MODELING THE ANTIQUITIES TRADE IN IRAQ AND SYRIA (MANTIS)

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Modeling the Antiquities Trade in Iraq and Syria (MANTIS) is an interdisciplinary research team based in the Oriental Institute. We use excavation data and art market data to study probable market values of Near Eastern artifacts. The model that we have built should have broad application in the ongoing scholarly effort to measure the scope and value of the global trade in looted antiquities. This report provides an update on our activities since our 2015–2016 *Annual Report*.

Refining the Research Scope

Our interest from the outset was whether it is possible to combine excavation data with market observations to predict market values for an entire archaeological site. To the best of our knowledge we are the first team to achieve the completion of such a model. We tested the model on two sites: Tell Bi'a and Dura Europos. We selected them as our main sites because they offer different archaeological profiles and yet are comparable in the context of contemporary looting patterns. While we initially discussed applying the model to ten sites, we found that variations in the reliability and accessibility of data from the other sites, combined with the time-intensive nature of the work, made the two-site focus more feasible. The refined scope of research allowed us to dig deeper into the market dynamics for our test sites. Our analysis revealed, for example, the relative market demand for Bronze Age, Hellenistic, and Roman materials (fig. 1). A finding like this has practical application for counter-looting initiatives, for example by highlighting categories of objects that are most vulnerable to trafficking and illicit sales.

Report from the Archaeological Research Team

At the time of our last report, the archaeological team was working on data collection from Tell Bi'a and Dura Europos. This work was completed in June 2016. Research assistants Monique Vincent and Teagan Wolter, together with project co-director Oya Topçuoğlu, combed through the work published by Eva Strommenger and her team who worked at the site between 1980 and 1995. These include annual excavation reports which appeared in the *Mitteilungen der Deutschen Orient-Gesellschaft* (*MDOG*) periodicals between 1982–1995, and six special volumes in the *Wissenschaftliche Veröffentlichung der Deutschen Orient-Gesellschaft* (*WVDOG*) series published between 1998 and 2007 and dedicated to graves; finds from the Early Bronze Age levels; written documents; city walls, houses and temples; seals and seal impressions; and the architecture and small finds excavated in Palace A. A total of 2,612 objects, excluding individual pottery fragments which often do not have market value, were entered into the OCHRE database as a result of this work. Material for Dura Europos was collected from the online

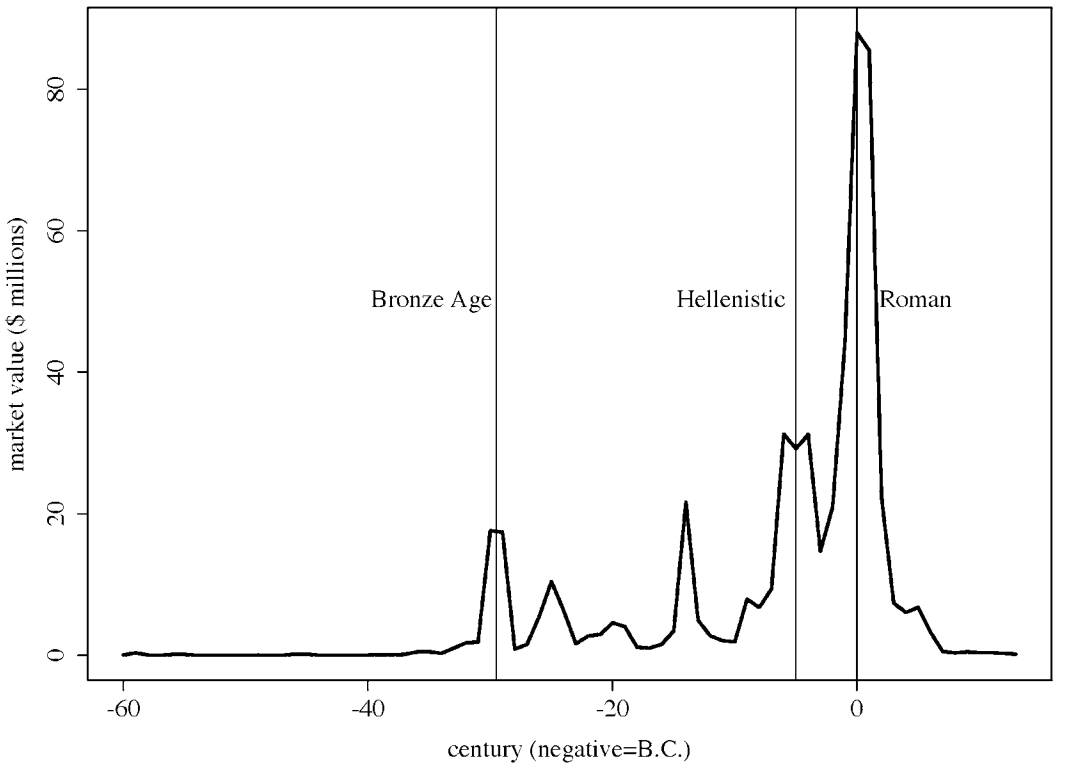

Figure 1. Total market value of objects in market database, by century of origin (2016 US dollars). Collecting trends imply that Bronze Age, Hellenistic, and Roman objects are most highly valued, and Dura Europos forms a relevant test case for the latter two periods (image: Yale University Art Gallery)

