Aqueduct Construction in the Late-Antique East

an agent-based modelling and geoarchaeological approach to building evidence for the Water Supply of Constantinople
About the water supply

- Had no sustainable fresh local water sources
- Hadrian provided aqueduct in the 2nd century
- Population boomed in the 4th century
- Textual sources claimed the city was “dying of thirst”
- Long distance water supply built in the mid 4th century and greatly expanded in the early 5th century
More about the water supply

- Made up of two structural elements: aqueduct bridges and channels
- Channels mostly built in “cut and cover” method
- Only two main structural materials: stone and mortar
- No structural brick
Why it matters

- One of the largest construction projects of the ancient world
- Massively understudied
- Potentially changes narratives on late antique construction
- Recent construction projects threaten its existence

<table>
<thead>
<tr>
<th>Phase</th>
<th>Total Length (km)</th>
<th>Total Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply - 4th Century Line</td>
<td>271</td>
<td>1,039,000</td>
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<tr>
<td>Water Supply - 5th Century Line</td>
<td>183</td>
<td>2,124,000</td>
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</tbody>
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What we plan to do

- Employ agent-based modeling to the construction of the Water Supply of Constantinople
- Combine a wide variety of sources to represent day-to-day activities and major organizational decisions
- Represent everyday life in different levels of agency
What we know

- Recent field survey data
- Geographical and Geological information
- Quantity/type of construction materials
- Reliance on local raw materials
- Manpower requirements (Energetics)
- Length of time of construction (4th century)
What we almost know

• Workforce: non-slave, skilled and unskilled
• Workforce organized by guild/workshop

• Construction divided into “contract sections”
• Work processes
What we don’t know enough about

- Exact location of raw materials
- Pathways of transportation
- Availability of materials and laborers
- Life and career of workforce
- The scheduling of work and appointment of laborers
Further reasons why this matters
(From an interdisciplinary perspective)

- Theoretical: emergence/foundation of cities
- Subject-wise: broader research trajectory of Balkan cities
- Methodological: generative social science
More on what we plan to do

- Use the version zero model as a simple visualization to discuss relevance of elements and issues (constructive validity)
- Gather information from different sources while trying to patch-up parts of the puzzle
- Experimenting with different combinations of scenarios to support generation of hypotheses related to organization of construction
- More specific contributions towards estimating limit values and manpower calculations
More specifically...

- Scenarios around
  - trade guilds (size, location, spread of skills and tacit knowledge)
  - contract sections (average length, logistics)
  - lives of workers (careers, working conditions, mobility)
- Studying possible roads and pathways via GIS to estimate labor for transportation
About the model design

- **Agents**: People (workers, residents of Constantinople) and the state
- **Environment**: Thrace with the city other towns, production areas, the construction site and the terrain
- **Relationships**: Guilds and social relationships, the state as designer/organizer
- **Interaction**: Within guilds, between different construction processes and teams
- **Historicity**: Daily lives of people and flows of material with seasonality and exogenous shocks over 25 years
Summary and Pre-conclusions

- Our research investigates the construction process of one of the biggest projects of antiquity.
- Can change our general understanding of the capabilities of the polities of the period.
- We have an interdisciplinary approach integrating social simulation with archaeology.
- We aim to use ABM as a generative tool as well as simulating interdependent construction processes across a large and difficult terrain.
- We developed the version 0 of our model, the basis for the upcoming project.
Thank you

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