

Managing and analysing pictorial documentation with GIS and graphs

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Since its creation, archaeology has largely focused on material culture (personal ornaments, pottery, burials, settlements, etc.) with an ongoing special interest shown in the ‘bel objet’. Recovered artefacts and the relations they share (spatial, temporal, typological, etc.) are documented in words, numbers, but above all pictures (drawings, photographs, 3D models, etc.). As a result, archaeology has a long tradition of technical drawing (artefact drawings, x-y ground plans, stratigraphic or elevation cross-sections, etc.). Graph theory and network analysis allow one to overcome the main difficulties arising from non-georeferenced and unscaled drawings by modelling qualitative relationships when the quantitative measurements are poor. For example, for a freehand 20th century historical map of an Urnfield necropolis, the spatial distribution of goods within the burials and the spatial relationship between the burial goods can be model with a spatialized network. Besides these spatialized networks, many other types of graphs are used (implicitly or otherwise) in archaeology. The two main ones are probably the directed acyclic graph (DAG) used to model stratigraphy (i.e, Harris matrices) and the tree-like structures modelling hierarchical relations between categorical variables (i.e, typology). Graph theory is multi-paradigm (e.g, can be used for spatial and temporal modelling), multi-scalar, and graph drawing is a well-known heuristic to communicate results. This type of modelling is currently used for linked open data (LDO, e.g. JSON-LD format).

We believe that pictorial documentation within a spatial database and with graph-based methods is one of the priorities for IT development in archaeology (package creation, shared conceptual models, best practices dissemination, open software, etc.). The recent R package ‘iconr’ employs spatialized networks to model prehistoric graphical content at the scale of the decorated support (pottery, wall, statues-menhirs, etc.) and favours GIS data entry. Currently, the package CRAN version allows the user to tag graphical units (GUs) with attributes and to filter the whole iconographical content when two or more chronological layers of GUs are present (superimposition, diachronic structure of the representations, etc.). The next version of the package will focus on functions to create DAGs and tree-like structures.

After an introduction to the importance of management of pictorial documentation with spatial databases and graph theory (network analysis), we will provide a critical review of DAGs and tree-like R packages available in archaeology. We will then briefly present the ‘iconr’ package and the planned developments in future versions.