HESTIA: the Herodotus Encoded Space-Text-Imaging Archive

Digital Classicist/Institute of Classical Studies
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Approaches to space in Herodotus

A map of Herodotus’ world, according to Wikipedia…
Some underlying principles

- The world in balance:
  - Most famously Hartog’s ‘mirror’ (Scythia vs. Egypt)
  - Greece in the middle...
- Close relation of geography to ideology:
  - Clearly defined continents
  - Each part has its place
- Water as a key organising principle:
  - Crossing rivers = hubris
  - Croesus crosses Halys; Xerxes bridges Hellespont
- = a world based on an East vs. West polarity?
  - Herodotus’ enquiry is based on investigating why Greeks and barbarians came into conflict
  - And organised around the idea of Persian expansion
Challenging the polarity model

• Scholars working on the Mediterranean:
  – a ‘contact zone’ (Purcell and Horden)
  – a series of networks (Malkin et al.)
  – islands both ‘insular’ and ‘connected’ (Constantakopoulou)

• What about Herodotus’ History?
HESTIA Questions

• How does Herodotus’ *History* organise space?
  – a divide between East and West (e.g. the Hellespont)?
  – two axes (e.g. Sardis / Sparta)?
  – a Mediterranean-wide web of connections?
• Does that picture remain consistent over the course of the narrative, or does it change over time?
• Do different groups within the *History* view the world differently and, if so, how?
• How can that world be represented in a visually striking way with the latest ICT available?
• And how might that technology be applied to answering these or other questions?
HESTIA Methodology: the sum of 5

1. TEI markup of Herodotus’ text to ‘tag’ place names, regions, etc
2. Compilation of a database populated by spatial references
3. Database fed into a Gazetteer
4. Production of network maps based on the logical connections between places
5. And all the way through: Textual analysis – the usual close interrogation of a text...
Stage 1: T(ext)E(ncoding)I(nitiative) e.g. Perseus
This XML file does not appear to have any style information associated with it. The document tree is shown below:

```
<TEI2>
  <text lang="en">
    <body>
      <div type="Book" n="1" org="uniform" sample="complete">
        <p>
          This is the display of the inquiry of 
          <name type="pers">Herodotus</name> 
          of
          <name key="tgn,7016142" type="place" reg="Bodrum [27.466,37.5] (inhabited place), Mugla Ii, Ege kiyilari, 
          Turkey, Asia">
            <placeName key="tgn,7016142" authname="tgn,7016142">Halicarnassus</placeName>
          </name>
          , so that things done by man not be forgotten in time, and that great and marvelous deeds, some displayed by the
          <name type="ethic">Hellenes</name>
          , some by the barbarians, not lose their glory, including among others what was the cause of their waging war on 
          each other.
        </p>
      </div>
    </body>
  </text>
</TEI2>
```
• XML = Extensible Markup Language
• If XML = the language, TEI = the ‘grammar’:
  – TEI: the initiative, which represents a consortium of institutions and research projects, maintains and develops a standard for the representation of texts in digital form
  – i.e. it allows different software applications, projects, etc to ‘speak to’ each other
• Specifically, using TEI P5 allows us/Perseus to ‘markup’ the text:
  – to include the ‘tagging’ of spatial information, such as place name, region, geo-feature, etc.
  – and to provide spatial co-ordinates for those places
Stage 2: The Database

• Once the text is marked-up, a database can be put together that houses all spatial data and that can be queried
• The table structure for the database is extremely simple…
  – the **ref table** provides a unique integer for all references to spatial locations within the text
  – the **section table** contains information about the section of Herodotus’ text in which the locations occur
  – and the **location table** identifies each unique location
e.g. Table structure of toponym database

