12TH INTERNATIONAL
ANAMED ANNUAL SYMPOSIUM

SPATIAL WEBS

Mapping Anatolian Pasts for Research and the Public

EDITED BY CHRISTOPHER H. ROOSEVELT

ANAMED
KOÇ UNIVERSITY
RESEARCH CENTER FOR
ANATOLIAN CIVILIZATIONS

12TH
INTERNATIONAL
ANAMED ANNUAL
SYMPOSIUM

Spatial Webs: Mapping Anatolian Pasts for Research and the Public

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Koç University Research Center for Anatolian Civilizations (ANAMED) Series

KOÇ UNIVERSITY SUNA KIRAÇ LIBRARY CATALOGING-IN-PUBLICATION DATA

Koç University Research Center for Anatolian Civilizations (ANAMED) Series
International ANAMED Annual Symposium (12th : 2017 : Istanbul, Turkey)
12th International ANAMED Annual Symposium: Spatial Webs: Mapping Anatolian Pasts for Research and the Public, November 29th-30th 2017 / Authors Ayşe Nur Akdal, Elton Barker, Anuja Dangol, Nicholas de Lange, Claudia Engel, Piet Gerrits, H. Murat Güvenç, Piraye Hacıgüzeller, M. Erdem Kabadayı, Vahakn Keshishian, Daniel Knitter, Turgay Koçak, Bernhard Ludwig, Dominik Lukas, Camilla Mazzucato, Osman Özkan, Jeroen Poblome, Michael Połczyński, Christopher H. Roosevelt, Amy Singer ; copy editors Lauren Davis, Jacob Chizzo ; publishing coordinator Alican Kutlay ; publishing assistant Alara Demirel ; book design Burak Şuşut ; symposium coordinator Şeyda Çetin; contributing coordinator Ebru Esra Satıcı ; project manager Buket Coşkuner ; ANAMED director Chris Roosevelt. -First edition- Istanbul : Koç University Press, 2021.
224 pages ; 19,5 × 25 cm.-- Koç University Press
ISBN 978-605-7685-37-7
1. Cartography. 2. Cartography--Turkey--History. I. Akdal, Ayşe Nur. II. Barker, Elton. III. Dangol, Anuja. IV. Lange, Nicholas de. V. Engel, Claudia. VI. Gerrits, Piet. VII. Güvenç, H. Murat. VIII. Hacıgüzeller, Piraye. IX. Kabadayı, M. Erdem. X. Keshishian, Vahakn. XI. Knitter, Daniel. XII. Koçak, Turgay. XIII. Ludwig, Bernhard. XIV. Lukas, Dominik. XV. Mazzucato, Camilla. XVI. Özkan, Osman. XVII. Poblome, Jeroen. XVIII. Połczyński, Michael. XIX. Roosevelt, Christopher H. XX. Singer, Amy. XXI. Roosevelt, Christopher. XXII. Çamurcuoğlu, Duygu. XXIII. Özgüner, N. Pınar. XXIV. Kutlay, Alican. XXV. Demirel, Alara. XXVI. Özgüner, Pınar. XXVII. Şuşut, Burak. XXVIII. Çetin, Şeyda. XXIX. Satıcı, Ebru Esra. XXX. Coşkuner, Buket. XXXI. Roosevelt, Christopher. XXXII.Title.
GA1303.5.A1 I58 2021

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Certificate No: 18318

FIRST EDITION
Istanbul, 2021

ISBN
978-605-7685-37-7

© 2021. This book has been published on the occasion of the 12th International ANAMED Annual Symposium "Spatial Webs: Mapping Anatolian Pasts for Research and the Public" that was held at the Koç University Research Center for Anatolian Civilizations (ANAMED), Istanbul, on 29–30 November 2017.

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SPATIAL WEBS

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Preface

Koç University's Research Center for Anatolian Civilizations (ANAMED) in Beyoğlu, Istanbul was founded in 2005 to support research on the archaeology, art, heritage, and history of Anatolia and to help bring that research to the public through fellowships, exhibitions, publications, library resources, and symposia. After two years in the role of director of ANAMED, I took on the organization of the 12th International ANAMED Annual Symposium (IAAS)—traditionally a collaboration between ANAMED and Koç University faculty—both because of my interest in the subject and because I wanted to learn better through experience what running a symposium at ANAMED entailed.

The intent of the 12th IAAS in 2017 was to bring together scholars engaged in creating and using spatialized data resources for research and web-based data presentation and collaboration. The symposium aimed not only to showcase projects that incorporated GIS and other analytical tools in spatially-significant research into the past, but also to showcase projects that had engaged or would soon engage in spatializing collections of data for interactive web-mapping applications for researchers and the public alike. The event was popularly attended, and participants were cajoled into submitting revised and expanded versions of their presentations for review and publication, the result of which now lies before you.

ANAMED began publishing its own scholarly volumes in 2015 but began publishing IAAS volumes (in English and Turkish versions) only in 2018, with the proceedings of the 10th IAAS of 2015 (*Spolia Reincarnated: Afterlives of Objects, Materials, and Spaces in Anatolia from Antiquity to the Ottoman Era*). The 11th IAAS of 2016 (*Sacred Spaces and Urban Networks*) was subsequently published in 2019, and now the 12th IAAS of 2017 in 2020. Our aim moving forward is to publish the scholarly work stemming from each symposium within two years or so of its initial presentation. This goal is currently on track with the diligent work of the ANAMED Publications Office, now in the capable hands of Alican Kutlay, to whom I offer great thanks for his patient guidance, diligence, and schedule-keeping-nudges throughout the process.

