
Regrowing Egyptian cults: The potential of using modern computational methods in the study of ancient religions

Adam Mertel

mertel.adam@gmail.com

Masaryk University, Czech Republic

Tomáš Glomb

tomas.glomb@gmail.com

Masaryk University, Czech Republic

Zdeněk Stachoň

zstachon@gmail.com

Masaryk University, Czech Republic

Introduction

Historical sources provide us only a fragmentary testimony of historical processes. The survival of specific sources and the information they contain is very often determined by chance. Because of these circumstances, the reconstruction of many historical processes remains problematic or, in some cases, almost impossible. In addition to these problems, some long-term historical processes are very difficult to recognize from the perspective of “event history” due to their gradual nature. The interdisciplinary project [GEHIR](#) (Generative Historiography of Religion) at Masaryk University strives to, within the framework of the historically oriented study of religions, adopt innovative methods used in the study of the dynamics of complex systems, i.e. methods including mathematical and geographical modelling, agent-based simulations or network analysis. Within the study of historical processes these formalized methods are conceptualized as an innovative third way through which the limitations of the traditional inductive analysis of historical sources and deductive application of social-scientific and cognitive theories to social and historical phenomena can be overcome. In this paper we would like to introduce the results from a case study within the GEHIR which focused on uncovering the possible factors influencing the early spread of the cults of Isis and Sarapis in the ancient Mediterranean.

Methods

In this project, traditional methods of historical research such as critical analysis of the archeological and literary sources or categorization of the historical evidence in the form of relational database were supplemented by the following computational methods:

- **Network analysis** is currently used in various areas of historical research, mainly to understand and analyse complex structures, e. g. trading cities in state, social groups. There are a number of historical research papers that have used network analysis; the work of Rivers et al (2012) should be mentioned.
- **Environmental/geographical modelling** is used to reconstruct the potential of locality within an examined phenomenon that is even partially spatially-dependent. It offers a unique opportunity for researchers to understand how spatial conditions are related to other events. The work of Turchin et al (2013) and others could be used as an illustration of such methods.
- **Mathematical statistical analysis** aims to find hidden logical patterns and existing correlations within multiple phenomena that may subsequently be interpreted in the context of the research questions. Various methods and approaches can be used, including clustering, multidimensional analyses, and exploratory data analysis.

Case study: Egyptian cults in the Aegean Sea region

Early in the Ptolemaic era, in the period between ca. 305 - 167 BCE, the Egyptian cults, particularly those of Isis and Sarapis, spread successfully to ports in the ancient Mediterranean. The reasons behind this process are, however, only partially understood. The original and still respected hypotheses in the academic discussion emphasize either the maritime trade (Fraser, 1960) or Ptolemaic political propaganda (Cumont, 1911:78-80) as key factors in the spread of these cults. Both of these claims are supported by historical evidence. Ptolemaic Egypt was one of the main exporters of grain, Isis was a patron goddess of sailors and many cities in the ancient Mediterranean had close diplomatic relations with the Ptolemies. To specify our area of interest, this research is mainly focused on the early spread of the Egyptian cults in the area of the Aegean Sea, particularly the Aegean islands. There are several reasons for this selection:

- the main trading routes between Alexandria and continental Greece passed through that particular area with the Aegean islands as potential places of Egyptian interest.
- the first Ptolemies were politically invested in the Aegean using the islands as strategic locations for military bases and administered the Island league.
- islands are more isolated worlds and thus more suitable for modelling.

In order to clarify these hypotheses, we sequentially applied the described computational methods to the issues of maritime transport network reconstruction, approximation of the urgency of importing goods, evaluation of positional advantages of particular islands, and statistical correlation of different modelled factors.

The first task was to reconstruct the maritime transport network, as this was the backbone of ancient Mediterranean trade. For this purpose, Pascal Arnaud's collection of ancient maritime routes were scanned and geo-referenced in GIS software and all the routes within the area of interest were redrawn. This network was then validated and modified by the [location](#) of ancient ports, the [AWMC map](#) and geometries of islands. Afterwards, we were able to use network analysis to calculate centrality values in order to approximate attractiveness of harbours.