<table>
<thead>
<tr>
<th>Ref Table</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ref_id</td>
<td>integer (FK)</td>
<td>unique id for each reference</td>
</tr>
<tr>
<td>section</td>
<td>integer (FK)</td>
<td>refers to section table</td>
</tr>
<tr>
<td>location</td>
<td>integer (FK)</td>
<td>refers to location table</td>
</tr>
<tr>
<td>toponym</td>
<td>varchar</td>
<td>the actual text of the reference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section Table</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>sec_id</td>
<td>integer (PK)</td>
<td>unique id for each section</td>
</tr>
<tr>
<td>book</td>
<td>varchar</td>
<td>the book it belongs to</td>
</tr>
<tr>
<td>chapter</td>
<td>varchar</td>
<td>the chapter it belongs to</td>
</tr>
<tr>
<td>section_no</td>
<td>varchar</td>
<td>the number of the section with the chapter</td>
</tr>
<tr>
<td>eng_txt</td>
<td>varchar</td>
<td>the complete English text of the section (Unicode)</td>
</tr>
<tr>
<td>grk_txt</td>
<td>varchar</td>
<td>the complete Greek text of the section</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location Table</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>loc_id</td>
<td>integer (PK)</td>
<td>unique id for each location</td>
</tr>
<tr>
<td>source</td>
<td>varchar</td>
<td>the source from which information about location is derived [temp] (hstia/null)</td>
</tr>
<tr>
<td>source_id</td>
<td>varchar</td>
<td>the id assigned to the location by the source</td>
</tr>
<tr>
<td>lat</td>
<td>double</td>
<td>the WGS84 latitude coordinate</td>
</tr>
<tr>
<td>lon</td>
<td>double</td>
<td>the WGS84 longitude coordinate</td>
</tr>
<tr>
<td>normal</td>
<td>varchar</td>
<td>The normalised name of the location (often modern)</td>
</tr>
<tr>
<td>loc_type</td>
<td>varchar</td>
<td>type of location (e.g. River, nation, etc.)</td>
</tr>
<tr>
<td>info</td>
<td>varchar</td>
<td>any further information</td>
</tr>
<tr>
<td>geom</td>
<td>geometry</td>
<td>OBsolete</td>
</tr>
<tr>
<td>geometry</td>
<td>geometry</td>
<td>a geometric point derived from the latitude and longitude. This is needed in order to spatially enable the data.</td>
</tr>
</tbody>
</table>
### Hestia

#### e.g. Herodotus 1.1-15

<table>
<thead>
<tr>
<th>loc_id</th>
<th>source</th>
<th>source_id</th>
<th>lon</th>
<th>lat</th>
<th>normal</th>
<th>ln_type</th>
<th>ln_char</th>
<th>ln_type</th>
<th>ln_char</th>
<th>info</th>
<th>geom</th>
<th>geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>hestia</td>
<td>Halicarnasus</td>
<td>27.466</td>
<td>37.5</td>
<td>Halicarnasus, Inhabited place</td>
<td>Caria</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>hestia</td>
<td>Argos</td>
<td>22.7333</td>
<td>37.6417</td>
<td>Argos, Inhabited place</td>
<td>Peloponnes</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>hestia</td>
<td>Greece</td>
<td>22</td>
<td>39</td>
<td>Greece, Country</td>
<td>Europe</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>hestia</td>
<td>Egypt</td>
<td>30</td>
<td>27</td>
<td>Egypt, Country</td>
<td>Africa</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>hestia</td>
<td>Tyr</td>
<td>35.183</td>
<td>33.266</td>
<td>Tyr, Al-Janub, Inhabited place</td>
<td>Phoenicia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>hestia</td>
<td>Phoenicia</td>
<td>35.183</td>
<td>33.266</td>
<td>Phoenicia, Country</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>hestia</td>
<td>Aea, Nisos</td>
<td>41.683</td>
<td>42.183</td>
<td>Colchis, Pott, Region</td>
<td>Colchis, Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>hestia</td>
<td>Asia</td>
<td>25</td>
<td>35</td>
<td>Asia, Continent</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>hestia</td>
<td>Europe</td>
<td>38</td>
<td>42</td>
<td>Black Sea, Euxine Sea</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>hestia</td>
<td>Troy</td>
<td>25.2833</td>
<td>39.9167</td>
<td>Troy, Inhabited place</td>
<td>Troy</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>hestia</td>
<td>Halyss River</td>
<td>25.2833</td>
<td>39.9167</td>
<td>Troy, Inhabited place</td>
<td>Troy</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>hestia</td>
<td>Syria</td>
<td>38</td>
<td>35</td>
<td>Syria, Country</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>hestia</td>
<td>Paphlagonia</td>
<td>38</td>
<td>42</td>
<td>Black Sea, Euxine Sea</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>hestia</td>
<td>Ionia</td>
<td>38</td>
<td>42</td>
<td>Black Sea, Euxine Sea</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>hestia</td>
<td>Sards</td>
<td>22.516</td>
<td>38.683</td>
<td>Sards, Inhabited place</td>
<td>Lydia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>hestia</td>
<td>Lydia</td>
<td>22.516</td>
<td>38.683</td>
<td>Lydia, Country</td>
<td>Asia</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>hestia</td>
<td>Paros</td>
<td>38</td>
<td>42</td>
<td>Paros, Island</td>
<td>Aegae</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>hestia</td>
<td>Delphi</td>
<td>22.516</td>
<td>38.4917</td>
<td>Delphi, Oracle</td>
<td>Phocis, Central</td>
<td>0101000020E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

844 rows.
Interlude: Progress Report

• Work done
  – All place names have been tagged and fed into a database (courtesy of Perseus and Leif)
  – Co-ordinates for all those places have been located
  – Each place has been assigned one of the following categories: inhabited place, region, geo-feature