For financial, administrative, and logistical support of the symposium and this resulting publication, many others deserve thanks, as well, beginning first and foremost with the Vehbi Koç Foundation (VKV) and Koç University (KU), the two organizations that make all things at ANAMED possible, along with Ömer M. Koç, VKV President Erdal Yıldırım, KU President Umran İnan, KU Vice President for Research and Development İrşadi Aksun, and College of Social Sciences and Humanities Dean Aylin Küntay. For logistical help with the symposium and its program, former ANAMED staff Şeyda Çetin and Özge Ertem were most instrumental, with the assistance of Ebru Esra

Satıcı, Ege Germen, and Müge Bulu Akar. ANAMED symposia and publications are not realized in bubbles but rely on the collaborative work of the entire ANAMED team; my sincere gratitude is extended to Buket Coşkuner, Duygu Tarkan, Mukaddes Gül, and Murat Türk, among others. Many thanks also to copyeditors, translators, designers, and draft readers, Lauren Davis, Jacob Chizzo, Duygu Çamurcuoğlu, N. Pınar Özgüner, Burak Şuşut, Gary Nobles, and Alara Demirel, as well as to KU Archaeology and History of Art undergraduate helpers A. Furkan İnan and Pelin Peker.

Publications and symposia are not realized without contributors, of course—their Most Valued Participants—and I remain especially grateful to all those who participated in the symposium—including moderators Ahmet Ersoy, Shirine Hamadeh, Hannah Lau, and Lucienne Thys-Şenocak—as well as to the contributors to this volume and those symposium participants who were unable to contribute to this volume. The latter includes Antonis Hadjikyriacou and Christos Chalkias, Nil Tuzcu, and Asım Evren Yantaç. Special thanks for his willing participation and both initial and *ex post facto* feedback goes to keynote speaker Elton Barker. Finally, for feedback on the initial, core idea of *Spatial Webs* and support throughout the process, a thousand and more thanks to Christina Luke.

Chris Roosevelt

Abbreviations

ACM	Association for Computing Machinery
ADS	Archaeological Data Service
AHRC	Arts and Humanities Research Council
ANAMED	Research Center for Anatolian Civilizations, Koç University
API	Application Program Interface
AVI	Audio/Video Interleaved
AWMC	Ancient World Mapping Center
BBC	British Broadcasting Corporation
BCE	Before Common Era
BMP	Bitmap Format
CAA	Computer Applications and Quantitative Methods in Archaeology
CALCS	Cross-Cultural After-Life of Classical Sites
CAMPOP	Cambridge Group for the History of Population and Social Structure
CC-BY	Creative Commons License
CERN	Conseil Européen pour la Recherche Nucléaire = European Council for Nuclear Research
CHGIS	China Historical GIS
CIDOC CRM	Conceptual Reference Model of the International Committee for Documentation
CLUSTERS	Consortium Linking Universities of Science and Technology for Education and Research
CRANE	Computational Research on the Ancient Near East
CSV	Comma-Separated Values Format
ÇRP	Çatalhöyük Research Project
DAAHL	Digital Archaeological Atlas of the Holy Land
DAI	Deutsches Archäologisches Institut = German Archaeological Institute
DARMC	Digital Atlas of Roman and Medieval Civilizations
DB	Database
DBF	dBASE Spreadsheet Format
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DOC	Microsoft Word Processing Format
DWG	Computer-Aided Design Drawing Format
DXF	Autodesk Drawing eXchange Format

EMODnet	European Marine Observation and Data Network
ESRI	Environmental Systems Research Institute
EU-DEM	European Digital Elevation Model
FAIR	Findable, Accessible, Interoperable, and Reusable (principles)
FLV	Flash Live Video Format
FWO	Research Foundation Flanders
GBHGIS	Great Britain's Historical GIS
GDAL	Geospatial Data Abstraction Library
GDPR	General Data Protection Regulation
GeoJSON	Geographic JavaScript Object Notation
GeoTIFF	Geostationary Earth Orbit Tagged Image Format
GIF	Graphics Interchange Format
GIS	Geographic Information System
GLAM	Gallery, Library, Archive, and Museum (sector)
GPS	Global Positioning System
GRASS	Geographic Resources Analysis Support System
GUI	Graphical User Interface
HEROM	*Journal on Hellenistic and Roman Material Culture*
HGIS	Historical Geographic Information System
HTR	Handwritten Text Recognition
IAAS	International ANAMED Annual Symposium
IDE	Integrated Development Environment (Python)
IFEA	Institut Français d'Études Anatoliennes = French Institute of Anatolian Studies
IIIF	International Image Interoperability Framework
INSPIRE	Infrastructure for Spatial Information in Europe
ISC	Istanbul Studies Center, Kadir Has University
KMKD	Kültürel Mirası Koruma Derneği = Association for the Protection of Cultural Heritage
KML	Keyhole Markup Language and File Format
KOPAL	Konya Basin Palaeoenvironments Project
KU	Koç University
LAÇ	Living Archive of Çatalhöyük
LOD	Linked Open Data
LODE	Linking Open Descriptions of Events
LPWG	Linked Pasts Working Group

MedArchNet	Mediterranean Archaeological Network
MEDMAPS	Mapping Mediterranean Lands
MHATNF	Maritime History Archives of the Turkish Naval Forces
MIT	Massachusetts Institute of Technology
MOV	QuickTime Movie Format
OCHRE	Online Cultural and Historical Research Environment
OCR	Optical Character Recognition
ODATE	Open Digital Archaeology Textbook Environment
ODF	Open Document Format
OpenAIRE	Open Access Infrastructure for Research in Europe
PDF	Portable Document Format
PostgreSQL	Postgre Structured Query Language
PST	Primary, Secondary, Tertiary System
QGIS	Quantum Geographic Information System
RDF	Resource Description Framework
RMSE	Root Mean Square Error
RTF	Rich Text Format
SIGCHI	Special Interest Group on Computer–Human Interaction
SIIS	Sagalassos Integrated Information System
SLLP	Stanford Literary Lab Pamphlet
SRTM	Shuttle Radar Topography Mission
TAYGIS	Türkiye Arkeolojik Yerleşmeleri GIS = Archaeological Settlements of Turkey GIS
tDAR	The Digital Archaeological Record
TEI	Text Encoding Initiative
TIF	Tagged Image Format
TPI	Topographic Position Index
UML	Unified Modeling Language
UNESCO	United Nations Educational, Scientific, and Cultural Organization
URI	Uniform Resource Identifier
VKV	Vehbi Koç Foundation
XLS	Microsoft Excel Spreadsheet Format
XLSTAT	Statistical Software for Excel
XML	Extensible Markup Language

