MODELING THE ANTIQUITIES TRADE IN IRAQ AND SYRIA (MANTIS)

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Introduction

Founded in January 2016, MANTIS is an interdisciplinary research project consisting of archaeologists from the Oriental Institute and social scientists from the Neubauer Collegium for Culture and Society and the Department of Economics at the University of Chicago. With financial and administrative support from the Oriental Institute, the Department of Art History, and the Antiquities Coalition (Washington, D.C.-based non-profit), MANTIS hired five Research Assistants and two Research Directors in addition to the Principal Investigator, Fiona Rose-Greenland. The broad aim of the project is to combine excavation data and data from the antiquities market to understand more clearly the interconnectedness of archaeological materials and illicit economic activities. MANTIS is structured around an archaeological research team directed by Oya Topçuoğlu and market research team directed by James Marrone.

In the first half of 2016, MANTIS focused on the looting situation in the self-proclaimed Islamic State in Iraq and Syria (ISIS). The goal of this particular research is to create a model of systematic quantitative analysis that can generate a reliable estimate of the scope and value of the antiquities trade to insurgent groups in Iraq and Syria. Concrete steps taken toward this goal in 2016 included (1) designing and loading a database of excavated objects from a representative sample of sites in the region; (2) research papers with concrete methodological questions and demonstrations resulting in three public presentations and a journal submission; (3) engaging with cultural heritage scholars and social scientists outside the University of Chicago to enrich the theoretical basis of the project; and (4) collaborating with the OCHRE team to enhance the technical proficiency of the database.

We began the project with a presentation of our goals and methodology to the American Schools of Oriental Research (ASOR)/Archaeological Institute of America (AIA) Cultural Heritage Collaboration summit in December 2015. Fiona Rose-Greenland traveled to Washington, D.C. to speak about MANTIS as part of the Oriental Institute's delegation to the summit. The event was an opportunity for MANTIS to connect with other scholars and organizations about possible future collaborations. By February we had a project logo and website, thanks to the efforts of Oya Topçuoğlu, Knut Boehmer, Josh Tulisiak, and Erik Lindahl.

The rest of this report focuses on our effort to build an estimate model. In late 2014 and much of 2015, mainstream media reported on ISIS's antiquities trade as a multi-billion dollar enterprise. Subsequent estimates were as little as $4 million. The outcome of these stories was a fuzzy picture of the revenue stream from looted antiquities to ISIS and other insurgent groups. To arrive at a more accurate estimate, the basic idea behind MANTIS's first phase of work was to produce a parameterized model that yields a total estimated value for both the quantity and market value of looted artifacts. Critically, the model also allows sensitivity analysis to be conducted on its various inputs in order to understand how each input (and

the confidence with which each input can itself be estimated) drives the overall result. For example, how many sites are at risk? What types of objects are being looted from a particular region? Who is looting where, and what might they have excavated? We do our best to answer these questions, and account for uncertainties as accurately as possible.

Report from the Archaeological Research Team

The archaeological research team is responsible for collecting data on objects systematically excavated at a representative sample of sites in Syria and Iraq, spanning the Early Bronze Age to the Islamic period, based on published information in excavation reports. The team consists of Oya Topçuoğlu (Research Director, PhD in Near Eastern archaeology), Tasha Vorderstrasse (Research Assistant, PhD in Near Eastern archaeology), Monique Vincent (Research Assistant, PhD in Near Eastern archaeology), and Teagan Wolter (Research Assistant, graduate student in Near Eastern archaeology).

The initial phase of the project was dedicated to the selection of archaeological sites from which to collect object data and the creation of a database where these data would be stored. Due to the extremely large number of known archaeological sites in the ISIS-controlled territories in Syria and Iraq, we selected ten sites as individual case studies, being fully aware of our bias towards large urban settlements. Several factors were influential in the selection of these sites:

1. Based on market data and general preferences of buyers, we decided to cover the period between the Early Bronze Age and the Islamic period and selected sites that were most representative of the individual time periods. Two sites were selected for each major period to reduce possible biases in artifact assemblages and publications.

2. Because our archaeological data regarding artifacts that have been excavated at these sites come from published excavation records, we leaned toward major sites that have a relatively good publication record.

3. Finally, we used satellite imagery and information published by the ASOR Cultural Heritage Initiative to narrow our selection down to sites that showed evidence of extensive looting since the beginning of the conflict in Syria in 2011.