As strategic positioning is not the only determinant of trade intensity, we also decided to estimate the ratio of agricultural potential and the number of inhabitants on each island. This can then be used as an approximation of the urgency of goods import. Food production was measured based on the geographical environmental model we created. Various approaches to population estimates were put forward and discussed. We decided to use historical censuses from the 19th century, as they were taken before the demographic transition in the area and the population values should more or less correlate.

In order to validate the hypothesis emphasizing the Ptolemaic political actions as a key factor of the spread of the cults, we also needed to define the political factors. The Ptolemaic garrisons dispersed in the Aegean Sea are of great importance in our research because many of them were maintained for a long period of time and could thus increase the chance of spreading the cults via Ptolemaic soldiers. The second potential factor influencing the spread of the Egyptian cults is the existence of political leagues. In the context of the Aegean Sea, Ptolemies led the Island league from ca. 287 to 250s BCE. Again, this political

factor is relevant because it is geographically delimited and lasted for a longer period of time.

The final and perhaps the most important dataset includes the locations of the Egyptian temples and artefacts from the above specified spatio-temporal frame (see Figure 1), collected from the RICIS catalogue (Bricault, 2005).

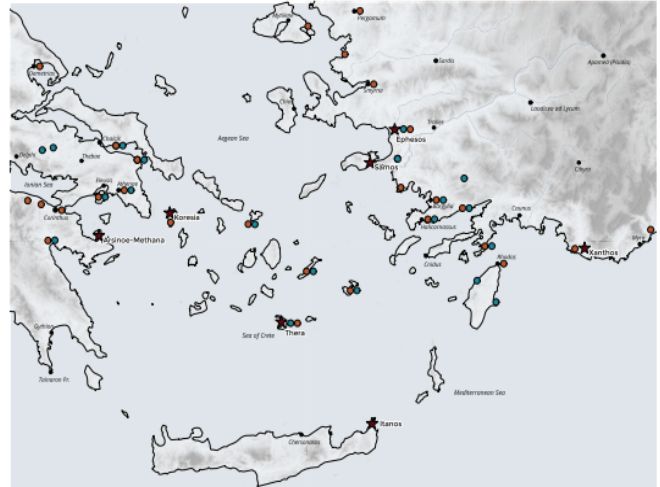


Figure 1: Map of the Aegean Sea region and locations of relevant temples (blue dots) and artefacts (red dots) of Egyptian cults, as well as Ptolemaic military garrison placements (stars).

Geographical analysis was used to calculate distances from each island to the closest army base and temple in order to evaluate spatial dispositions.

The final part of the research is the statistical analysis of data obtained in previous steps. At that point we had a table containing the list of islands with their attributes based on the data (e.g. if an island occupied a strategic position on the network, or if it had a Ptolemaic garrison) and the goal was to find a solid and interpretable mathematical model that would be able to find and explain relations between these values, mainly their dependency on the distance to the closest temple on the network.

Results and Conclusions

The mathematical model we selected using the statistical analysis of covariance uncovered a few patterns within our datasets. The results suggest that there is a strong correlation between the placement of the Ptolemaic garrisons and the dissemination of Egyptian temples and artefacts in the Aegean sea. The interpretation would, in this case, be that the Egyptian military forces potentially played a significant role in the spread of the cults. However, the analysis also showed that in areas far from these military ba-

ses the islands with higher trade attractiveness intensified the presence of the Egyptian cults.

The main task of this paper is to show how we can “regrow” the Egyptian cults in space and time using innovative computational methods from multiple disciplines. This allows us to validate the selected hypotheses from the academic discussion constructed by using traditional historiographical methods. We see great potential for using these approaches in the other case studies of GEHIR, as well as in historiography in general.

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