A Preliminary Attempt to Construct a Geospatial, Multimodal Ottoman Transport Network for 1899

M. Erdem Kabadayı

Piet Gerrits

Osman Özkan

Turgay Koçak

Introduction

This chapter presents a brief account of work in progress. As a team based at Koç University, we have been working on various aspects of population geography and occupational structure in the Balkans and Anatolia between the Late Ottoman period and the end of the twentieth century within the framework of a broader project (UrbanOccupationsOETR, n.d.). Launched at Koç University in October 2016, our project officially partners and collaborates closely with the University of Cambridge's Cambridge Group for the History of Population and Social Structure (CAMPOP) toward, among other aspects, establishing historical and geospatially accurate multimodal transport networks. Details and some visualizations of preliminary results relevant to historical transport networks can be found on both our and CAMPOP's webpage (CAMPOP, n.d.). The well-known ORBIS project of Stanford University, led by Walter Scheidel and Elijah Meeks and featuring an impressive and interactive webpage (ORBIS, n.d.), was an inspiration both for us and the CAMPOP team.

The expansion and integration of Geographic Information System (GIS) capabilities into academic fields have varied among disciplines and subdisciplines. This uneven integration is evident also for the subfields of larger umbrella groupings, such as the social sciences and humanities. For obvious reasons geography and cartography have been at the forefronts of the geospatial, or GIS, revolution, with their closer ties to geomatics. To be sure, revolution is a strong term in social sciences, and time will tell whether there will actually be a revolution. Such a revolution was argued enthusiastically already in

the early 2000s. As Dobson rightfully assessed in 2004, however, GIS and its effects were not revolutionizing the science, and the process could be seen more as a reluctant evolution (Dobson 2004, 573). As historians, we prefer with conventional comfort to wait, see, and comment on change that has already happened. Nevertheless, from our point of view, it is beyond doubt that we are at the verge of a more decisive spatial turn in the field of history, with increasing numbers of examples of the incorporation of geospatial capabilities in historical methods and with ever-growing digital toolboxes. We think the Coursera online course of Pennsylvania State University on "Maps and Geospatial Revolution" in the subfield of Data Science and Data Analysis is a good example (Coursera, n.d.). For a concise evaluation of cooperation between historical studies and GIS in the early 2010s, see Martí-Henneberg (2011, 1–8). Yet, we argue that this spatial turn has not yet been georeferenced, at least not in the field of history. To georeference this new spatial turn, space, in general, and locations and territories, in particular, should be incorporated into historical analyses as geospatially tagged, coordinated places.

We are convinced that this crucial, yet mammoth, task can be achieved only with a digitally well-connected, healthy, and strong development of the emerging interdisciplinary subfield of Historical Geographic Information Systems (HGIS) (Weiwei and Logan 2017), which is being used ever more frequently in historical research (Gregory, DeBats, and Lafreniere 2018). Although more than ten years have passed since the first major publication on HGIS (Gregory and Ell 2007), the fact that no international HGIS journal has been developed shows how HGIS is still in its early stages of development as a research field. This chapter is the result of our modest attempt to contribute to the development of HGIS applications within Ottoman studies, and ours is not the first such effort. Since 2014 a few studies have begun to position Ottoman studies within the emerging field of digital and spatial humanities. In addition to Połczyński and Singer (this volume), we can mention the work of Gratien, Połczyński, and Shafir (2014) and Hadjikyriacou and Kolovos (2015). Experts in HGIS have also already contributed to literature with highly developed analyses of historical transport networks focusing on Balkan railways after the 1870s. Stanev's publications are pioneering in this regard, for example (Stanev 2013). Although preliminary, we think our attempt to construct a multimodal transport network for the Ottoman Empire is timely and, to our knowledge, unprecedented.

Multimodal Components and Their Importance

In constructing digital, georeferenced historical transport networks, multimodality is a crucial element. Without allowing for goods and people to switch modes of transport (coastal navigation, land roads, railways, etc.), advanced techniques of GIS path determination can result in misleading routes. The exclusion of sea travel, in particular, might result in extremely problematic projections of historical transport activity. ORBIS showcases the importance of multimodality very successfully by incorporating

fourteen different modes of road travel, in addition to fluvial, coastal, and overseas travel. ORBIS also provides clear information on the functioning of their transport network model in minute detail (ORBIS, n.d.). The preliminary model we present here is drastically primitive compared to that of ORBIS yet includes the crucial characteristic of multimodality even in a very simple form. The four modes we include are two types of roads (primary and secondary), railways, and coastal navigation. The model is based on two historical maps from 1899, a lighthouse directory from 1911, and a commercial vessel logbook from 1894. In the following sections we explain, step by step, how and based on which material we have constructed the 1899 historical transport network. First, we illustrate the geographical coverage of the exercise.

Scope and Geographic Coverage of the Network

Although on land our case study is limited to the 1899 borders of the Ottoman Empire, on sea and regarding the coastal maritime network, we go beyond Ottoman borders. Our scope encompasses almost the entire coastline in Figure 1, except for certain parts of today's Greek coast. In constructing the network, we used two historical maps as the main building blocks. These maps were made in the same year, 1899, and at the same scale (1:1,500,000). For the sake of simplicity, we call them the Huber (Huber 1899) and Vogel maps, the latter derived from the 1908 edition of the map created with the help of B. Domann in 1899 (Vogel and Domann 1908). Both maps were georeferenced by and downloaded as GeoTIFF files from the EarthWorks geospatial data discovery application (EarthWorks, n.d.) of Stanford University Libraries, where details of their georeferencing can be found. We made only minor adjustments regarding the datum and projection of the maps to bring them into alignment with preexisting project data (Fig. 2).

