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# The Imitation Phenomenon of Royal Architecture by the Upper Classes During the Thinite Age

Víctor GARDÓN-RAMOS

The most important evolution in the royal architecture of Ancient Egypt was probably the emergence of pyramidal architecture. This revolutionary new concept, started with Netjerkhet's step pyramid, does not have a clear architectural explanation in the Egyptological context. Most scholars argue that the emerging solar cult was the only clue to this transformation. The present work shows that pyramidal architecture was the result of mixing the clear importance that the solar cult was growing in this historical context and the necessity of the pharaohs to stop the imitation phenomenon that their buildings were suffering by the upper classes during the Early Dynastic Period.

*El fenómeno de imitación de la arquitectura regia por la arquitectura privada durante la Época Tinita*
La aparición de la arquitectura piramidal fue sin duda la evolución más importante en las construcciones regias del antiguo Egipto. Este revolucionario concepto arquitectónico, iniciado por Netjerkhet en su pirámide escalonada, no tiene una clara explicación desde el punto de vista de su diseño arquitectónico. La mayoría de académicos sostienen que el creciente culto solar que arraigaba durante la época Tinita fue el único aliento para su aparición. El presente trabajo pretende exponer que la aparición de este tipo de arquitectura fue una combinación entre el evidente auge del culto solar durante esta época y la necesidad de suprimir el fenómeno de imitación que estaban sufriendo las construcciones regias por parte de las clases altas de la época.

**Keywords**: Cult, duality, solarization.

**Palabras clave**: Culto, dualidad, solarización.

Beyond the aesthetic development in royal architecture, many scholars have attempted to find trends and patterns in the architectural design of royal buildings in ancient Egypt. One of these studies, published in 2021, is the only one which proposes a geometrical pattern (GPAD: Geometrial Pattern of the Architectural Design) that seems to be applied systematically throughout pharaonic Egyptian history, in order to define the main proportions of its royal architecture.[1]

This geometrical pattern was probably defined during the very first years of the Early Dynastic Period, and possibly even before, and its

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1 Gardón-Ramos 2021a: 1–43.

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aim was probably to symbolically link the physical world and the celestial one in the very geometry of the proportions of royal architecture,[2] from the tombs and enclosures at Umm el-Qa'ab and Abydos through the pyramid temples of the Old Kingdom[3] and, later, mortuary temples of the Middle Kingdom.[4] This link was possibly represented with two rectangles, R.α and R.ß, which appear from the intersection and the union of a square and a circumference with the same perimeter and center (fig. 1).[5]

It is clear that ancient Egyptians had no kind of mathematical tools with which to solve this kind of mathematical problem. Therefore, it is very likely that they managed to match the perimeter of a square and a circle by realizing a simple geometrical coincidence: a rectangle of 11x14 cubits defines a circle with a radius of 14 and a perimeter of 87.964 cubits, and a square with a half side of 11 cubits and a perimeter of 88 cubits (fig. 1a). Both figures have the same perimeter, with a difference of 0.036 cubits. Once again, ancient Egyptians had no measurement tools to demonstrate how significant this relation might be.[6] Finally, the GPAD can be summarized as the mix of the rectangles R.α, R.ß (figs. 1c and 1d) with regular rectangles as R.1x2, R.1x3 and R.2x3.

The concept of ambivalence in the culture of ancient Egypt can be seen in different aspects of it. Although that is not the subject of study of this work, it is important to point out that for the ancient Egyptians the opposition of life and death, night and day, or dawn and dusk, governed their understanding of the universe and of existence itself. The land of Egypt was the place where physical life developed, where the mortal and the tangible took place. This earthly concept of existence was even understood as a "box" of light, a place of experience and a space bounded by the four cardinal points. At sunset, the solar disk crossed the limits of known nature and began to dwell in the dark and formless space of creation, reappearing the next day - thus, repeating the idea of infinite regeneration between non-existence and existence, between life and death.[7]

It is very likely that, in the origins of this culture, even when the first traces of writing began, the ancient Egyptians found a geometrical relationship which could link these two concepts by a square and a circle of the same perimeter. They used a square to represent the concept of the earthly, the physical and the tangible. Meanwhile, they used a circle with the same perimeter to represent the transcendental concept of existence and regeneration, divine in its discoid appearance.

The practical application of the GPAD can be perfectly framed in the archaeological context since the necessary tools to carry it out were within the reach of the ancient builders from the very first years of the Early Dynastic Period.[8]

2 Gardón-Ramos 2021a: 17.

3 Gardón-Ramos 2021a: 9–16.

4 Gardón-Ramos 2021b: 45–70.

5 The square could represent the physical and earthly aspect of the existence with its four cardinal points, while the circumference could allude to the celestial level expressing the idea of regeneration and eternity, the solar disk and possibly the vault of heaven in which the gods would dwell. See, Gardón-Ramos 2021a: 17.

6 In order to understand how close this geometric solution is to reality, if a square is planned with an 11x14 proportion and its perimeter is the same as 1 cubit, it appears that the perimeter of the circumference is 0.9996 cubits - that is to say, a difference in perimeter of a mere 0.0004 cubits (fig. 1b). See, Gardón-Ramos 2021a: 7.

