The annexe of the 'Temple of Venus' at Baiae: an exercise in Roman geometrical planning

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1. Introduction

Traditional architecture of many cultures relies to some extent on geometry, and in this respect that of the Roman period is no exception. Ornament may model the visual effect, but Roman buildings ultimately conform to a set of geometrical forms such as rectangles, polygons and circles (or parts thereof). However, this is not to say that design was always rigorously geometrical, as understood in the sense used by Vitruvius, namely based on the successive use of compasses and ruler.[1] Indeed, it is clear that simple arithmetical computation was often the main determinant of the size and shape of surfaces, spaces and architectural elements. Most classical buildings are likely to have been designed using a mixture of arithmetic and geometry, with the architect switching from one to another according to the merits of each in particular circumstances.

To illustrate this point, it is sufficient to cite the use of both arithmetic and geometry in architectural drawings dating to the 3rd c. B.C. which survive at the Temple of Apollo at Didyma. In the detail showing the junction between the column base and shaft, arithmetic was first used to fix the limits of the main elements and the centres for locating compass points; a series of geometrical operations then established the profile of the torus as a part-oval, and that of the shaft as a part-ellipse.[2]

Vitruvius intermingles arithmetic and geometry on many occasions. In his design for the Latin theatre, for example, the plan is developed by manipulating compasses and straight edge, whereas the elevation of the *scaenae frons* conforms to arithmetical proportions.[3] It has been argued that many of the arithmetical ratios that appear in Vitruvius' treatise are really approximations to geometrical ones,[4] but this should not be regarded as the norm. Vitruvius' natural propensity towards arithmetic is evident in the first chapter of Book 3, where he expounds his understanding of the rôle of mathematics in architectural design. All things being equal, Vitruvius reserved geometry for solving only relatively complex or special problems.[5] We should also remember that other ancient texts, such as the design specification for the Arsenal at Piraeus or Pliny's account of the legendary tomb of Lars Porsena, are characterised by "round" dimensions which tend to relate to each other arithmetically.[6]

Such is their enthusiasm for geometry that some scholars overstate the case for it. The poor fortune of attempts to impose concepts like Dynamic Symmetry and the Golden Section on the Parthenon should warn us of the dangers.[7] In many instances buildings were not constructed with the precision that it is reasonable to associate with such sophisticated concepts. A case in point much later is the Umayyad Dome of the Rock in Jerusalem. D. Chen has claimed that the ratio of the diameter of the circle circumscribing the building to that of the inner diameter of the drum of its cupola was defined by the square of the golden number, $\Phi^2 = 2.618$.[8] The application of squares of the golden number assumes that the architect of the Dome of the Rock possessed a

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1 Vitr. 1.2.2.
2 Haselberger 1980; 1985, 119-21.
3 Vitr. 5.6.1-6.
4 Frey 1990; Gros 1976.
5 Vitr. 1.1.4.
6 Bundgaard 1957, 117-32; Jeppesen 1958, 69-101; Pliny, *NH* 36.19; cf. Wilson Jones 1989b, 106-7.
7 Berger 1984, passim.
8 Chen 1980; 1985.