

EtanaViz: A Visual User Interface to Archaeological Digital Libraries

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Abstract. Analyzing and hypothesizing are important scientific processes involved in archaeological activity. In this paper, we describe a visual user interface closely coupled with services for archaeological digital libraries, to help archaeologists analyze data and test hypotheses. Our system, EtanaViz, employs a dynamic hyperbolic tree to display hierarchical relationships among excavation records, based on spatial, temporal, and artifact-related taxonomies. Also, EtanaViz provides stacked bar charts to indicate categories. More specifically, we show how EtanaViz can help users analyze data about animal bones excavated from two archaeological sites, Tell Nimrin and Tell al-‘Umayri’. The fauna are associated with cultural phases. Comparisons of animal bones from Tell Nimrin across cultural phases provide insights into changing subsistence strategies during these time periods. Inter-site comparisons also show shifts in animal use as well as long-term adaptations to environmental changes.

1 Introduction

ETANA-DL [2], a growing union archaeological digital library (ArchDL), integrates heterogeneous archaeological data from various information systems. While searching and browsing services provided by ETANA-DL allow users to access primary archaeological data, their help with comprehending specific ArchDL phenomena is limited when vast quantities of data are harvested into ETANA-DL. Fortunately, visual interfaces to ArchDLs enable powerful data analysis and information visualization techniques to help archaeologists test hypotheses and extend the understanding of past material cultures and environments. Data generated from the sites’ interpretation then provides a basis for future work including publication, museum displays, and, in due courses, input into future project planning. Thus, we developed a visual interface, EtanaViz, to support analyzing and hypothesizing for ArchDLs.

2 Insights Sought: Sample Scenario

The initial interface of EtanaViz is shown in Fig. 1. The top left of the screen is a query box. On the top right is a hyperbolic tree showing hierarchical relationships among excavation data based on spatial, temporal, and artifact-related taxonomies. A node name represents a category, and a bubble attached to a node represents a set of

displayed as a hyperbolic tree illustrated in Fig. 2. All excavation bone records are grouped into cultural phases (time periods). They are Middle Bronze, Iron I, Iron II, Persian, Late Hellenistic/Roman, Byzantine, Islamic, and Ottoman-Modern. The records are also classified by archaeological site organization and animal categories. The user wants to know the number of bone records for each period. She left clicks a node labeled “MIDDLE BRONZE” in the hyperbolic tree and selects the “add to compare...” option to view total bones throughout the Middle Bronze Age. This causes a bar to be displayed in a chart below the hyperbolic tree and an entry to be listed on the left. She continues to add more bars to view bones throughout the entire time sequence of Tell Nimrin occupation. When she moves the mouse over a bar, a tool tip shows the number of animal bones for the corresponding culture phrase.

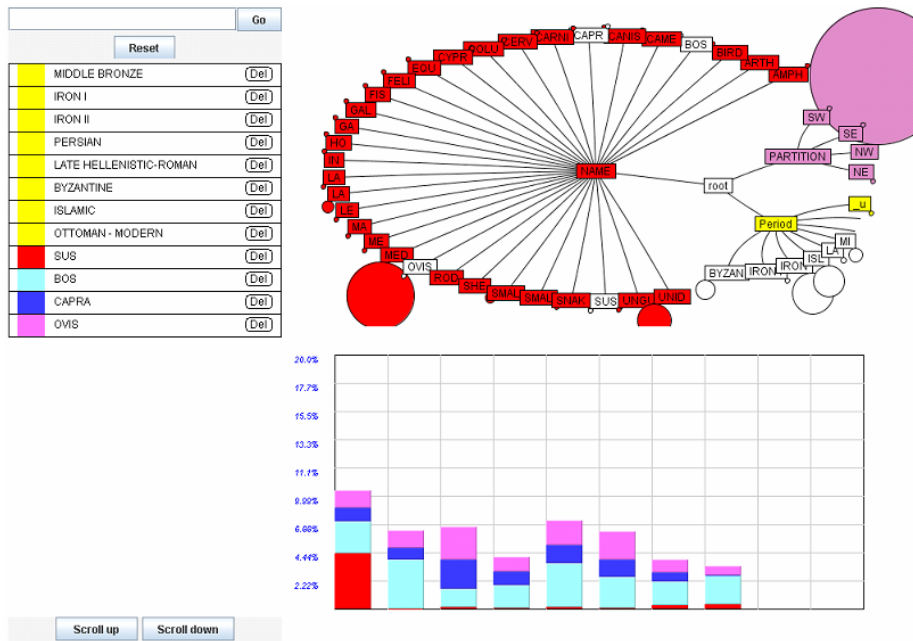


Fig. 3. Percentages of Animal Bones across Nimrin Culture Phrases

She continues navigating the hyperbolic tree. She left clicks a node labeled “SUS” and selects the “add to view distribution...” option. She then left clicks the “BOS”, “CAPRA”, and “OVIS” nodes to show how those animal bones constitute the identified bones in each culture phrase. 8 stacked bars representing percentage of those bones are displayed and 4 entries with different colors are included in the list on the left of the screen (see Fig. 3.).

The color of the entry can be changed to distinguish different categories. It is always synchronized with the color in the stacked bars. The red bars (at the bottom of the stacked bars), representing sus (pig) bones, show that sus constitute 4.71% of the Middle Bronze Age faunal assemblage, but less than 1% at the beginning of the Iron Age. The user is wondering why pig bones drop dramatically over time at Tell Nim-

rin. She may hypothesize that the reasons are probably twofold: 1) the introduction of religious taboos against eating pork, and 2) increased demand for clean water sources as human populations grew at Nimrin [3].

Light blue bars (on top of the red sus bars) represent bos (cattle) bones percentages. Two light blue bars are higher than the others. They are corresponding to the Iron II and Late Hellenistic/Roman culture phrases, respectively. The user, considering that cattle figure most prominently during these periods, may suggest improved grazing conditions in the Jordan Valley during that time.

Pink bars and blue bars (the top two of the stacked bars) represent ovis (sheep) bones and capra (goat) bones, respectively. Pink bars are slightly higher than blue bars. This means that ovis bones slightly outnumber capra bones across culture phrases of Tell Nimrin. This would suggest that past environmental conditions in the Jordan Valley provided enhanced forage for sheep while goats would have been employed as browsers on drier vegetation. Relatively stable percentages of slightly higher sheep populations versus those of goats may indicate that favorable environmental conditions and environmental or cultural desertification did not greatly impact the agrarian way of life at Tell Nimrin on the banks of the Jordan, over time [3].

The user may be interested in animal bones excavated from other sites. By repeating the interaction with EtanaViz describe before, she starts to analyze animal bones excavated from the Umayri site. She also can make inter-site comparisons. Detailed screenshots of exploring EtanaViz are shown in [1].

3 Conclusion

We developed a visual user interface, EtanaViz, closely coupled with services for archaeological digital libraries, to help archaeologists analyze data and test hypotheses. EtanaViz provides overviews of navigation results, which are hierarchically organized and displayed as a hyperbolic tree supporting “focus + context” navigation. It uses stacked bars to indicate categories. The sample scenario depicted in this paper suggests what insights may be obtained when exploring the data with EtanaViz. Future work will include interface improvement and more user studies.

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References

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