7 In his work, J.P. Allen studies several religious texts from different periods of ancient Egypt. Although some of them are much later than the beginning of the ancient Egyptian culture, Allen exposes an evident tradition in them that goes back to the very origins of the culture of Pharaonic Egypt. See, Allen 1988: 56–57.

8 Gardón-Ramos 2021a: 26.





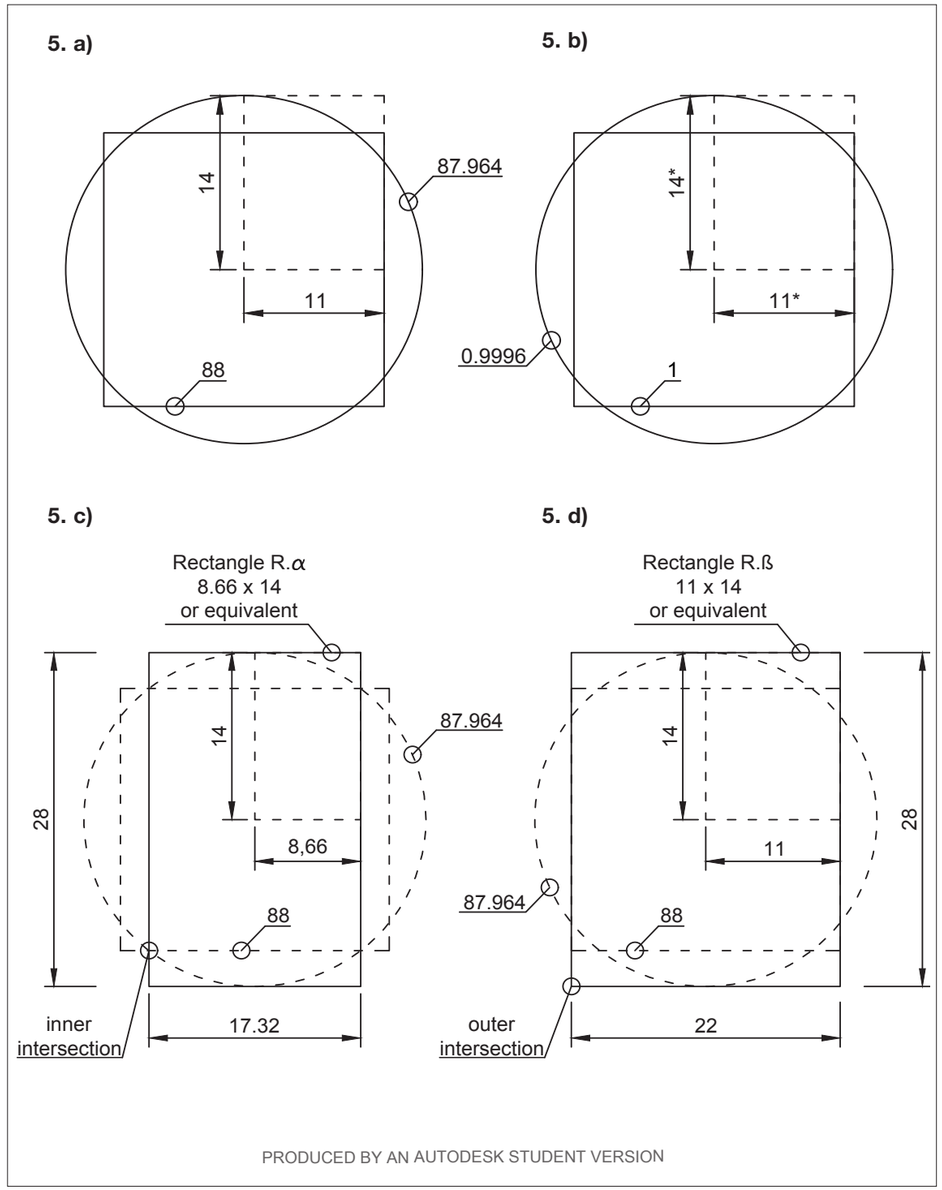



Figure 1. Geometrical pattern of the architectural design (GPAD) in royal buildings that emerged during the Thinite Age (after Gardon-Ramos 2021a: 25).

| The royal tombs at Umm el-Qa'ab | | |
|---|---|---|
| **Pharaoh** | **Architectural Design** | |
| | Mortuary chamber | Main wall |
| Aha | R.α (1x1.62) | |
| Djer | R.ß (1x1.27) | |
| Djet | R.α (1x1.62) | |
| | | R.ß (1x1.27) |
| Meretneith | R.ß (1x1.27) | |
| Den | R.1x2 | |
| Andjib | | R.1x2 |
| | R.α (1x1.62) | |
| Semerkhet | R.1x2 | R.α (1x1.62) |
| | | R.1x2 |
| Qa'a | R.1x2 | |
| | | |
| Peribsen | | |
| | R.ß (1x1.27) | |
| Khasekhemwy | R.α (1x1.62) | |

Table 1. The royal tombs at Umm el-Qa'ab.

| The royal tombs at Umm el-Qa'ab | | | | |
|---|---|---|---|---|
| | **Inner face of the wall** | **Outer face of the wall** | **Central axis of the wall** | **Perimeter wall** |
| **Aha** | | R.2x3 | | |
| | | R.2x3 | | |
| | | R.2x3 | | |
| **Djer** | R.1x2 | | | R.α |
| **Djet** | R.1x2 | | | R.α |
| **Meretneith** | | R.ß' | | R.1x2 |
| **W. Mastaba** | R.ß' | | | |
| **Anonymous** | R.1x2 | | | |
| **Peribsen** | | | R.1x2 | |
| **Khasekhemwy** | | | R.1x2 | |

Table 2. Funerary enclosures at Abydos.

