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COMPUTER APPLICATIONS AND QUANTITATIVE METHODS IN ARCHAEOLOGY  
GERMAN CHAPTER  
Irmela Herzog, Tim Kerig, Axel Posluschny

## **Layers of Perception**

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Hanna Stöger

## Roman Ostia: Space Syntax and the Domestication of Space

*Abstract:* Ostia, Rome's harbour city, offers one of the few archaeological sites where the full complexity of Roman urban life can be investigated. Despite wide-ranging scholarly interest in Ostia's built environment, the city's spatial organisation has not previously received much attention. This study focuses on one of Ostia's city-blocks, Insula IV ii, analysing the insula's spatial configuration, its inner communication via the courtyards, as well as the insula's integration and interaction with the exterior, the city's street network. By applying Space Syntax's analytical tools (UCL Depthmap software for spatial analysis) this paper highlights some of the spatial and visual patterns possibly experienced by its inhabitants and visitors.

### Introduction

Since Ostia's insulae of the 2<sup>nd</sup> century AD came to light during the large-scale excavations of the late 1930s, they have been attracting widespread research interest, ranging from structural assessments<sup>1</sup> to attempts to claim that ideological continuity between Roman imperial and Italian fascist architecture<sup>2</sup>. Current approaches view particular insulae as short-lived material manifestations of architectural dreams, quickly responding to changing demographic and economic demands<sup>3</sup>, while others emphasise their infra-structural capacity and ability to adapt to dynamic urban processes.<sup>4</sup> Whereas earlier studies on insulae concentrated on typological and cultural-historical explanations<sup>5</sup>, more recent approaches follow advances made in Pompeian studies, partially integrating concepts of today's urban planning and urban geography into archaeological research.<sup>6</sup> With reference to Ostia, these studies incorporate aspects of the insulae's spatial organisation into research deploying a wider social focus relating to status and ownership<sup>7</sup>.

Space Syntax's methods of spatial analysis add a new perspective to the current insula discussion. Space Syntax techniques not only give evidence for the intricate organisation of space within the insula, but also investigate the active role of spatial characteristics, considering the ways in which built spaces themselves function to pattern the social interaction taking place within them<sup>8</sup>. Ostia's insula IV ii serves as a case study, while various other insulae equally warrant a detailed spatial analysis. Still, insula IV ii is of particular interest. Firstly, as yet it has not received much scholarly attention and thus remained largely unpublished<sup>9</sup>. Secondly, a number of spatial features, consisting of interlinked courtyards, render insula IV ii a very appealing dataset for spatial analysis. This paper presents the first results applying selected Space Syntax analysis tools<sup>10</sup>. For better clarity it also includes archaeological information and places the spatial discussion within the context of Ostia's 2<sup>nd</sup> century AD urban development, widely understood as a "boom-town" phenomenon<sup>11</sup>.

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<sup>1</sup> BAUERS 1999, 26.

<sup>2</sup> See KOCKEL 2001, 66–72 on G. Calza's influence on architectural interpretation.

<sup>3</sup> GERING 2002.

<sup>4</sup> SCALIARINI-CORLÀITA 1995; STEUERNAGEL 2001.

<sup>5</sup> PACKER 1971; PASINI 1978.

<sup>6</sup> LAURENCE 1994; FRIDELL ANTER / WEILGUNI 2003.

<sup>7</sup> DELAINE 1999; 2004; GERING 1999.

<sup>8</sup> Cf. ANDERSON 2005.

<sup>9</sup> RIEGER (2004) briefly discusses selected buildings of the insula in relation to the adjacent Campo della Magna Mater.

<sup>10</sup> Depthmap (UCL version) 6.0824r.

<sup>11</sup> HEINZELMANN 2002; 2005.

### *Insula IV ii – Location and Description*

Insula IV ii, is located on the southern *cardo maximus*, one of Ostia's principle streets which leads from the forum towards the gate to Laurentum, which connects to the rural areas southeast of Ostia. Placed at the intersection between the *cardo* and the *Via della Caupona*, (a side road south off the *cardo*), the insula appears well positioned within the urban street network (*Fig. 1*). Towards the East, the triangular area of the Campo della Magna Mater, one of Ostia's main sanctuaries, delimits the insula. Its eastern and southern extent are limited by borders of retaining walls of height of about 1.50–2.00 m, which keep in place a fill layer presumably placed when the terrain was levelled prior to development during the Trajanic period (98–117 AD).

next to the Campo della Magna Mater. Starting from the street front along the *cardo*, the baths continue almost the entire length of the insula. Their building history cannot be fully reconstructed. The existing baths have been installed during the Severan period (end of the 2<sup>nd</sup> century AD), replacing preceding structures of unclear date and function<sup>13</sup>. From the standing remains it can be assumed that all buildings still standing were in use during the end of the second century AD, forming a simultaneously existing spatial relation.

The insula is characterised by diverse land-uses, representing a built environment that potentially accommodated commercial, recreational, sacred, communal and habitation space within its confines. These spaces were not only linked functionally, but also through a structural relationship provided by



Fig. 1. Ostia's built environment within the excavated areas. The circle marks insula IV ii.

