*) in the 18th century.[1] He was the most prolific and famous hydrographer during the French Enlightenment. *Dépôt* printed 127 plates from 1737 to 1772, 115 of which were by Bellin.[2] The first map made by Bellin and published by *Dépôt* was the *Carte reduite de la mer Mediterranée* (1737). He produced this map by compiling spatial data from nautical charts and geographical maps by European (mainly Venetian, Genoese, French and Spanish) mapmakers.[3] He produced three atlases: *Neptune françois* in 1753, *L'Hydrographie françoise* in 1756 and *Le Petit Atlas Maritime* in 1764.[4] Also worth mentioning is his work *Description géographique du Golfe de Venise et de la Morée*, which contains a considerable number of cartographic representations of parts of the Adriatic coast, underlining his perception of the importance of the Adriatic. The sample consists of three smaller scale nautical charts depicting the entire Adriatic basin (published in 1737, 1745 and 1771), four larger scale regional charts depicting the north-eastern Adriatic coast (published in 1771) and several other even larger scale cartographic representations depicting ports, islands and bays.

Bellin's three smaller-scale nautical charts of the Adriatic and four larger-scale regional maps do not contain much new information about the northeastern Adriatic coast, as he was a compiler who updated printed maps, charts and plans. It should be noted that he was criticised and accused of plagiarism[5], but his maps and charts give a different insight into the representation of the Adriatic. There is a document explaining how the 1737 chart of the Adriatic was made, which states "...the (coast) of Dalmatia and Albania was taken from that of Francois Berthelot, as it best suits the various remarks we have on the Gulf".[6] His maps are not identical to those of other cartographers, but they have similarities with older charts and maps. Conversely, the large-scale depictions of ports were a novelty, presenting new spatial data and containing important nautical information, such as depths.

Bellin made a great contribution to the depiction of the northeastern Adriatic by paying great attention to the Adriatic as part of the Mediterranean and by depicting in detail some of the most important Adriatic ports. The reason for this is most likely the contemporary importance of the Adriatic for maritime trade in the Mediterranean and the complex geopolitical situation in this part of Europe.

- [1] Ferley P (1996) The French Cartographer Jacques-Nicolas Bellin's Plans of 18th-century Urban Settlements in Present-Day Canada. *Urban History Review*, 25(1), 36–42
- [2] Chapuis O (2019) Jacques-Nicolas Bellin. In M. H. Edney [&] M. Sponberg Pedley, *History of Cartography Volume 4: Cartography in the European Enlightenment* (pp. 154–156)
- [3] Chapuis (2019)
- [4] Ferley P (1996)
- [5] Ibidem
- [6] Bellin J-N (1737) *Observations sur la construction de la nouvelle carte de la Méditerranée, dressée au Dépôt des Plans de la Marine, par ordre de M. le Comte de Maurepas, en 1737.* (pp. 8).

Keywords: Jacques-Nicolas Bellin, nautical charts, maps, Adriatic Sea, north-eastern Adriatic coast

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Historical GIS Applied for the Study of Old Watermills in the Province of Padova (Italy): Uncovering a Forgotten Territorial Network

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Abstract

This work is part of the PhD project "Historical Watermills in the territories of the Republic of Venice in the last three centuries: Geohistory and Digital Humanities", aiming to research the geohistory of watermills in the different regions once part of the Republic of Venice from the last century of Venetian domination to the current situation. This presentation focuses on the territory of the province around the city of Padova, which served as the first case study.

The main goals of the research are: 1) the construction of a historical geographic information system (HGIS) database containing the position of the watermills along with additional information such as: date of first and last records in the sources, activity carried, and technology employed, 2) The analysis at different scales of the relationships among a) distribution of watermills, b) technological solutions employed, c) morphological and anthropic features of the territory.

The study is characterized by a multidisciplinary geohistorical approach that relies on different sources: historical maps, written documents, visual sources, field surveys and interviews. The data collected were elaborated and analysed within an HGIS. The following set of old maps at different scales was employed to locate the mills in the province of Padova:

Cadastral maps (1:2000) were created at first by the French administration of the Venetian territories (1805-1814) and later updated under the subsequent Habsburg domination (1814-1866).

The first Habsburg Military Survey (1:28.800) was conducted under Habsburg's army officer Anton Von Zach from 1798 to 1805.