Tables 1 and 2 show how the kings of the first dynasty built and designed their tombs at Umm el-Qa'ab and their funerary enclosures at Abydos apparently, following the GPAD.[9] When the second dynasty began, its first pharaoh, Hetepsekhemwy, left Umm el-Qa'ab to build his tomb at Saqqara with no apparent reason, because there appears to have been no break between dynasties.[10] He carved an underground gallery and his two successors, Raneb and Ninetjer tried to emulate him: Raneb expanded Hetepsekhemwy's grave and Ninetjer carved his own tomb.[11] It seems clear that Hetepsekhemwy tried to change the first dynasty's royal architectural tradition, but he did not get the chance to establish a new tradition beyond his two successors.

The first great evolution in the royal architecture of ancient Egypt, and consequently in the GPAD, occurred during the construction of Netjerkhet's step pyramid (fig. 2). This first evolution was intended to project the GPAD from the horizontal plan to the vertical one.[12] The power of the pharaoh could be observed from several kilometers away, reflected in these pyramidal buildings which were built at areas as Saqqara, Giza or Abu Rowash, taking advantage of the orography to further enhance their presence.[13]

It is clear that the Netjerkhet's step pyramid at Saqqara is an ascensional monument with a strong stellar and solar aspect.[14] Moreover, the fact that Netjerkhet built a shrine at Heliopolis clearly devoted to the Heliopolitan ennead demonstrates the importance that kingship gave to the solar cult.[15] However, the solarisation of Egyptian kingship was probably not a specific event which occurred in Netjerkhet's reign but a profound transformation which originated during the Second or even the First Dynasty.[16]

There is evidence from the Second Dynasty which shows this solarisation. The main one is perhaps the fact that Raneb, second king of the Second Dynasty, was the first royal name that alluded to a solar divinity. Also, some inscriptions on vessels from the underground galleries of Netjerkhet's step pyramid, belonging to the Second Dynasty,





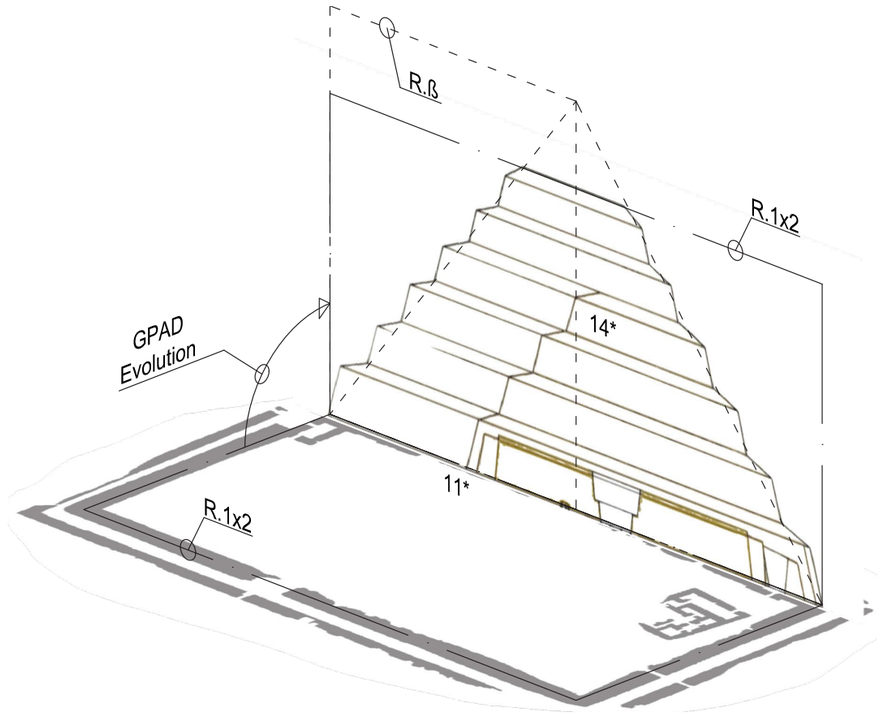



Figure 2. First evolution of the GPAD in the royal architecture of ancient Egypt (after Gardon-Ramos 2021a: 28).

9 Furthermore, over twenty royal buildings built during the Thinige Age have been studied geometrically by the present author. See, Gardón-Ramos 2021a: 24.

10 Bard 1999: 125.

11 Lacher 2008: 440.

12 Figure 2 represents Khasekhemwy's enclosure at Abydos on the horizontal plan as a rectangle R.1x2 and its projection to the vertical plan. On this vertical plan is represented Netjerkhet's step pyramid framed by the very same Khasekhemwy's rectangle R.1x2 and the diagonals of the rectangle R.ß. See, Gardón-Ramos 2021a: 10–11.