The insula covers a total area of 7420.60 m<sup>2</sup> comprising 14 buildings. The visible architectural remains largely date to the second half of the second century AD, with earlier structures (Trajanic period) still extant in the southern part along the retaining wall. In the northern part of the insula, along the *cardo*, the *Casggiato dell'Ercole* (2<sup>nd</sup> half of the second century AD), a multi-storey apartment block with commercial space at ground floor level replaced the earlier, possibly Late Republican/Early Augustan buildings<sup>12</sup>. The bath-complex of the so-called *Terme del Faro* lies along the eastern boundary wall

spatial interdependence within a configuration of spaces (*Fig. 2*). A number of the insula's spatial characteristics are readily apparent. Commercial space was predominantly located along the street fronts, maximising the potential for accidental visitors at the building's interface with public space. Industrial space, on the other hand seemed to reach deeper into the insula, within the narrow end of the plot along the street front. The southernmost corner of the insula, the area least accessible, was dedicated to a *mithraeum*, a cult room serving a limited number of members devoted to Mithras. Several buildings

<sup>12</sup> CALZA 1953, 233–238; see RIEGER 2004, 124–128 and RICCIARDI / SCRINARI 1996, 45, Fig. 51.

<sup>13</sup> PAVOLINI 2006, 206–207; RIEGER 2004, 125.

provided dwelling units at ground floor level, while the majority of habitation space was located on the upstairs floors. Five staircases are linked directly to the public domain of the street-space; they offer access to the upstairs areas independent of the inner space of the insula. Five additional staircases are present in buildings inside the insula, linking those upstairs areas closer to the insula's internal communication (Fig. 2). The insula's communication with Ostia's public space, the street network, appears similar to today's gated communities, defined as a residential social system that closes itself off from other areas through some social or physical mechanism<sup>14</sup>. Every individual entrance to the street could be closed off; travertine thresholds are still present in situ. In addition, the portico along the *cardo maximus* could be barred off, adding a further screen building between the insula and the public domain. The insula could close itself off from the street network, and could still keep internal movement flow.

### *Spatial Assessment and Space Syntax*

Descriptive qualitative methods of analysis often seem beneficial, even more so when spatial characteristics give the impression of being evident and obvious. However, description sometimes substitutes for understanding the spatial laws of interaction and visibility and fails to comprehend generative spaces for social activities<sup>15</sup>. By exploring different ways of formal spatial assessment, a better understanding of the insula's spatial organisation and its social activities can be achieved. The emphasis needs to be on the term 'exploring'. Hillier and Hanson state that it is impossible to establish in advance which spatial dimensions are likely to be the most relevant<sup>16</sup>, thus it becomes the researcher's task to discover which representation and which measure captures the logic of a particular system<sup>17</sup>.

#### **Physical Form and Size of Space**

To begin with, the most straightforward approach to space is the physical size and the form of spaces.

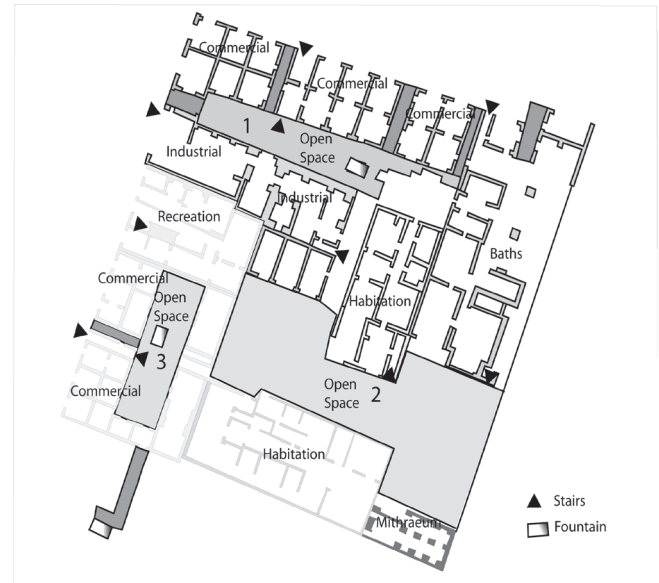


Fig. 2. Diversity of land-uses and functional spaces within insula IV ii.

This is already quite informative. Plotting out the insula's covered and open spaces leads to a ration of 4:1, with 25% of the total area left open (Fig. 2). This accounts for a larger area than that which was dedicated to commercial space, which covers about 20%. At the same time the insula dedicates some 20% to recreational space<sup>18</sup>. Habitation space is difficult to assess since it was mostly located on upper floors no longer extant. Nevertheless from the generous distribution of open spaces and the diversity of land-use some assumptions relating to the quality of the "lifeworld" within the insula can be made. Urban theory postulates that next to a lively mix of land-use and building types, particular qualities of the physical city are also needed to provide for a good neighbourhood.<sup>19</sup> These physical qualities include doors directly entering the streets, small walkable blocks and the opportunity for pedestrians to turn corners frequently; all of these features are present within insula IV ii.