• Work to do?
  – Should other categories also be tagged, such as ‘ethnos’?
  – Should information be tagged about the manner in which places are described and represented in the History, such as focalisation or time?
Stage 3: The Gazeteer

• Since TEI uses a language with which computers speak to each other, the database, once fully populated, can be fed into a geo-server such as Google Earth in order to represent in a visually striking way Herodotus’ world

• Or else it can be represented in a series of Google Maps, housed by the project’s dedicated website

• This ‘Herodotus Earth’ has several applications other than simply plotting the places that Herodotus mentions on a digital map
• Using Google Maps
  – It will be possible to represent how Herodotus’ world changes over time (e.g. by book)
  – Furthermore, if focalisation can be tagged, it will be possible to isolate and analyse differing depictions of the world as seen through the eyes of agents within the narrative

• Using Google Earth
  – It will be possible to construct ‘mashups’:
  – i.e. Since locations and regions are linked to entries in the database, when a browser is passed over a particular point it will bring up a dialog box containing all the data that Herodotus has for it…
e.g. screenshot of Herodotus’ world using Google Maps
e.g. screenshot of a personalised mashup on Google Earth
Stage 4: Network maps

- The problem with the above process is that it again risks imposing our own technology/ideology on reading space in Herodotus.

- The second, and most important, use of the database, therefore, will be to investigate the way Herodotus’ text itself organises space, makes connections.

- By quantifying relationships between places, and representing them graphically, it will be possible to create a cumulative map of those spatial relationships.

- In turn, this should provide an unprecedented visual tool to capture the ‘deep’ topological structure of the text.
Stage 5: textual analysis of networks

- **Problems:**
  - scope: since it isn’t possible to cover all examples in the History, which should be analysed?
  - scale: how can we classify relationships in a way that renders them quantifiable?

- **Strategy?**
  - Gain an overview of the presence and makeup of networks and key nodal points using the database before honing in on particular areas
  - i.e. the general analysis should be ‘quick and dirty’, geared towards an overall sense of the network culture: e.g. raw count of occurrences of places in one section of the text

- **Sampling could then take different forms:**
  - By book: e.g. how a particular section of narrative represents networks
  - By location: how one place interacts with the rest of the world
  - By quantitative analysis: ‘hot spots’ (e.g. Athens, Sardis, Delphi) or ‘super-networks’ (e.g. Susa-Sardis, Sparta-Delphi, coastal cities)
e.g. ‘Hot-spots’ – Internet industries (after Krebs)

- 219 nodes (companies), 631 edges (partnerships), 3 colours (kind)
- the nodal size is proportional to its betweenness
• 66 days combined; 13332 nodes, 243447 edges
• The weight of edges is the frequency of co-appearance of given two words linked by the edge.

e.g. ‘Super-networks’ – Reuters: Terror news network
Typology for a Qualitative Analysis of Networks

• Passive, spatially static (topos-topos)
  – inclusion
  – proximity
  – comparison
  – origin

• Passive, spatially fluid: (proxy-topos)
  – [forced] movement terminating in
  – [forced] movement through
  – [forced] movement away from

• Active, spatially fluid (proxy-proxy)
  – intervention
  – conflict
  – alliance/communication
  – foundation/commemoration

• Active, spatially static (topos-proxy)
  – awareness
  – dominance
  – insurgency
5.42.2 Since he would not tolerate being made subject to Cleomenes, Dorieus asked the Spartans for a group of people whom he took away as colonists. He neither inquired of the oracle at Delphi in what land he should establish his settlement, nor did anything else that was customary but set sail in great anger for Libya, with men of Thera to guide him. [3] When he arrived there, he settled by the Cinyps river in the fairest part of Libya, but in the third year he was driven out by the Macae, the Libyans and the Carchedonians and returned to the Peloponnesus.

- Dorieus/Spartans/Sparta
  - Delphi ⇒ communication [negative]*
  - Libya ⇒ movement terminating in
  - Therans/Thera ⇒ alliance
- Dorieus/Spartans/Sparta
  - Libya ⇒ movement terminating in [pronoun ‘there’]
  - Cinyps river ⇒ movement terminating in
    - Libya ⇒ inclusion + comparison
  - Macae, Libyans/Libya, Carchedonians/Carthage ⇒ conflict
- Libya [Dorieus/Spartans]
  - Peloponnessus ⇒ [forced] movement terminating in †
• To be continued…

• For results, as and when they occur, go to: http://www.open.ac.uk/Arts/hestia/

• End of project conference: ‘Imagining space in texts: developing new analytical techniques for classicists and geographers’, 1-3 July 2010