13 Love 2004: 209–210.

14 It is true that Pyramid Texts make reference to the ascensional and solar symbolism of the pyramidal architecture, see Cervelló-Autuori 2011: 1128–1129. However, it is also true that Netjerkhet's Serdab, the north entrance of the pyramid and its north-south orientation have a clear stellar connotation also mentioned in the Pyramid Texts, see Lull 2016: 284–285.

15 Cervelló-Autuori 2011: 1128–1129.

make clear references linking the *Sed*-festival with solar devotion. Furthermore, some scholars have pointed out the possibility that the first symbolic solar reference of the god Horus appears on an ivory comb in the reign of Djet (from the mid-First Dynasty).[17]

This evidently growing solar cult was represented in the very designs of the royal buildings from the beginning of the Third dynasty – even though, in the ancient town of Hierakonpolis, this solar cult revolved around the sacred *benben* stone, which would later shape the first pyramids and the obelisks of the Fifth Dynasty sun temples. Furthermore, the pyramidion of pyramids took the same name: *benbenet*. During the Middle and New Kingdoms, pyramidia and obelisks were usually covered by gold, electrum or copper.[18] Taking into account that the etymological origin of the word *benben* probably came from the idea "to rise" (of the sun), the link between this object and the representation of the solar cult in royal architecture is clear. Therefore, the *benben* stone, nowadays lost, was pictorially represented several times and became an architectural symbol.[19]

Nerjekhet's step pyramid is the first royal building clearly representing this solar cult and he made it in an apparently too disruptive way, compared to previous royal architecture. Hetepsekhemwy also tried, one hundred years before Netjerkhet, to differentiate his tomb from those of his ancestors constructing and underground gallery; unfortunately, his royal architectural designs did not endure. Then, is it possible that another reason, apart from the cultural context, forced the pharaohs of the Second and Third Dynasties to find a new architectural tradition for their royal buildings?

## 1 | The Private Cemetery of Helwan

The cemetery of Helwan is the largest necropolis of the Early Dynastic Period.[20] Located almost 10 km east from Saqqara, on the opposite shore of the Nile, its private funerary architecture shows a wide array of tombs. According to Köhler, there are two main types of tomb, with numerous subdivisions and variations depending on their sides or constructions materials.[21] Fig. 3[22] shows one of these types, which requires additional material, such as wood, to finish their underground construction. The tombs represented by fig. 4[23] which are usually entirely cut into gravel deposits and used monolithic blocks. Finally, fig. 5[24] shows a type of tomb bigger than the previous ones, being superstructures with a mastaba appearance. An in-depth study of all their geometry clearly shows similarities with the royal tombs of this epoch. Tables 1 and 2 provide the proportions of the royal tombs at Um el-Qa'ab and the funerary enclosures at Abydos built by the pharaohs of the First and Second dynasties.[25] Their geometry seems to be based on the GPAD, and the rectangles R.α, R.ß, R.ß',[26] R.1x2 and R.2x3 are systematically applied as well at Helwan (tables 3, 4 and 5 and see figs. 3, 4 and 5).

16 Cervelló-Autuori 2011: 1127.
17 Cervelló-Autuori 2011: 1133–1134.
18 Rossi 2003: 182–183.
19 Kemp 2006: 137, fig. 48.
20 Köhler 2008: 113–130.
21 Köhler presents subtypes of tomb. The present work has chosen the most representative ones. See, Köhler 2008: 114.
22 Köhler 2008: 115.
23 Köhler 2008: 120.
24 Köhler 2008: 123.
25 Gardón-Ramos 2021a: 37.





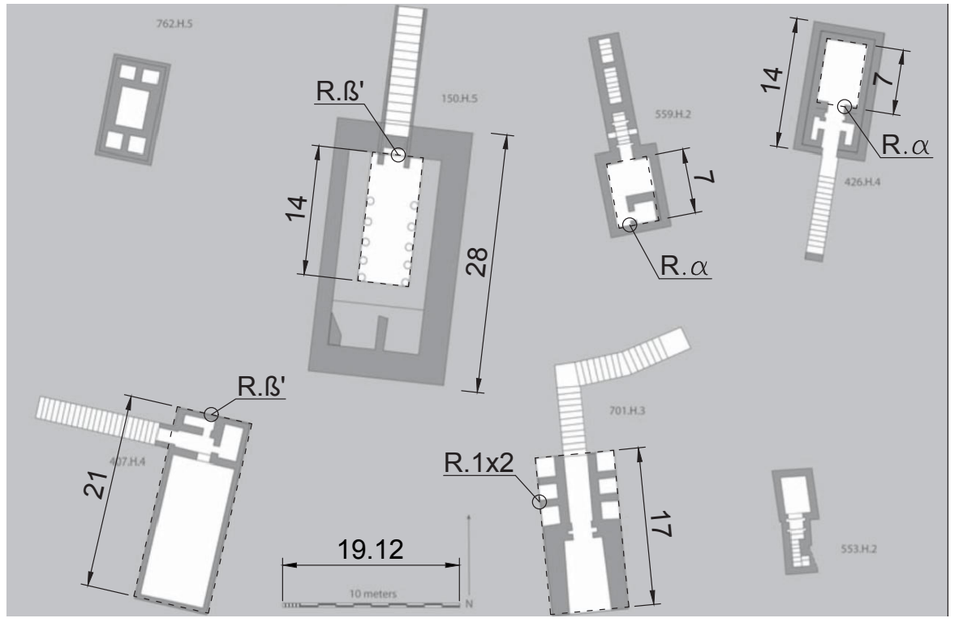





Figure 3. Private architecture at Helwan. Tomb Type I. Figure made by the author.