The final selection of sites by period is as follows:

Bronze Age:	Tell Bi'a, Mari
Iron Age:	Nimrud, Khorsabad
Hellenistic/Roman periods:	Dura Europos, Palmyra
Byzantine period:	Qal'at Seman, Resafa
Islamic period:	Raqqa, Qasr al-Hayr al-Sharqi

Many of these sites are occupied in more than one period. However, for the purposes of the project data collection focused primarily on the main period of occupation at the site. Once the selection of sites was complete, we proceeded to compile a comprehensive bibliography of site reports, journal articles, and other relevant publications for each site. This bibliography is stored in a Zotero Group account and is updated regularly by the research assistants.
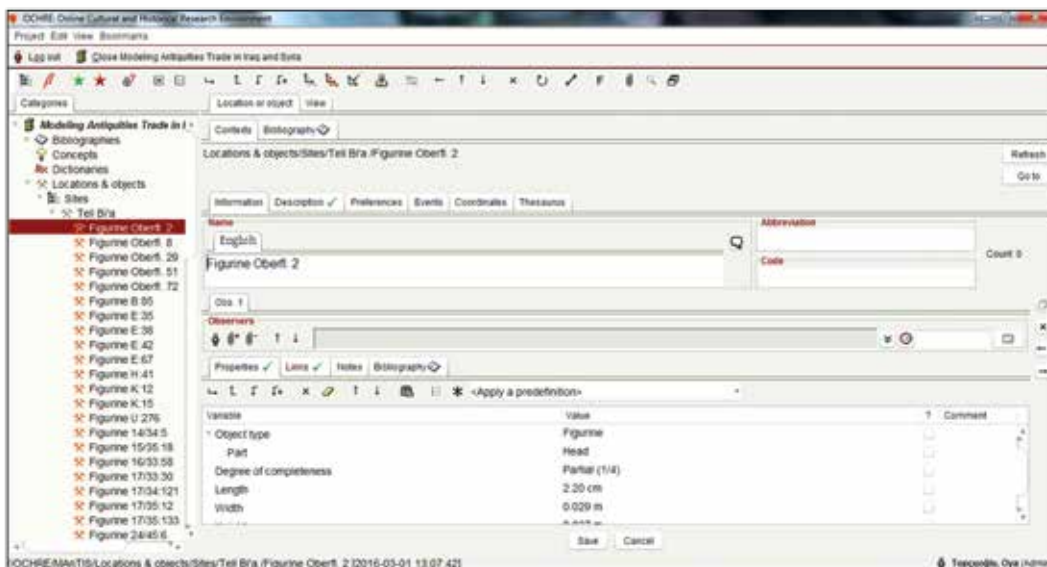
Figure 1. Customized database used by MANTIS

At the same time, we started building the MANTIS database on the OCHRE platform with the technical support of OCHRE Data Services (ODS) specialist Miller Prosser and ODS director Sandra Schloen, whose assistance and expert knowledge have been invaluable for the project. The database was customized to represent the archaeological data used by the project. The information collected by the research assistants from published site reports is stored on this platform and is updated on a regular basis as data-entry continues. The record for each artifact in the database includes findspot, object type and condition, size, material, and other relevant information such as decoration and treatment. Object photos and bibliographic information are also attached to each entry (see fig. 1).

So far we have been working on data collection from Tell Bi'a, Khorsabad, and Dura Europos. All known publications on Khorsabad were consulted by Monique Vincent, who entered 642 excavation objects from the site into the database and completed data-entry as of April 2016. Both Monique and Teagan Wolter are currently working on Tell Bi'a and have completed data-entry from several volumes of the site reports. Tasha Vorderstrasse has been working on entering in material from the site of Dura Europos. As of June 2016, 2,094 individual objects have been entered into OCHRE.

Finally, Monique Vincent, Tasha Vorderstrasse, and Fiona Rose-Greenland assisted the market research team led by James Marrone in manually cleaning up the Dura Europos excavation data gathered from the Yale University Art Gallery. They identified and hand-coded over 3,000 individual objects based on the photographic evidence made available online, which will allow the market research team to analyze the material more consistently. Tasha Vorderstrasse is also working on placing the excavated objects from Dura Europos back into their archaeological contexts with the help of site reports, which will help us understand the density of artifacts and the distribution of artifact types and assemblages across the various parts of the settlement and fill in the blanks in the unexcavated portions of the site.