Coastal Navigation Mode

Turning to the modes of transport incorporated in the network, we began with coastal maritime transport. First, we "map mined" nearly 500 harbors, 246 from the Huber and 245 from the Vogel maps. In doing so we aimed to geolocate all possible nodes of maritime transport. From both maps, we included all points on coasts that are connected to inland roads (Fig. 3).

Thereafter, we aimed to construct a corridor of safe coastal navigation. We based the outer boundary of that corridor on lighthouse visibility ranges. To do this, we extracted latitude and longitude data from a 1911 directory of lighthouses (Fener Risâlesi 1911). This printed source in Ottoman script is a partial translation of a non-specified contemporary European directory of lighthouses for the entire Mediterranean, and it includes 179 lighthouses for our chosen territory (Fig. 4). The lighthouse directory also provides detailed information about the visibility range of individual lighthouses (Fig. 5), which, when combined, served to set the outer boundary of safe coastal navigation (Fig. 6).



Fig. 1. Scope of the network.



Fig. 2. Georeferenced Huber and Vogel maps.



Fig. 3. Possible nodes of maritime transport.



Fig. 4. One hundred seventy-nine lighthouses from *Fener Risalesi* (1911).

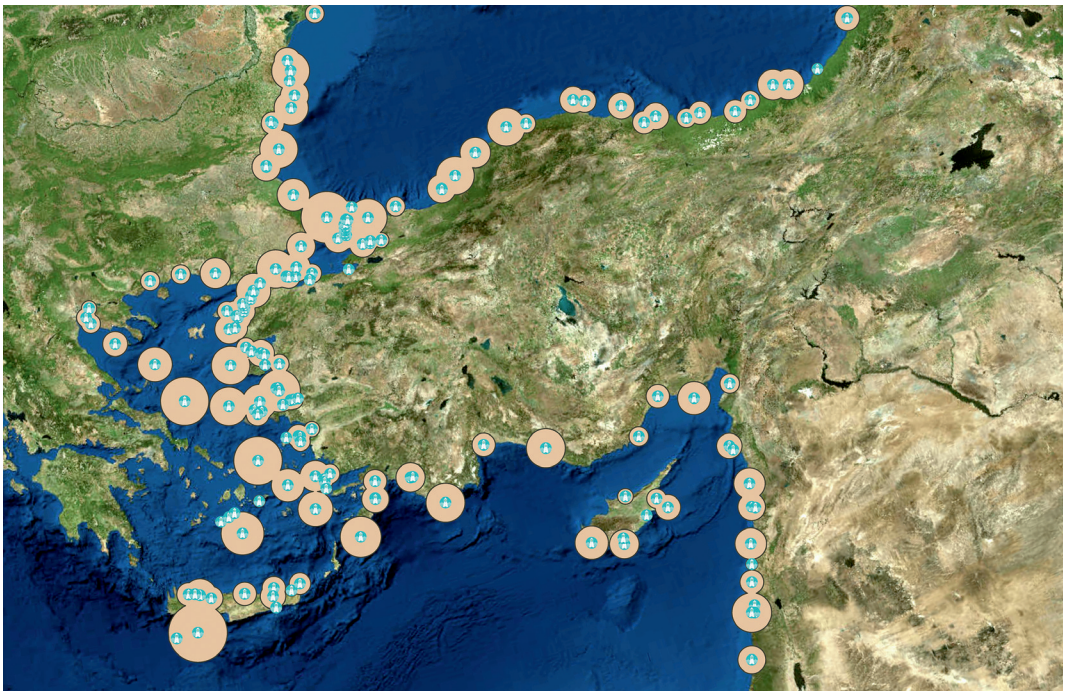


Fig. 5. Visibility ranges of 179 lighthouses from *Fener Risalesi* (1911).



Fig. 6. Coastal navigation corridor.

For the inner boundary of the safe coastal navigation corridor, we made combined use of bathymetric data from the European Marine Observation and Data Network (EMODnet, n.d.). For our analysis we resampled the EMODnet data to present a higher spatial resolution of 30 meters, and we set 8 m as the minimum depth for safe navigation (the minimum depth for passage and embarkment of vessels) based upon historical documentation from the 1900 restructuring and modernization of the Salonica harbor (HH.THR. 214/30). This document from the Ottoman state archives is quoted in Bayram (2009, 158). We are aware of the fact that in several Ottoman maritime transport nodes barges were used to load and unload vessels. Nevertheless, we think a minimum depth of 8 m still makes sense in this early stage of our model development. The spatial resolution of EMODnet bathymetry data is also unfortunately not perfectly in accord with our needs, yet for this preliminary version, we think it serves our purposes. Combining these data, we created the safe coastal navigation corridor, displaying impassable parts in red (Fig. 7).

The Istanbul Naval Museum Archives belonging to the Maritime History Archives of the Turkish Naval Forces (MHATNF) has a rich collection of detailed vessel logbooks. To test our coastal navigation corridor, we used the logbook of a steamer named the *Turk* (MHATNF, 4118). In particular, we closely examined three journeys of the *Turk* from Istanbul in 1894, one each to Rize (following the southern Black Sea coast), Salonica, and Jaffa (Fig. 7).

The logbook of the *Turk* provides exact information on the mileage between stops and the times of arrival to and departure from stops in these three representative journeys. We compared the mileages given in the logbook with the distances our model provides, constraining travel within the safely navigable zone of the model. In general, time distances given in the logbook deviated no more than 10 percent between stops in these comparisons. The best fit was the longest journey, between Jaffa and Istanbul, with fifteen stops (Fig. 8).