The second Habsburg Military Survey (1:28.800) was accomplished from 1824 to 1838 with later minor updates.

The surveys of the Italian Geographic Military Institute (1:25.000). This series of topographic maps was produced from 1890 to 1971.

Written sources include the registers of properties related to the cadastral maps and the documentation produced by the Venetian offices appointed to supervise mills' ownership, construction, and structural



modifications. Examples of visual sources of data are paintings of rural and urban landscapes, historical photos and postcards.

A widespread network made by different types of mills has started to emerge from the construction of the HGIS. Mills were built on almost every water stream: standing on riverbanks, navigating from one landing point to another or floating in a fixed position. This array of technological solutions was conceived to deal with the hydrographical complexity of a territory drained by a rich set of streams characterized by different widths and water levels. This network of structures disappeared between the late 19th century and the first half of the 20th century due to the advancing process of industrialization. Many structures still survive, but they stand as isolated nodes of a forgotten network once encompassing the whole landscape.

This attempt to reconstruct the presence of watermills could improve the geohistorical knowledge of these structures at the same time providing new perspectives for local cultural heritage and tourism (such as new information for boards, routes for field trips and strategies of valorisation from the network point of view).

Keywords: historical watermills, Republic of Venice, geohistorical approach, historical GIS

Evaluation of OpenStreetMap, Wikimapia and OpenTopoMap Data Quality for Test Sites in Slovenia

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Abstract

OpenStreetMap, Wikimapia and OpenTopoMap are three online cartographic platforms that are formed based on Volunteered Geographic Information (VGI). In our analysis we focused on completeness and positional accuracy of the displayed data. Three types of test areas were chosen within Slovenia's boundaries, representing urban, rural and high mountain areas and for each type three test sites were determined. As a reference data latest ortophoto and lidar data, supplemented with vector topographic database data, building cadastre, cadastre of public infrastructure and eVode (eWaters) were used. The focus was on three object groups: buildings, transport networks (roads and paths) and water (rivers and streams). The results show that the quality of the data differs between the different cartography platforms and also the different types of test areas.

Keywords: Volunteered Geographic Information, completeness, positional accuracy, Slovenia

Interactive Web Map of Syrmia Diocesis

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Abstract

In our presentation we will show the creation of an interactive web map of the Diocese of Syrmia (Srijem). The Diocese of Srijem is a spatial-organizational unit of the Roman Catholic Church. The special feature of this diocese is that it is located in Serbia, and it belongs to the Đakovo-Osijek Metropolis, which has its seat in Croatia.

Since there is no map showing the Diocese since its last definition in 2008, the making of the map required research and different challenges solving and discovery of sacral objects that are crucial for this type of sacral map. The map is unique because it shows sacral objects that have not yet been shown and presented in this way. The author has successfully created a map based on sacral themes and emphasized cartographic details related to this Diocese.

Keywords: cartography, map, Diocese of Syrmia, religion

Creating a Cartographic Visualization of all Croatian Islands on a Poster Using Monochrome Mapping

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Abstract

Croatia is internationally known as the country with thousand islands. The exact number of naturally formed parts of the land surrounded by the sea with an area of more than 1 km² is defined by the law and amounts exactly 78. It is not an easy task to show all the islands on one map, while at the same time their indentation, shape, relief and size are visible and highlighted. Thinking about the kind of cartographic display that would emphasize the appearance, shape, relief and size of each individual island as a separate entity, we decided to create a poster in A1 paper format on which we placed all the islands with a surface area of more than 1 km² according to their surface area. The marine benthos layer was used as a source of spatial data for creating the island polygon by connecting to the Web Feature Service (WFS) of the environmental protection information system called 'bioportal'. It is a layer that contains the entire territorial sea of the Republic of Croatia, and which was used to create the polygons of the island from its internal voids. The shaded relief and contour lines of all islands were obtained by processing the European digital surface model (EU-DEM). The entire processing of the spatial and attribute data of the polygon, as well as the final creation of the map design, was performed in QGIS. In the final representation of all Croatian islands, a shade of blue was used for the background of the map to give the impression of a marine environment. In addition, different shades of blue were used to display the polygons of the island, as well as the shaded relief, layers, and the entire text in the map description. Therefore, it can be said that we created the first unique representation of the Croatian islands using monochrome mapping of cartographic content.

Keywords: Croatian islands, cartographic visualization, poster, monochrome mapping



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