In the coming months the archaeological research team will continue to focus its efforts on gathering and entering object data from the remaining archaeological sites selected for the project.

Report from the Market Data Research Team

The market data research team is responsible for collecting and cleaning observations of market transactions involving antiquities listed with Middle Eastern provenance. The team consists of James Marrone (Research Director, PhD candidate in Economics), Ziv Dreyfuss (Research Assistant, BA in Economics), and Theodore Watler (Research Assistant, undergraduate major in Art History).

Making auction house records and online antiquities sales observations useful for systematic quantitative analysis involves a labor-intensive process of cleaning the data and making the different data types comparable. Specifically, we need observations of objects on the market and objects with known excavation records. Objects rarely fit both categories at once, and so it is necessary to develop a matching algorithm to impute prices of objects from archaeological records using observed prices of similar objects on the market.

To this end, the economics team compiled a database of 25,000 objects offered for sale at auction houses and dealers. The data consist of sales visible online or in published catalogs, of objects from Europe, the Near East, or North Africa. These objects are commonly sold together in the same auctions or by the same dealers, whereas they are rarely sold with antiquities from other regions — hence these data comprise objects that together form a somewhat isolated market. For each object, the data contain images, descriptions, an appraisal or asking price, and a sales price, if applicable. Descriptions, in particular, record the raw materials, dimensions, time period and culture of origin, type of object, and some additional detail — for instance, if the object is fragmentary or if it has written inscriptions.

To develop and test a matching algorithm between market records, the various data sources need to be commensurable. This is a non-trivial hurdle, as the descriptive language used by market dealers is different from that used by archaeologists. In addition, some dealers provide more detailed descriptions than others. Therefore it was necessary to standardize the language and develop a glossary of terms that can easily and objectively characterize any object, regardless of how it might be described in the data. This glossary comprises part of the empirical method.

For example, Apulian vases are variously characterized by dealers and auction houses. Sometimes they are said to be made of "terra-cotta," other times "pottery," and still other times they have no specific mention of material — in which case the fact of being an Apulian vase implies the physical medium. These ambiguities must be clarified. In addition, archaeologists would not apply the word "terra-cotta" to vases from the Apulian period; hence, everything must be standardized as "pottery."

Many empirical exercises can be performed using the standardized descriptive variables. On a small scale, the market data can provide a quantitative and historical context for recent anecdotal evidence from the black market. We demonstrated this point by mining our data to assess a widely circulated report in April 2016 about a live auction in Raqqa in which two Palmyrene funerary busts supposedly offered for $150,000. Using the MANTIS market database we found twenty-eight similar busts that had been purchased at legal auctions in the period 2003–2016. Only one sold for approximately $90,000, and most were well below that figure. This simple analysis allows for more insightful conclusions about black market behavior than could be generated by the media reports alone. For example, if the reports are indeed true, then the black market may be generating higher prices than the normal market — which has different implications than if the pattern were reversed. Of course, this conclusion is specula-

tive at best; more evidence from auctions such as Raqqa would be necessary to confirm that this is truly a pattern.

On a larger scale, we are using the Syrian site of Dura Europos as our first major case study (see the following section for more information about the site and why we selected it). To evaluate all objects in the Dura Europos dataset, the archaeological data must be matched with the market data. It is important to determine the salient characteristics of each object from the point of view of the market. Strictly speaking, each object is unique; the goal is to determine what common characteristics can predict a price within a small margin of error. In addition, prediction should be done agonistically — rather than generating assumptions about whether or not two objects should be comparable, the data should yield the most predictive groupings. Machine learning techniques are most appropriate for this task, as they can yield rich predictive models with minimal assumptions.

After randomly splitting the market data into a training sample and a testing sample, multiple predictive methods were compared: linear regression; principal components analysis; lasso regression; random forests; Bayesian additive regression trees, and logic regressions. The latter three proved to offer the best fits. The next steps are as follows: the resulting predictive algorithms must be applied to the Dura data. These data will generate an estimated value of the Dura objects were they to sell on the legitimate market. This estimate can be scaled to the entire Dura site by comparing the area covered by archaeological excavations to the total area of the site.

