Conceptualizing and implementing an agent-based model of an irrigation system

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Laneri Nicola

Theme 4/Workshop 10

An approach to material religion: Connecting spaces, material culture and practices in the interpretation of human religiosity among small-scale societies in the ancient Near East

The interpretation of the materialization of ancient religious beliefs is a difficult task that needs a reflection on the relationship between ideas and the material traces of ritual activities. To this end, it is important, for the archaeologists interested in such a topic, to establish a coherent process of inference that establishes a contextual association of elements (e.g. the performance of ceremonial activities, the creation of symbolic objects, the construction of ceremonial spaces) that validates the meaning of each component as part of a whole. Thus, archaeologists should try to connect these elements to form a network of meanings that, in ancient times, stimulated the senses of individuals in framing their cognitive perception of the divine. This paper will thus tackle such general theoretical tenets focusing particularly on the importance of the materialization of religious beliefs in constructing the social practices of small-scale societies in rural contexts. In so doing, these topics will be confronted and developed through the analysis and interpretation of the archaeological data obtained from an early second millennium BC architectural complex discovered at the site of Hirbemerdon Tepe, located along the upper Tigris river valley region in southeastern Turkey.

Laneri Nicola, see **Valentini** Stefano

Lang Dengxiao, Maurits W. **Ertsen**

Theme 2

Conceptualizing and implementing an agent-based model of an irrigation system

An irrigation system can be conceptualized as a complex adaptive system composed of environmental and social components (water resources, stakeholders, hydraulic infrastructures, crop productivity) that interact dynamically and continuously with each other both in temporal and spatial. We claim that exploring those interactions between humans, water, crops, and hydraulic infrastructures in detail builds a better understanding of the longer-term operation – and as such development trajectories – of irrigation systems, both old and new. This study introduces an agent-based model (ABM) that explores the possibility of mimicking the operation of an irrigation system under varied scenarios. The model Irrigation-Related Agent-Based Model (IRABM) provides a platform for integrating human and non-human agents (including water managers, farmers, barley, river, canals, and gates), building on actions of and interactions among the model agents. The model's conceptualization and implementation theories are presented in this study. The emphasis of this version of IRABM is exploring the impacts of different water distribution strategies on crop production by setting a variety of scenarios. Given the different irrigation controls-irrigation time control and irrigation water demand control, we applied a cascade of river discharges, a series of irrigation times, varied gate capacities, and

different water allocation strategies to this IRABM. The initial model as developed and shown in this study has been built with barley as the object crop. Results illustrate how barley yields respond to varied irrigation strategies. Yield patterns on individual farmer's level, canal's level, and the whole system's level are discussed. This type of theoretically and empirically informed computer model can be used to develop new insights into simulating interactions between individuals and their environment in an irrigation system, and also demonstrate how and why irrigation and yield patterns can emerge from interactions between agents. We can show how apparently unrelated actions in parts of the model system produce effects on other parts – or not. Our results illustrate how patterns in irrigation systems can emerge from decisions made by (simplified) heterogeneous agents. We built the model with the flexibility of different crop water demands, allowing the modelling framework to be modified to any irrigation system, ancient Mesopotamia was the main setting we had in mind. The current version of IRABM is a baseline model – the first step of studying the performance of irrigation systems, in terms of activities of human and non-human agents. Ultimately, we aim for modelling a short-term to a long-term perspective for southern Mesopotamia.

Langis-Barsetti Dominique

Theme 6

Teaching the Neo-Hittite world one block at a time: Minecraft as an educational tool in archaeological outreach

This paper presents the ongoing work on an educational Minecraft adventure map designed to introduce players of all ages and backgrounds to the Neo-Hittite world. Although limited by the particularities of the Minecraft environment, the map will allow players to explore an archaeologically-informed reconstruction of the Neo-Hittite lands, starting with the city of ancient Kunulua, modern Tell Ta'yinat. Through quests and mini-games involving a series of characters representing important aspects of ancient life – e.g. potters, priests, farmers – players will enter an interactive environment more likely to stimulate and engage them than a traditional educational setting. The immensely popular and yet rather simple mechanics characteristic of Minecraft will allow us to reach a public who may not otherwise seek out this knowledge. This work is part of the wider Computational Research on the Ancient Near East (CRANE) Project and fits within both its educational and broader outreach aims.

Laoutari Rafael

Theme 5/Workshop 15

People, Pottery and Death: Social dynamics in the Prehistoric Bronze Age site of Bellapais-Vounous

PreBA is almost a thousand-year long period in Cypriot prehistory (c.2500-1750BC) during which a new way of life is introduced and negotiated. By the end of it, urbanization is triggered, and the island seems to be fully embedded into the Eastern Mediterranean world. Based on the models expressed for this "transitional" society, communities in the island seem to follow