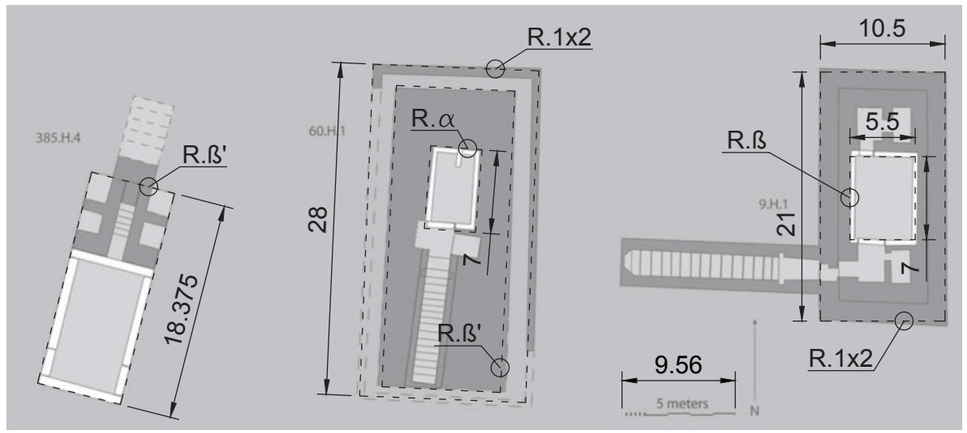





Figure 4. Private architecture at Helwan. Tomb Type II. Figure made by the author.

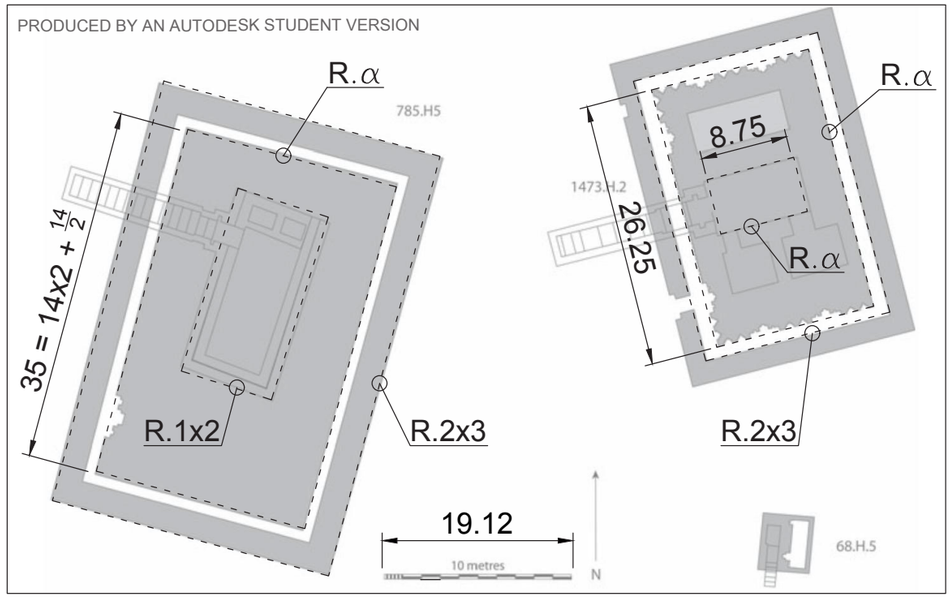



Figure 5. Private architecture at Helwan. Superstructures. Figure made by the author.

| Private funerary architecture at Helwan. Tomb Type I. (fig. 3) | | |
|---|---|---|
| **Tomb** | **Main wall (lengths in cubits)** | **Burial chamber (lengths in cubits)** |
| 407.H.4 | R.ß' | |
| 150.H.5 | | R.ß' |
| 701.H.3 | R.1x2 | R.α |
| 559.H.2 | | R.α |
| 426.H.4 | | |

Table 3. Private architecture at Helwan. Tomb Type I.

| Private funerary architecture at Helwan. Tomb Type 2. (fig. 4) | | | |
|---|---|---|---|
| **Tomb** | **Main wall. Outer face** | **Burial chamber. Inner face** | **Perimeter wall** |
| 385.H.4 | R.ß' (18.375=14+1/4x14+1/16x14) | | |
| 60.H.1 | R.ß' (25.375=14+1/2x14+1/16x14) | R.α (7=14/2) | R.1x2 (28=14x2) |
| 9.H.1 | R.1x2 (21=14 + 1/2x14) | R.α (7=14/2) | |

Table 4. Private architecture at Helwan. Tomb Type II.

| Private funerary architecture at Helwan. Superstructures. (fig. 5) | | | |
|---|---|---|---|
| **Tomb** | **Main wall. Outer face** | **Burial chamber. Inner face** | **Perimeter wall** |
| 785.H.5 | R.α (35=14x2+1/2x14) | R.1x2 | R.2x3 |
| 1473.H.2 | R.α (26.25=14+7/8x14) | R.α (8.75=6/8x14) | R.2x3 |

Table 5. Private architecture at Helwan. Superstructures.