records provided by the Yale University Art Gallery based on the work of the Yale University-French Academy team that worked at the site between 1928 and 1937. These records represent 12,398 objects and exclude coins. Coins were excluded from data collection and the resulting market analysis, because they are usually sold by auction houses that specialize in coins and therefore do not overlap with the auction houses that were studied by MANTIS's market data research team.

Archaeological Analysis

At both sites, we analyzed artifacts along lines of five characteristics: period/date, type, size, component materials, and geographic origin (i.e., findspots). This level of analysis supports the statistical work of price imputation. In addition, we studied other kinds of patterns in the data. At Dura Europos, for example, we examined the different types of artifact assemblages that are found at the site. This includes items that are commonly thought of as coming from Hellenistic-Roman archaeological sites such as coins, but also less common items, such as textiles, parchment, and papyri documents (all of which are often omitted from studies of looting since they are not thought to be marketable) (Bradford Wells, Fink, and Gilliam with Henning 1959). These additional finds underscore the importance of looking at assemblages in detail and also considering them as part of the wider archaeological context of Syria. To take

another example, by reconstructing object findspots in specific buildings at Dura Europos, we may be able to generate a clearer picture of what was potentially in the ground prior to illicit digging activity. In previous research, Guiraud showed that intaglios at Dura Europos came primarily from houses, the rampart fill, or blocks with houses and commercial installations. They largely did not come from religious areas of the site or the necropolis (located outside the city walls), although apparently, people did lose several in bathhouses (Guiraud 1992, p. 52, fig. 4). As for artifact assemblages, the detailed work of Baird on the site (2014), for example, has meant that it is possible to partially reconstruct the finds in some of the houses (fig. 2). Some of the finds from House E4 could be reconstructed on the basis of her work (see Baird 2014, pp. 131–37) and connected with finds at the Yale University Art Gallery. Further study of the excavation records of House E4 will hopefully lead to more information about finds from this house, as well as other parts of the site, in the future. This will allow us to build up a more detailed understanding of where certain types of artifacts are found and begin to suggest what types of objects might have come out of different parts of the site when it was looted.

Report from the Economic Research Team

Since the last report, the market data has been expanded, yielding a final database comprising 41,587 unique individual objects sold at thirty-three different firms. Using the standardization technique described in last year's report, the market and archaeological data were made

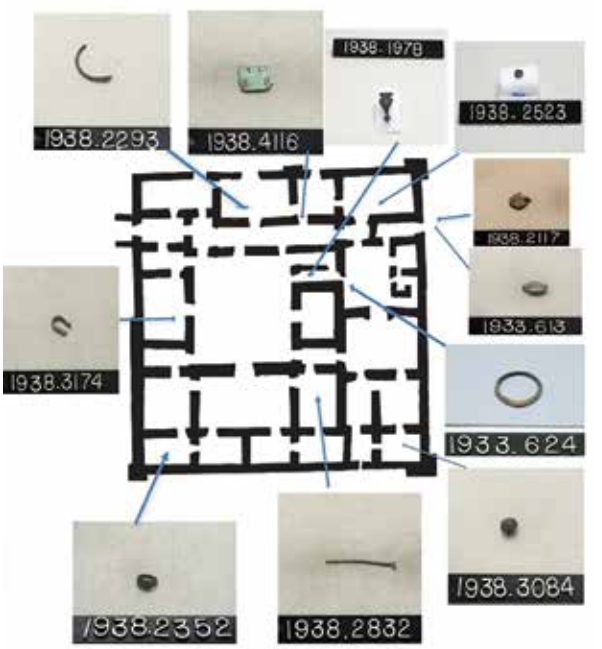

Figure 2. Reconstruction of Dura Europos House E4 with the findspots of some of the objects found in the Yale University-French Academy excavations in 1932–1933 (image: Yale University Art Gallery)
(Findspots based on the work of J. Baird. The Inner Lives of Ancient Houses: An Archaeology of Dura Europos. *Oxford: Oxford University Press (2014): 131–37. Schematic house plan after Dura Europos glass negative h36a: Plan of e4, southern half. Dura Europos Archive. Yale University Art Gallery)*

commensurable by recording the characteristics of each object according to 322 different descriptor variables. When size and/or date were unknown, they were imputed using random forests. This machine learning technique uses the 322 observed variables in thousands of random combinations to determine those which best predict price, and then applies the predictions to out-of-sample data.