Land Transport Modes

After establishing a workable coastal navigation corridor, we extracted land transport features as strings from the Huber map, that is, roads and railway tracks, in three categories (with the French terms deriving from the map legend): primary roads (*chaussées*), secondary roads (*chemins*), and railroads (*chemins de fer en exploitation*). *Chaussées* were paved roads constructed by laying and compacting successive layers of broken stone. An authoritative and contemporary dictionary gives the meaning of *chaussée* as a macadamized road, after John Loudon McAdam, who revolutionized the construction of paved roads in England in the early nineteenth century (Redhouse 1890, 1141). Based on this information, and more importantly via analyzing the locations and density of the *chaussée* network, we ranked *chaussées* as primary roads. *Chemin*, on the other hand, was translated into Ottoman as path or road without any further

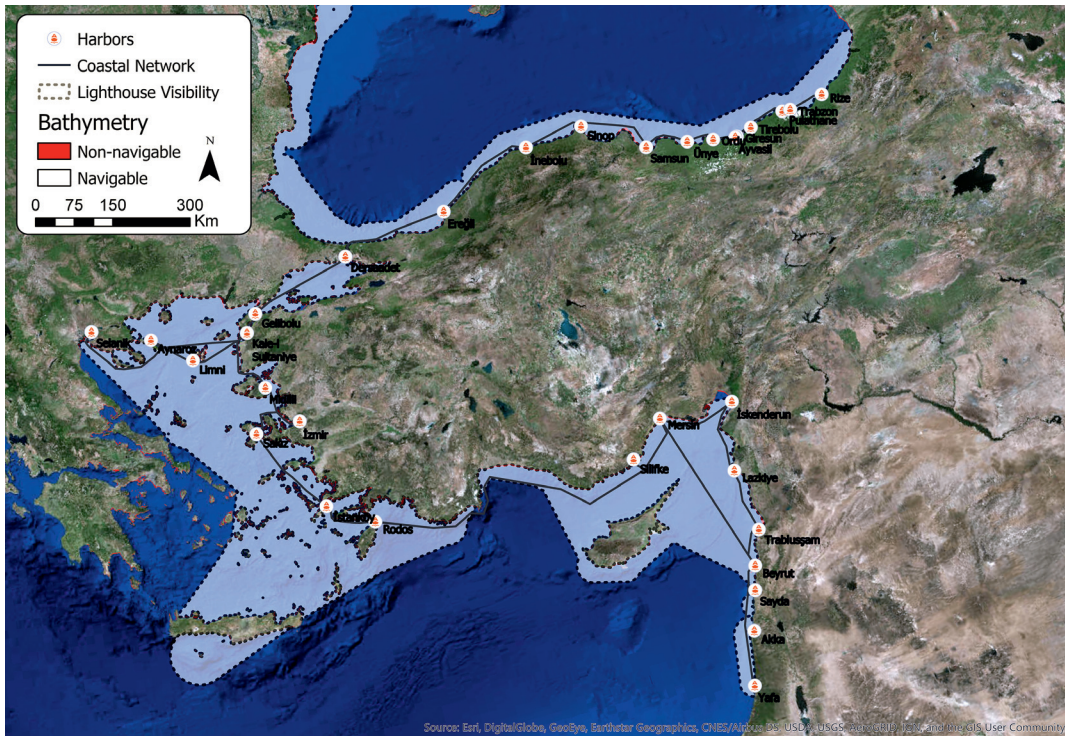


Fig. 7. Return journeys (from/to Istanbul from/to Jaffa, Salonica, and Rize) of the steamer *Turk*, 1894.

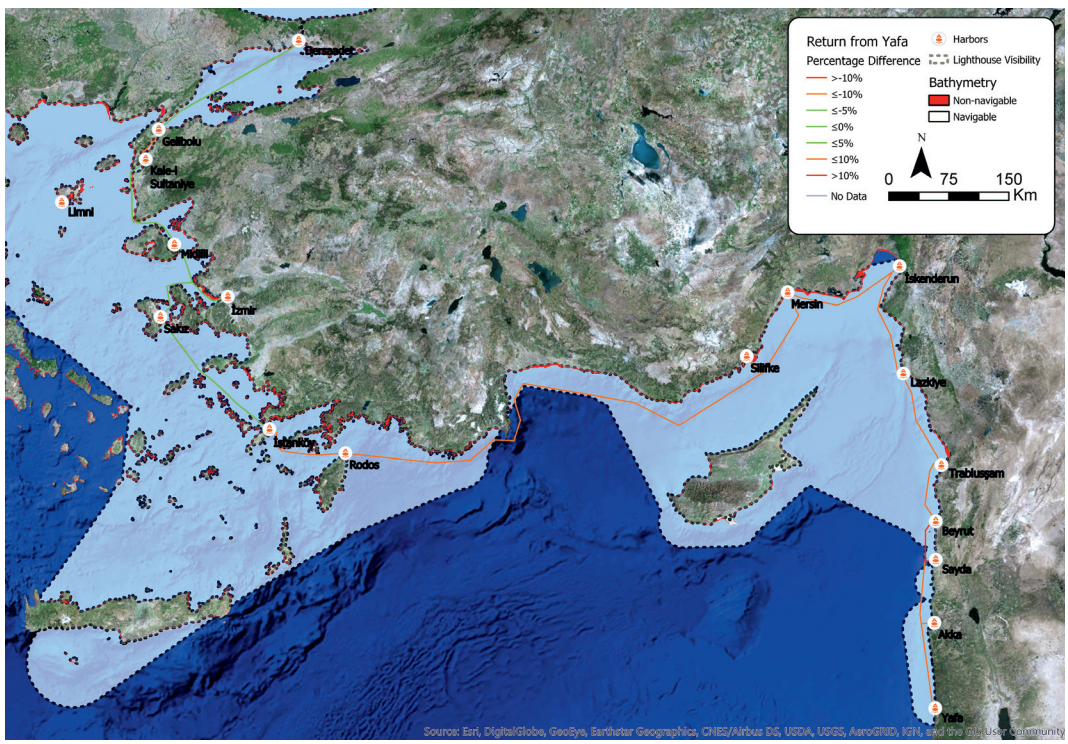


Fig. 8. Close-up of Jaffa–Istanbul journey of the steamer *Turk*, 1894.