Figure 2. Aerial view of Dura Europos looking south (P. 35256)

Case Study: Dura Europos

We selected Dura Europos (fig. 2) as the first test of our methodology. Dura Europos has a number of advantages for a case study of this nature. First, the site was largely occupied from the foundation of a Hellenistic town at the end of the fourth century BC until the Sasanian sack of the city in the third century AD (for the limited evidence before and after see Baird 2012; Baird 2014, pp. 20, 29). Second, it offers a selection of antiquities that have been proven to have high collecting interest. Third, other scholars and cultural heritage organizations have documented the site's looting history via satellite images and ground surveys, allowing us to leverage their studies to strengthen our analysis.

Finally, due to the natural preservation conditions in this portion of eastern Syria, Dura offers up rare object types (basketry, leatherwork, papyri/parchment, and wall paintings) in addition to more standard artifact categories such as coins, ceramics, and glass (Leriche, Coqueugniot, and du Pontbriand 2011, pp. 15, 17; Brody 2014. pp. 6–7; see exhibition catalogs illustrating the finds in Brody and Hoffman 2011; Chi and Heath 2011). In addition to pagan temples, excavators found a synagogue with wall paintings from the third century AD (Kraeling 1956; Gutman 1992) and a third century AD house church, which also had wall paintings (Kraeling 1967; Peppard 2016), pointing to a diversity of religions at the site, while the different documents and inscriptions found point to a diversity of peoples and languages (Gascou 2011). These advantages also make Dura unrepresentative of archaeological sites in the region that are not in this climate zone, although finds of papyri from the region (Gascou and Feissel 1989) argue that there are other sites in the vicinity that have similarly well-preserved and

Figure 3. Colorized version of Breasted's photograph of first century AD wall painting of the priest Konon sacrificing to the gods (P. 8853/N.3099)

rare objects. Recent work on Roman coins suggests that Dura Europos has certain similarities (and some differences) to other Roman fortified sites along the Euphrates in the third century AD (Butcher 2013, pp. 1, 6–8, 12, 19). These are issues that we start to address in our analysis.

In 1920, James Henry Breasted, director of the Oriental Institute, was called in by the British army to investigate ruins they had uncovered while stationed at the site of Salihiyah (ancient Dura Europos) on the Euphrates to the south of Deir ez-Zor. As he vividly describes, Breasted was only able to visit the site for a day and thus was hampered by a serious time pressure to record what he found, which were a number of well-preserved wall paintings (Breasted 1924). These unique wall paintings (fig. 3) attracted the interest of scholars and the site soon came under excavation by Franz Cumont in 1922–1923, since Breasted was unable to work at the site further. After two seasons, Cumont ceased to work at the site and the joint Yale University and French Academy excavated the site from 1928 to 1937. After a hiatus of almost fifty years, French excavations resumed in the mid-1980s, ceasing with the Syrian civil war in 2011 (Hopkins 1979; Leriche, Coqueugniot, and du Pontbriand 2011, pp. 15, 18; Baird 2014, pp. 4, 6–8; Brody 2014, p. 7).

There have been a variety of publications by the excavators of Dura Europos since it was excavated, from Breasted's *Oriental Forerunners of Byzantine Painting* (1924) to the Yale University-French Academy preliminary and final reports, as well as various studies done by the later French excavators. The material from Dura Europos can be primarily found in the Damascus Museum and the Yale University Art Gallery, along with a few other collections such as the Louvre and the Royal Ontario Museum in Toronto. The Yale University Art Gallery currently has 12,378 objects, primarily with photographs, on their website from the 1928–1937 excavations. In addition, Yale University houses the excavation archive from the Yale-French Academy work and many photographs and other documentation from the excavations are now on Artstor (which also has pictures of objects from the excavations held by the museum and the Beinecke Library). These different datasets, combined with the published reports, constitute an invaluable resource for anyone wishing to do work on the site (Baird 2011a; Brody 2011b; Leriche, Coqueugniot, and du Pontbriand 2011, pp. 17, 20; Baird 2014; Brody 2014, pp. 7–8).

The final phase of our work on Dura will focus on developing and testing methods for imputing numbers and types of objects potentially found in looters' pits, characterizing unobserved data more precisely than would be possible with only the market-data matching algorithm described above. We are collaborating on a number of papers with the intention of submitting them to peer-reviewed journals. We plan to make our data available to other scholars interested in questions related to archaeological materials and political and economic questions. Finally, we are focusing on new funding opportunities that would allow us to extend the project to test the price imputation method on additional sites.

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