The next step accounts for the observation that sale location and context are important predictors of price: objects sold in a large group or at a lower-tier auction house have lower price-per-item (and probably lower unobserved quality) than objects that sell in smaller groups or at top-tier auction houses. Two non-linear regression techniques were used to model hypothetical final sale outcomes of excavated items. The techniques predict various outcomes using bundles of observable characteristics. Random forests were used to predict both the probability of each object selling at each firm, as well as the probability of selling in a group of a given number of other objects. Finally, a Bayesian Additive Regression Tree (BART) analysis determined the expected price and predicted standard deviation for each archaeological item in each firm/group combination.

In the final step, a simulation performed one million hypothetical sales of each archaeological item by randomly drawing a firm/group size based on the probabilities determined above, as well as a random sale price from the predicted price distribution. Aggregating all trials over all objects provided an average total price along with a 95% confidence interval. The estimates are for the recorded archaeological items, but can be adjusted to account for the entire Dura Europos or Tell Bi'a site by accounting for how much of the site was excavated.

Research Output and Future Directions

In addition to the data collection and analysis work, MANTIS team members also spent time introducing the project and disseminating the preliminary results of our analysis in various outlets.

In April, Fiona co-curated (with OI Research Associate Morag Kersel) The Past Sold: Case Studies in the Movement of Archaeological Objects, an exhibit at the University of Chicago's Neubauer Collegium for Culture and Society. The show featured photographs and documents from three research projects: MANTIS, Follow the Pots, and Landscapes of the Dead. In May, Jim presented a paper at the two-day conference "Antiquities as Global Contraband" at the Neubauer Collegium. The paper showcased our model and explained the principle of data matching between excavation and market observations. Also in May, Oya presented at the annual meeting of the American Institute for Conservation of Historic and Artistic Works. Her talk focused on the effects of the Syrian conflict on the cultural heritage of the region, its repercussions on the black-market trade for antiquities and MANTIS's work on quantifying this trade.

We have also been working on publishing our work in peer-reviewed journals. Jim was invited to submit a contribution to the *Journal of Cultural Heritage Special Issue: Cultural Heritage in Times of Armed Conflicts in the Middle East: Much More Than Material Damage?* His article, "Quantifying the Supply Chain for Near Eastern Antiquities in Times of War and Conflict" will be published in 2018. Fiona's paper on artifact valuation and public policy design is in preparation for submission to *Social Studies of Science*. In addition, Fiona is editing a special issue for the *International Journal of Cultural Property*, "New Insights into the Antiquities Market," to be published in 2018. Oya and Tasha are preparing an article for this issue entitled "Small

Finds, Big Values: A Study of Cylinder Seals and Coins from Syria and Iraq on the Antiquities Market," in which they will provide an analysis of Bronze Age cylinder seals and Hellenistic-Roman coins from Syria and Iraq sold by online galleries and auction houses. Tasha's article on textiles and cultural heritage in Syria is in press in an edited volume, *Cultural Heritage Care and Management in Theory and Practice* (ed. C. Salvatore).

Finally, Fiona, Jim, Oya, and Tasha are working on an article entitled "Evaluating the Market Value of Cultural Artifacts from Looted Archaeological Sites" for submission to *Science Advances*, the online open-access offspring of *Science*. The article presents the work conducted by the MANTIS team since the beginning of the project, detailing the data and research methodology, as well as the results of the analysis conducted on the two test cases, Tell Bi'a and Dura Europos.

Website

In June of this year we updated our website, https://oi.uchicago.edu/research/projects/mantis, to reflect our revised research questions, provide more details on our model combining archaeological data with analysis of sales of Near Eastern antiquities on the market, and announce public talks and forthcoming papers by our team members. We would like to thank Knut Boehmer, the IT Support Specialist of the Oriental Institute, for his endless patience and continuous help in improving our web presence.

Future Directions

Three of the four project co-directors are leaving the University of Chicago this summer. Fiona joined the Department of Sociology at the University of Virginia, Oya joined the Middle East and North African Studies Program at Northwestern University, and Jim is with the RAND Corporation in Washington, DC. Tasha remains at the Oriental Institute in her new role as University and Continuing Education Program Coordinator. Although we are no longer working together physically, we continue the intellectual partnership by collaborating on co-authored papers and supporting each other's individual publications. The immediate task is to publish our four-author paper on site-level market estimates. Beyond that, we are working on several topics related to artifact looting and trafficking, always maintaining our commitment to strong empirical work, data transparency, and novel conceptual contributions.

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