qualification in the most used contemporary French-Ottoman dictionary (Sami 1901). Therefore, we categorized *chemins* as unpaved, conventional roads of secondary connections, and grouped them into secondary roads. The third and the last category of polylines extracted from the Huber map were railroads in operation. During the digitization of strings/polylines of these three categories from the Huber map, we also digitized every point of their intersection, as nodes, to allow multimodality and movement among primary and secondary roads and railroads. Due to relatively limited coverage of railroads and lacking detailed location information for railway stations, we included railroad intersections with primary and secondary roads as possible locations to switch between modes. In total we connected around two thousand nodes via these three modes of land transport (Fig. 9). Combining this land transportation data with the coastal navigation corridor allowed us to construct the first version of the 1899 multimodal transport network model for the Ottoman Empire (Fig. 10).

Travel Times, Distances, and Average Speed of Modes

As a last step in this exercise, we aimed to calculate the average speeds of each of the modes of the network. Because the network is georeferenced, we can calculate distances in kilometers using the road connections between the nodes of the model. The Huber map also provides travel times in hours for primary and secondary roads. Therefore, we were able to calculate average speeds on primary and secondary land roads solely relying on the Huber map and the model. We have time and distance data for 327 primary and 899 secondary road segments of the Huber map. We extracted respective road segment lengths from our model and calculated average speeds for both road types as 4.8 kmph for primary roads and 4.7 kmph for secondary roads. As a result, we rounded up the general average speed to 5 kmph for both road types. For railroad transport we used an 1875 timetable of the Ottoman Railway Company (n.d.) for the Izmir–Aydın segment to calculate the average speed of trains as 22 kmph. For the average speed of coastal navigation, we relied on the 1894 logbook of the *Turk*, which traveled at an average rate of 17.5 kmph over 54 segments. With average speeds for all modes of transport calculated, we are able to calculate average travel times between any connection among the nodes of the network based on distances and average speeds. For example, the model allows us to simulate a hypothetical journey through the network from Eskişehir to Baghdad using all possible modes of transport. The resulting simulated journey would stretch 2,028 km over 15 stops, would take 12 days and 9 hours of active travel time (ignoring the passage of time while switching modes), and takes advantage of both overland and coastal routes (Fig. 11).

In Lieu of a Conclusion, Future Plans

With this brief chapter we wanted to share the very preliminary results of our efforts to construct a geospatial, multimodal Ottoman transport network for the late nineteenth

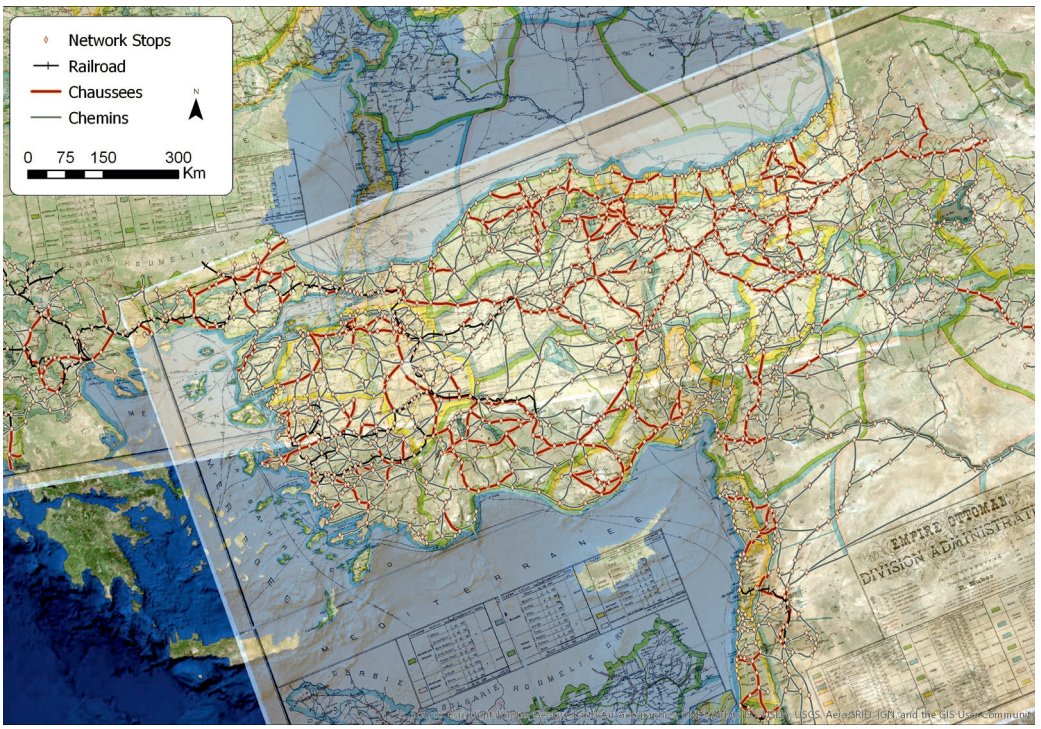


Fig. 9. Nodes of land transport (intersections of primary and secondary roads and railways), 1899.

