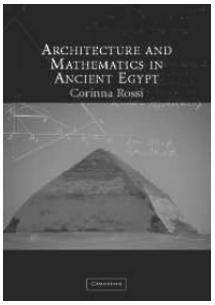


Book Review

# Corinna Rossi

## *Architecture and Mathematics in Ancient Egypt*

Cambridge: Cambridge University Press, 2004

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A book bearing such a title surely will arouse the curiosity of the readers of the *Nexus Network Journal*, especially those engaged in the study of ancient architecture. So far, the scientific study of the reciprocal interactions between mathematics and architecture has produced a vast amount of articles and papers, but there are not yet many books in which every chapter is dedicated only and entirely to this topic, especially as far as pre-classic antiquity is concerned.

Architect and Egyptologist Corinna Rossi presents the results of the research that she carried out while preparing her Ph.D. at Cambridge University under the guidance of Prof. Barry J. Kemp. Her main purpose is to understand how Egyptian architects used mathematical concepts in the process of designing and building architectural monuments. The research methodology that she defined for the achievement of her project consists in approaching ancient Egyptian architecture from two different standpoints, and in combining the knowledge of architectural historians, who mainly focus on building remains, with the knowledge of Egyptologists, who mostly study textual and figurative (and other) remains. The book is therefore divided in three parts. The first part is an overview of the historical theories suggested (until very recently) to explain the proportions of ancient Egyptian architecture. Part two is dedicated to the analysis of all the surviving archaeological evidence of the planning and building processes in ancient Egypt. Part three is the attempt to reconcile the architectural and archaeological approaches to the study of the relationship between architecture and mathematics.

In her attempt at highlighting interactions between Egyptian science and architecture, Corinna Rossi's most valuable effort lies in the definition of a strict methodology – as objective as possible – based on comparative analysis, capable of producing reliable scientific conclusions. The first "mathematical" interpretations of Egyptian architecture began in France in the nineteenth century, and were prompted by the illustrations published in the *Description de l'Egypte* authored by the scientific escort of Napoleon during his oriental campaign. In part one of her book, Corinna Rossi reviews various interpretations – among which the ones by Viollet-le-Duc (1863), Choisy (1899) and Badawy (1965) – showing how they all tend to subjective conclusions, as they are based on some anachronistic concepts. In the preface Rossi writes:

> These theories do not necessarily provide any useful information about the ancient culture to which they are supposed to refer, but on the other hand they may play an


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important role in the study of the culture and the historical period that produced them – that is, Europe in the last two centuries.

In fact, the best research methodology for analysing historical design principles from a geometrical/arithmetical standpoint consists in the comparison between architecture and the contemporary mathematical knowledge. The manipulation of proportional systems and geometric patterns has to be rigorously coherent with the historical scientific context. Although this concept might seem obvious, it is paradoxically rather recent. "Thinking of it, this constraint should have imposed itself long ago" says Pierre Gros, French scholar of Roman architecture [1995, 21]. But it did not. This attitude started to spread among scholars only in the last few decades, in parallel to a greater accuracy in survey operations and rigour in digital representation.

In speaking of Egyptian mathematics, many notions have to be redefined. Corinna Rossi's outline of the mathematical knowledge in ancient Egypt is drawn from the many comments written by historians of mathematics on the four main extant original documents: the "Rhind" and "Moscow" mathematical papyri, the Kahun Papyri, and the "Egyptian Mathematical Leather Roll". Following her bibliographic sources, Rossi asserts that the "Egyptian triangle" – right-angled, with sides of 3 and 4 and hypotenuse of 5 – was given its name by the Greeks, and that no written Egyptian document really proves that it had a special function or meaning in early Egyptian culture. Viollet-le-Duc, in his *Entretiens sur l'Architecture* [1863], calls "Egyptian" the isosceles triangle with base 8 and height 5. According to him, this particular triangle comes from the diagonal vertical section of a pyramid having a height of 5 and whose vertical cross-section is an equilateral triangle. Those – very – approximate ratios suggested to some nineteenth- and twentieth-century scholars that the Egyptians were already aware of the Golden Section and the Fibonacci arithmetical series, a hypothesis that Rossi firmly rebuts.

Every architect engaged in the search for hidden geometrical patterns in historical architecture sooner or later bumps into the realization that some of the geometrical figures that appear while analyzing the survey drawings may be mere consequences of other primary layouts. Reconstructing the design process adopted by the original designer consists in recognizing the difference between intention and coincidence, far from any cultural influence tending to lead towards some specific "preferred" geometrical patterns.