## 2 | The private mastabas at Tarkhan and the great mastabas at Saqqara

According to their palace façade walls or the distribution of inner niches, the mastabas built at Tarkhan during the First Dynasty are very similar aesthetically to those built in Saqqara built at the same time.[27] It is seems very likely that Saqqara's mastabas were built during the First Dynasty by a select group of people very close to the pharaoh, perhaps even by himself.[28] In fact, one of the debates in Egyptology is focused on clarifying the builders of the great mastabas at Saqqara.[29]

One of the purposes of the present work is to ensure that the very same geometrical principles, used to build the first pharaonic architecture during the Thinite Age, were also used, or not, to also define the main architectural proportions of Tarkhan's private mastabas and the great mastabas at Saqqara.

Figure 6 shows how rectangles R.ß', R.1x2 and R.1x3 define the main proportions of the main three mastabas at Tarkhan.[30] Actually, the final design of mastaba 1060 (fig. 6c) can be simulated thanks to the GPAD. Table 6 presents all of the data.

6. a) Mastaba 2038 (Tarkhan) 6. b) Mastaba 2050 (Tarkhan) 6. c) Mastaba1060 (Tarkhan)

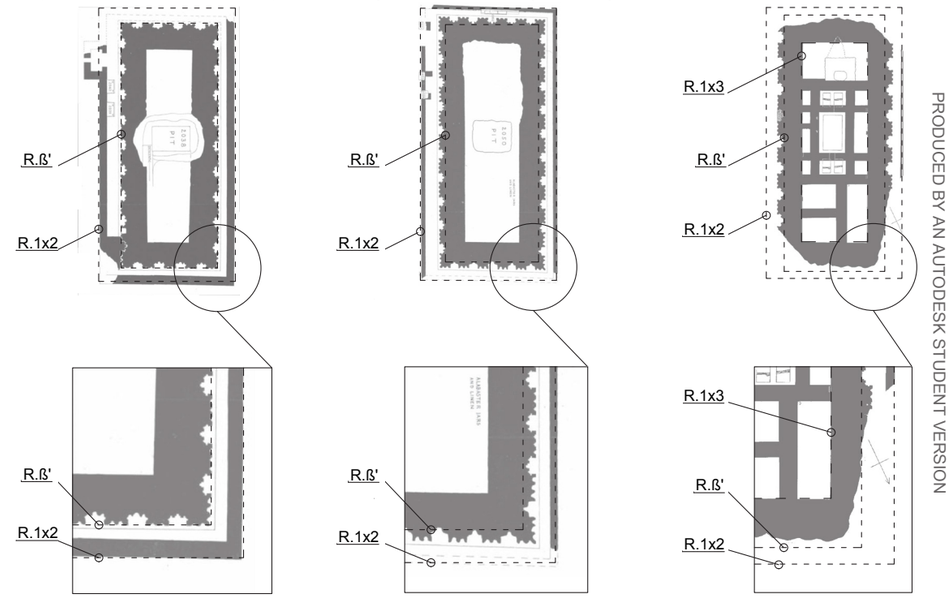



Figure 6. Private funerary architecture at Tarkhan. Mastabas. Figure made by the author.

26 Rectangle R.ß' is the longitudinal half of a rectangle R.ß. It is to say, a rectangle with proportions 11/2 x 14 (5.5x14).
27 Grajetzki 2008: 108.
28 Hendrickx 2008: 82–83.
29 Cervelló-Autuori 2014: 211.

| Private funerary architecture at Tarkhan. Mastabas. (fig. 6) | | | | |
|---|---|---|---|---|
| **Mastaba** | **Main wall (Serekh façade). Inner face** | **Main wall (Serekh façade). Incoming outer face** | **Main wall (Serekh façade). Outgoing outer face** | **Perimeter wall** |
| 2038 | | | R.ß' | R.1x2 |
| 2050 | | R.ß' | | R.1x2 |
| 160 | R.1x3 | R.ß' | | R.1x2 |

Table 6. Private funerary architecture at Tarkhan. Mastabas.

In the same way, fig. 7[31] illustrates how the same rectangles, together with R.α, were used to define the main proportions of the great mastabas at Saqqara during the First Dynasty. In this case, the rectangle R.1x3 seems to be a more important proportion in the specification of the inner face of the Serekh façade wall. At the same time, rectangles R.α , R.ß' and R.1x2 were intended to define all perimeter walls. Finally, fig. 8[32] shows how, during the Second Dynasty at Saqqara, rectangle R.1x2 was mainly used to define the outer facing wall of several mastabas.