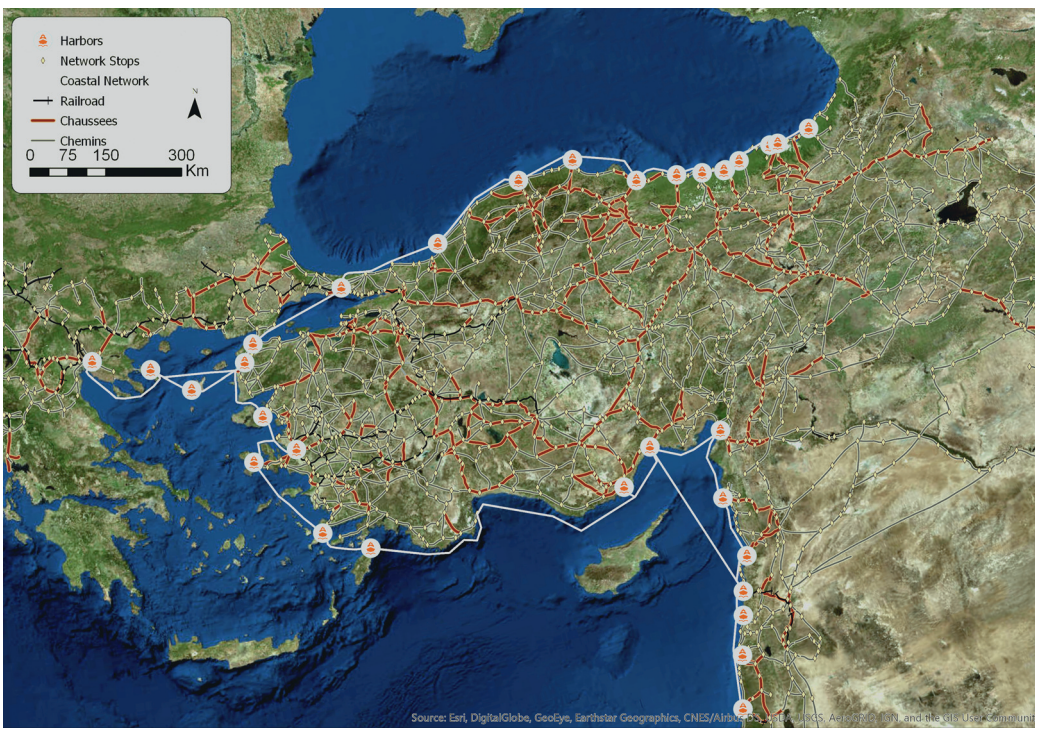


Fig. 10. Multimodal transport network for the Ottoman Empire, 1899.

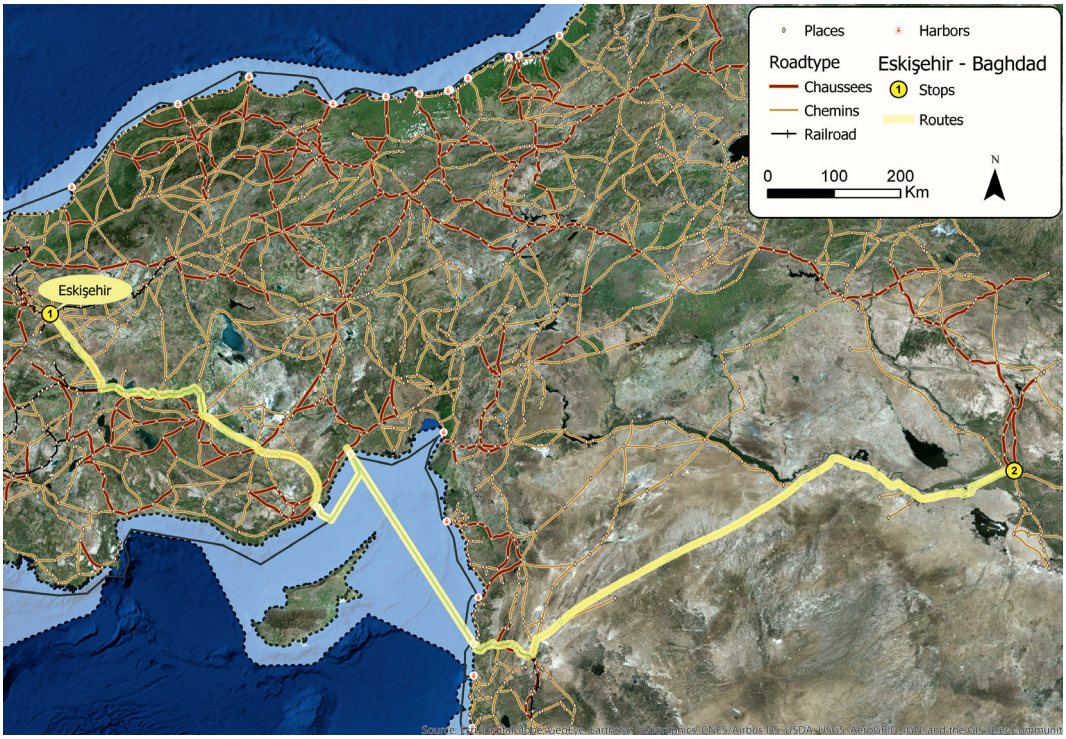


Fig. 11. Hypothetical journey from Eskişehir to Baghdad on the network.

century. This is the first step of an ongoing project. Over time, we aim to develop the model by incorporating additional historical maps, as well as other time, distance, and topographic data. Ottoman provincial statistical yearbooks (*vilayet salnameleri*) from the second half of the nineteenth century are promising sources for travel times in hours. Numerous historical maps provide similar data. A major shortcoming of the current model is that it fails to adjust times and distances according to seasonality, and thus accessibility. To the best of our understanding, this type of information could be gleaned only from careful study of travelogues. Enriching the model with data from the logbooks of additional steamers and other seagoing vessels, as well as the railway timetables from several decades of the nineteenth century, will increase its detail and accuracy with real-life data. Finally, the model presented here makes no use of topographic data. We remain convinced that with careful integration of digital elevation models (DEMs), our GIS-based analyses and simulations will be far more versatile and realistic, able to consider directionality and altitude changes. For a very first step, see our model of an interactive online DEM (UrbanOccupationsOETR, n.d.). These and other future aims should make the model increasingly reliable, and thus increasingly useful as a research tool. We look forward to sharing future iterations of the model as they progress on our project webpage (UrbanOccupationsOETR, n.d.). Sustaining the interactive online presence of digital humanities projects going beyond the lifetime of their funding is

a crucial aspect for the future of digital scholarship. To reach this aim we need to go beyond the capabilities of digital repositories for conventional publications or digital applications. We are convinced that ensuring accessibility to academic output in digital formats that allow interactivity on the web is the way forward. We need to establish and maintain interconnected hubs and/or portals for digital scholarship.