#### **Space Syntax Analysis Tools**

For economy of purpose only the basic principles of Space Syntax will be briefly introduced:

<sup>14</sup> see BERT LOTT 2004, 18–19 on neighbourhoods in modern thought.

<sup>15</sup> CLARK 2007, 85.

<sup>16</sup> HILLIER / HANSON 1984.

<sup>17</sup> Cf. THALER 2005.

<sup>18</sup> Total area of insula IV, ii 7240.60 m<sup>2</sup>, the open space covers 1851 m<sup>2</sup>.

<sup>19</sup> Cf. JACOBS 1961.



Fig. 3. (left) Axial connectivity graph, ranking of integration is indicated by thickness of lines; (right) Visual axial line integration, visual lines converge in passages and courtyards.

general trends and problems in the archaeological application of Space Syntax methodology have been discussed elsewhere<sup>20</sup>. Space Syntax is built on two formal ideas, which try to reflect both the objectivity of space and our intuitive engagement with it. First, space is an intrinsic aspect of all activities that human beings do. Secondly, human space is not about the properties of individual space, but about the interrelations between the many spaces that make up the spatial layout of a building or a city, the configuration of space<sup>21</sup>. Thus all human activities have a necessary spatial geometry: movement is linear, interaction requires a convex space in which all points can see all others, and from any point in space we see a variably shaped visual field, called *isovist*<sup>22</sup>.

A promising starting point for most spatial analysis is access analysis, which allows quantitative assessment of integration and segregation within a closed spatial system. Access analysis is calculated by means of the topological distances between a given space and all other spaces in the system, thus it can indicate how central a given space is within the total movement flow within the insula. A strictly quantitative assessment would require a calculation of numerical indicators for all spaces. A qualitative description of the so-called *j-graph* (justified graph) already allows a deeper understanding of the insula's spatial organisation. With regard to insula IV ii, it is immediately

noticeable that the primary areas of access were provided by the long entrance corridors leading into the insula, while all commercial spaces along the street fronts were directly linked to the public carrier space. In all, 39 spaces connect to the outside space, making the insula highly permeable towards the city's street network. In contrast, none of the spaces located along the retaining walls are linked to the outside. Inside the insula, the courtyards come into action and act as major integrators and distributors mixing movement into and within the insula. The first courtyard controls 17 spaces and is located behind the large multi-story apartment block (Cassegiato dell'Ercole) with ground-floor tabernae (shops and pubs). The courtyard is between 1 and 3 topological steps (depth-steps) away from the outside and only 1 depth-step from the second courtyard located deeper inside the insula. The second courtyard controls 11 spaces and offers the largest open space. It is the only courtyard directly connected to all other courts via passage corridors. The third courtyard is located within a commercial building along the Via della Caupona and controls fourteen spaces. The presence of three courtyards could potentially engender a sense of fragmentation within the insula, however this seems balanced by the fact that the largest courtyard acted as a centre for the entire layout. This becomes clearly visible through Depthmap analysis and the visibility graphs produced by Depthmap.

<sup>20</sup> THALER 2005, 324-326.

<sup>21</sup> HILLIER / VAUGHAN 2007.

<sup>22</sup> HILLIER / VAUGHAN 2007; cf. TURNER ET AL. 2001.

### Depthmap for Spatial Analysis

Depthmap software for spatial analysis offers user-friendly Space Syntax tools compatible with maps created in MapInfo or AutoCAD. Out of a larger number of analysis tools, axial line analysis and visibility analysis have been chosen to closer investigate insula IV ii. The graphs produced are based on the longest visual lines and their visual integration. To some extent they are visual aids to better understand the spatial dynamics. Very often the structural properties of space are complemented by visual properties<sup>23</sup>. The graph shows those spaces which are visually most integrated or segregated, through colour coding reaching from red to blue. The black and white rendering shows the darker areas as those visually integrated through to the lightest for the least integration (Fig. 3, Fig. 4).

Depthmap line analysis, calculated for axial connectivity based on the longest visual lines, identified the visual line reaching from the portico to the second courtyard as the most integrated line, followed by the visual line along the street-front of the portico. The line ranking third runs along the first courtyard. Clearly the courtyards are converging points for visual lines from all directions, making the courtyards the prime spaces for social encounter (Fig. 4). Interestingly enough, the fountains located within the courtyard were placed in a way so as not to obstruct long visual lines.



Fig. 4. Point map connectivity of visual lines.

### Conclusion

The spatial case study of Ostia's insula IV ii has demonstrated that syntactical and visual tools of spatial analysis can add an interesting dimension to the archaeological assessment of a past built environment. Spatial aspects can be detected which would otherwise not be noted by observation only. The real advantage of Space Syntax lies in the fact that the method forces the researcher to understand a building or a group of buildings as a configuration of space. With regard to the insula and its quality as lived space, spatial tools could make a valuable contribution to show that within the insula space was designed to promote encounters, and to promote integration over segregation, which ultimately makes for a better and safer neighbourhood, not only in 2<sup>nd</sup> century Ostia.

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<sup>23</sup> HILLIER / VAUGHAN 2007, cf. ANDERSON 2005, 152–153.

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