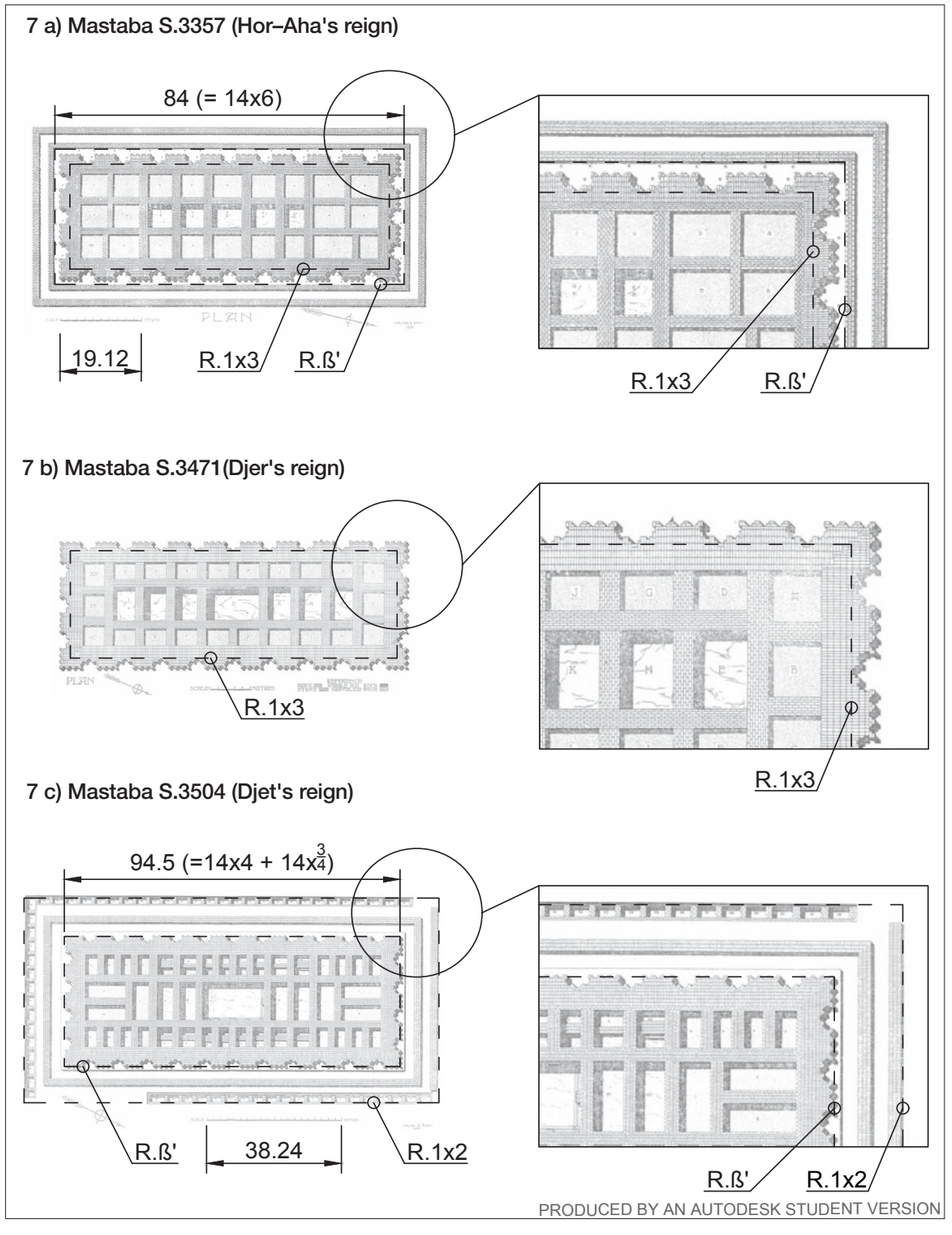
| Architecture of the great mastabas at Saqqara (Figs. 7 and 8) | | | | |
|---|---|---|---|---|
| **Mastaba** | **Main wall (Serekh façade). Inner face** | **Main wall (Serekh façade). Incoming outer face** | **Main wall (Serekh façade). Outgoing outer face** | **Perimeter wall** |
| S.3357 | (35=14x2+1/2x14) | R.1x3 | R.ß' | R.ß' (inner face of the first perimeter wall) |
| S.3471 | (26.25=14+7/8x14) | R.1x3 | | R.1x2 (outer face of the second perimeter wall) |
| S.3504 | | | R.ß' | R.1x2 (outer face of the perimeter wall formed by individual niches) |
| S.3503 | | R.1x3 | | |
| S.3035 | R.1x3 | | | R.α (outer face) |
| S.3036 | | R.1x2 | | |
| S.3111 | R.1x3 | | | R.α (outer face) |
| S.3505 | R.1x2 | | | |
| S.2307 | | | R.1x2 | |
| S.2406 | | | R.1x2 | |
| S.2429 | | | R.1x2 | |

Table7. Architecture of the great mastabas at Saqqara.

30 Grajetzki 2008: 108, 110.
31 Hendrickx 2008: 63, 64, 74, 75, 77, 80.
32 Lacher 2008: 436.








Figures 7a to 7c. Architecture of the great mastabas at Saqqara. Figure made by the author.

