Visualization and Spatial Sense: the House of Octavius Quartio in Pompeii

Scholarship on Pompeii's House of Octavius Quartio (II.2.2) has not included a careful synthesis of the social cues offered by its spatial layout and decoration (Tronchin 2006; Spinazzola 1953; Clarke 1991). Since evidence for the house is uneven, studies have selected rooms for analysis but not addressed the residence in its entirety (Platt 2001, Von Stackelberg 2009). Various areas are inconsistently labeled with traditional room names which are tenuously derived from written sources (Allison 2001). In order to trace the relation between art and decoration more comprehensively, this paper draws upon network topology, using the software Gephi, while the software Depthmap is used for Visibility Graph Analysis (VGA). VGA tracks patterns of visual integration throughout the house and predicts likely high traffic areas (Turner 2004). Although some contemporary Roman archaeologists employ VGA (Stöger 2007), traditional Space Syntax Analysis (SSA) - whose metrics have not matched advances in the wider field of network analysis - is still the preferred method for taking a statistical approach to understanding ancient environments (Weilguni 2007). Often, SSA approaches eschew the quality of a room's decoration as a possible reflection of its spatial type (Grahame 2000). Unlike previous scholarship, this paper utilizes contemporary network topology in combination with VGA, reading the distribution of art against the statistics gathered with these methodologies, then reviews these findings in the immersive context of a 3D model of the House of Octavius Quartio, created with the game engine Unity.

The Unity model is founded upon the archaeological and photographic evidence assembled since Spinazzola's 1916 excavation. It is useful not only for reassembling missing or destroyed decoration, but also for exploring the house in real time, integrating immersive

elements such as lighting, audio, water features, and garden decoration. Exploring the model allows us to determine how the network topology and visibility graph reflect patterns of decoration in the house. Three network topology metrics are crucial, each of which is calculated once for movement in one direction (directed movement) and once for movement in any direction (undirected movement). Most notably, eigenvector centrality predicts each node's importance as a locus of information (Newman 2008). Meanwhile, VGA analyzes the house's floor plan to determine which areas are most visually integrated and which are the most conducive to high traffic.

A clear correlation emerges between each room's decorative type and network topology/VGA statistics. In particular, areas of high visual integration and undirected network centrality feature large figural paintings which display narratives of dangerous power relationships and the consequences of sexual transgression. Meanwhile, areas of modest visual integration but high directed network centrality tend toward small figural painting, baroque architectural motifs, Dionysiac or heroic themes, and axial vistas out doorways. This connection between the type of art in a room and its visibility/centrality profile is evident once the house is traversed in Unity. Studies of Pompeian residences based on 2D plans and photographs cannot uncover these patterns as easily, or "experience" them in real time. The multi-dimensional approach of VGA, network topology, and Unity allows for a nuanced view of the likely social interaction in each room, given our understanding of power relations in the Roman world (Clarke 1991). This paper concludes that network analysis and 3D visualization are vital tools for advancing Pompeian studies, which have yet to determine a reliable method for tracing patterns of space and art within the city's domestic residences.

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