The second part of the book focuses on Egyptian architectural documents. Corinna Rossi does not intend to draw a picture of the history of Egyptian architecture but she analyses the archaeological remains of documents related to design and construction. She lists twenty architectural sketches and drawings, eight full-size geometrical sketches, and five architectural models that have survived and are kept in various museums. The overall quantity of these documents may seem rather abundant compared with what comes from the Greek and Roman cultures; however, the oldest of these remains are dated from the third dynasty (2686-2600 B.C.) and the more recent are from the Roman Period (30 B.C.-395 A.D.), which means that they spread over a period of time which covers nearly 3000 years. Therefore, what appears at first sight to be a fair amount of documentation is, in fact, a very limited quantity of material compared to the length of duration of the civilization about which it is supposed to give us information. And therein lies the first difficulty of interpretation. Since it lasted for so many centuries, Egyptian civilization cannot be considered as a whole, unified cultural period; how, therefore, are scholars to take into consideration evolution and progresses in scientific knowledge while analyzing remains

from different ages? The most productive age of extant architectural documents is the period known as the "New Kingdom", corresponding to the eighteenth, nineteenth, and twentieth dynasties (1550-1069 B.C.). Thirteen out of the twenty architectural sketches and drawings listed by the author come from that period. In fact, the most interesting chapters of the book are the ones related to the study of the Royal Tombs, in the Valley of the Kings, in Thebe (nineteenth and twentieth dynasties). An additional nineteen documents on construction processes, all related to these tombs, makes possible direct comparison between the written (or drawn) evidence and the actual monumental remains. Bearing in mind that the Rhind Papyrus is dated from sometime around 1650 B.C., we have here a situation where mathematical and architectural documents, and buildings are all roughly contemporary, a particularity which the author does not really underline, and from which no specific conclusion is drawn.

Corinna Rossi chose to include in her overview of the Egyptian architectural documents the "building texts" of the two Ptolemaic temples of Edfu and Dendera, the first of which was built 237-142 B.C., the second 54-20 B.C. She says,

> Even if the architecture built in Egypt in the last three centuries B.C. and then under the Romans is strictly related to the ancient tradition of the country, it cannot be excluded that foreign influences combined with the old traditions [Rossi 2004: 173].

In fact, at the time when the construction of Edfu began, the "Golden Age" of Greek geometry was reaching its acme, and by the time the Dendera temple was completed, Archimedes had been dead for two centuries and Vitruvius was writing his treatise on architecture. Therefore, relating these two temples mostly to the ancestral Egyptian mathematical knowledge and to the ancient tradition of the country seems quite inappropriate. And surely it would be interesting to envision the process of influence between Egypt and Western culture in the opposite direction. Egypt gave and transmitted much knowledge to occidental countries before receiving back foreign influences. Since many of the early great Greek geometers studied in Alexandria, from Thales (600 B.C.) to Euclid (300 B.C.), the study of Egyptian Ptolemaic architecture could probably provide many clues about progress in Egyptian mathematical knowledge and about early Greek geometry, and thus about the transition from Egyptian to Greek relationships between mathematics and architecture.

In the final part of the book, the author applies her method of analysis to the study of the most fascinating architectural typology of ancient Egypt: pyramids. So much has been said about pyramids that it seems impossible to say more, but in fact, after discarding all the superficial, fantastic and esoteric writings, very few real scientific works are left. Roger Herz-Fischler [2000], for instance, has dedicated a full book to all the theories suggested so far by the Great Pyramid of Khufu alone. Rossi's conclusion is that "they are representative of the modern culture which generated them, rather than of the ancient culture to which they refer" [2004: 201].

Corinna Rossi's personal contribution to the study of pyramids is to try to unveil some typological geometric rules, taking into account an historical evolution of the shape throughout the centuries. It is indeed a risky proposal. However, the result is rather convincing, especially because the conclusions are discussed objectively, pointing out the limits of such an inquiry, and also because the author does not try to prove more than what her documentation allows her to do. The author lists about a hundred monuments coming

from the very first so-called "bent pyramid" built by Snefru, up to the end of the thirteenth dynasty. However, only sixty-eight of the pyramids listed are completed with measures regarding both the side of the base and the angle of the slope. Corinna Rossi did not measure all the pyramids herself, but collected numbers from various data-bases. The origin of the data is mentioned for every monument, together with the degree of reliability of each survey.

From her collection of measurements, Rossi establishes fourteen different numerical ratios between the base and the height of the pyramid, the ratio which determines the "*seked*" of the pyramid, that is, the slope of its faces. Some of these numerical ratios are more recurrent than others. They are the ones that define the most regular geometrical figures: the equilateral triangle of the cross vertical section, or of the pyramid face itself. But other patterns are discussed that highlight Egyptian skills in combining geometry and arithmetic. Every scholar in Egyptian architecture can find here an interesting and innovative presentation of already available information that had never been assembled in such a way previously. Some famous Egyptologists produced extremely precise information on single monuments, or on single periods, but the value of Corinna Rossi's work is to draw a full overview of the pyramid typology. Comparative analysis is a powerful tool of inquiry. Mark Wilson Jones has written:

> Exceptions and compromises are only to be expected of any grouping of the products of human creativity, and if half to two-thirds can be seen to conform to a pattern, that is quite sufficient to demonstrate that a certain procedure existed and was reasonably if not universally popular [Wilson Jones 2006].

Not one single photograph, even in black and white, illustrates Corinna Rossi's book: only drawings, schemes and sketches. No concession was made to seduce a non-academic readership! However, the architect reader, professionally trained to examine and criticize his peers' drawings, cannot help but notice that many illustrations are labelled "drawn from XXX", indicating that they are not first-hand but second-hand drawings. Copies from copies never produce scrupulous representations. Some photographs or reproductions (even at the cost of paying some copyright fees!) would have helped to understand the level of interpretation of the original transcriptions, and would have granted the book the touch of *pathos* that it lacks.

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## *About The Reviewer*


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