Acknowledgments

This work was carried out within the framework of UrbanOccupationsOETR, Industrialisation and Urban Growth from the mid-nineteenth century Ottoman Empire to Contemporary Turkey in a Comparative Perspective, 1850–2000, funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 679097). We would like to thank the Director of the Cambridge Group for the History of Population and Social Structure (CAMPOP), Leigh Shaw-Taylor, and his team for our ongoing fruitful collaboration.

Works Cited

Bayram, Selahattin. 2009. "Osmanlı Döneminde Selanik Limanı (Salonica Harbor in Ottoman Era): 1869–1912." PhD diss., Istanbul University.

CAMPOP. n.d. "Urbanization and Economic Development in England and Wales c. 1670–1911." Accessed February 26, 2019. https://www.campop.geog.cam.ac.uk/research/projects/transport/.

Coursera. n.d. "Maps and Geospatial Revolution." Accessed February 26, 2019. https://www.coursera.org/learn/geospatial.

Dobson, Jerome E. 2004. "The GIS Revolution in Science and Society." In *Geography and Technology*, edited by Stanley D. Brunn, Susan L. Cutter, and J. W. Jr. Harrington, 573–87. Dordrecht: Springer.

EarthWorks. n.d. Stanford Libraries: EarthWorks. Accessed February 26, 2019. https://earthworks.stanford.edu/

EMODnet. n.d. European Marine Observation and Data Network. Accessed February 26, 2019. http://www.emodnet.eu/.

Fener Risâlesi. 1911. *Bahr-i Sefîd, Bahr-i Siyah ve Marmara ve Boğazları, Bahr-i Azak, Bahr-i Ahmer, Bâb ei-Mendeb ve Arabistan'ın Cenub-ı Sâhili ile Bahr-i Umman ve Basra Körfezi Fenerlerinin Ta'rifatını Şâmil Risâledir. (Erkan-i Harbiye-i Bahriye Dairesi Ma'rifetiyle Tercüme Edilmişdir)*. Istanbul: Matbaa-i Bahriye.

Gratien, Chris, Michael Połczyński, and Nir Shafir. 2014. "Digital Frontiers of Ottoman Studies." *Journal of the Ottoman and Turkish Studies Association* 1, nos. 1–2: 37–51.

Gregory, Ian, Donald A. DeBats, and Donald Lafreniere, eds. 2018. *The Routledge Companion to Spatial History*. Abingdon: Routledge.

Gregory, Ian N., and Paul S. Ell. 2007. *Historical GIS Technologies, Methodologies, and Scholarship*. Cambridge: Cambridge University Press.

Hadjikyriacou, Antonis, and Elias Kolovos. 2015. "Rural Economies and Digital Humanities: Prospects and Challenges." In *Ottoman Rural Societies and Economies*, edited by Elias Kolovos, 415–21. Rethymno: Crete University Press.

Huber, R., cartographer. 1899. *Empire Ottoman: Division Administrative* [dressée d'après le Salname 1899]. 62 × 44 cm. 1:150,000 scale. Bibliothèque nationale de France, GED-4181. https://gallica.bnf.fr/ark:/12148/btv1b530068545.

Martí-Henneberg, Jordi. 2011. "Geographical Information Systems and the Study of History." *Journal of Interdisciplinary History* 42 (1): 1–13.

MHATNF (Maritime History Archives of Turkish Naval Forces), Logbook Collection, no. 4118.

OpenOttoman. n.d. "A Developing Transnational Digital Collaborative for Scholarship and Public History Focused on the Ottoman World." Accessed February 26, 2019. https://openottoman.org/.

ORBIS. n.d. "The Stanford Geospatial Network Model of the Roman World." Accessed February 26, 2019. http://orbis.stanford.edu/.

Ottoman Railway Company. n.d. "Ottoman Railway Company (Smyrna to Aidin) of His Imperial Majesty the Sultan. Passenger Time Table on and After 29 August 1875." Levantine Heritage. Accessed February 26, 2019. http://www.levantineheritage.com/rail.htm.

Redhouse, James W. 1890. *A Turkish and English Lexicon*. Constantinople: A. H. Boyaciyan.

Sami, Şemseddin. 1901. *Kamus-i Fransevi: Fransızca'dan Türkçeye lügat kitabı = dictionnaire Français-Turc illustre de 3000 gravures*. Istanbul: Mihran.

Stanev, Kaloyan. 2013. "A Historical GIS Approach to Studying the Evolution of the Railway and Urban Networks: The Balkans, 1870–2001." *Historical Methods* 46 (3): 192–201. https://doi.org/10.1080/01615440.2013.804789.

UrbanOccupationsOETR. n.d. "Ottoman Road and Coastal Network 1900." ESRI. Accessed February 26, 2019. http://arcg.is/2hTVeai.

UrbanOccupationsOETR. n.d. "Urban Occupations. Bringing Ottoman/Turkish History into Digital Humanities." Accessed February 26, 2019. https://urbanoccupations.ku.edu.tr/.

Vogel, C., and B. Domann, cartographers. 1908. "Die Balkan-Halbinsel in 4 Blättern: Türkei, Rumänien, Griechenland, Serbien, Montenegro, Bulgarien." 1:1,500,000 scale. *Stieler's Hand-Atlas*, Nr. 51,52,53, 54. Gotha: Justus Perthes. Accessed February 26, 2019. https://earthworks.stanford.edu/catalog/harvard-g6800-1908-v6.

Weiwei, Zhang, and John R. Logan. 2017. "Historical GIS." Oxford Bibliographies. Accessed February 26, 2019. http://www.oxfordbibliographies.com/view/document/obo-9780199874002/obo-9780199874002-0163.xml.