7 d) Mastaba S.3503 (Mer-Neith's reign)

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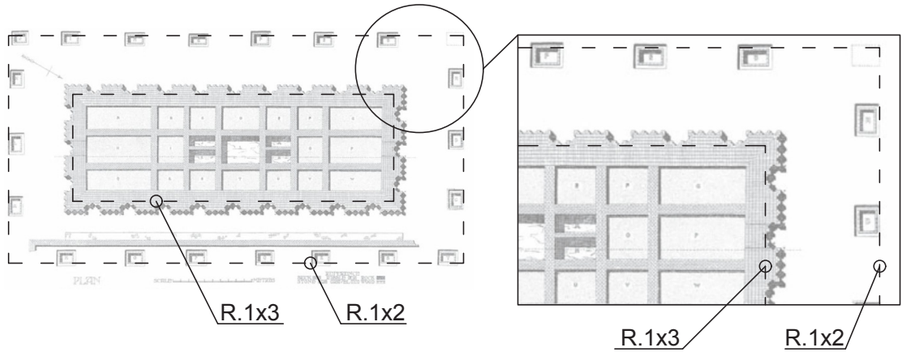
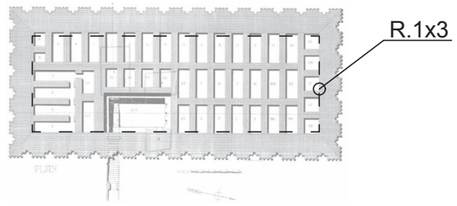
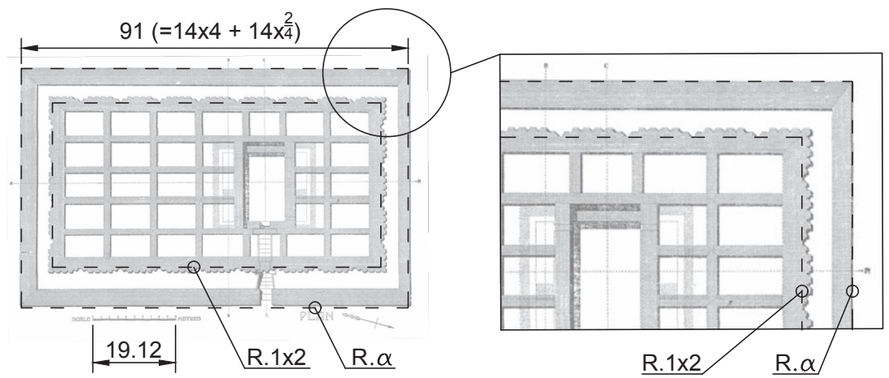



7 e) Mastaba S.3035 (Den's reign)




7 f) Mastaba S.3036 (Den's reign)




Figures 7d to 7f. Architecture of the great mastabas at Saqqara. Figure made by the author.





7 g) Mastaba S.3111 (Andjib's reign)

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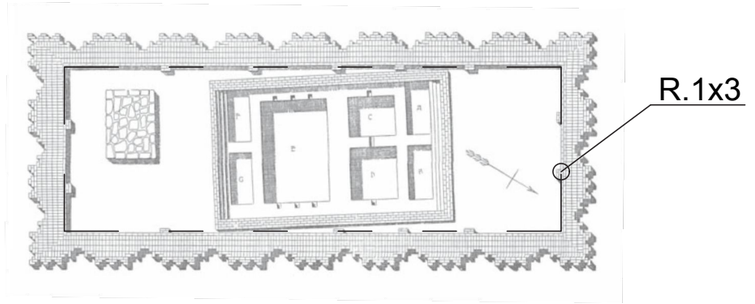
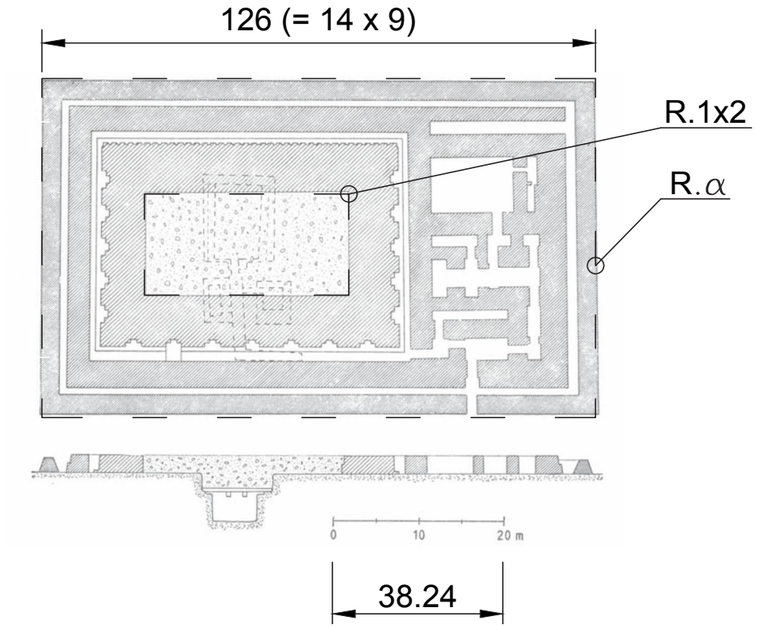



7 h) Mastaba S.3505 (Qa'a's reign)




Figures 7g to 7h. Architecture of the great mastabas at Saqqara. Figure made by the author.

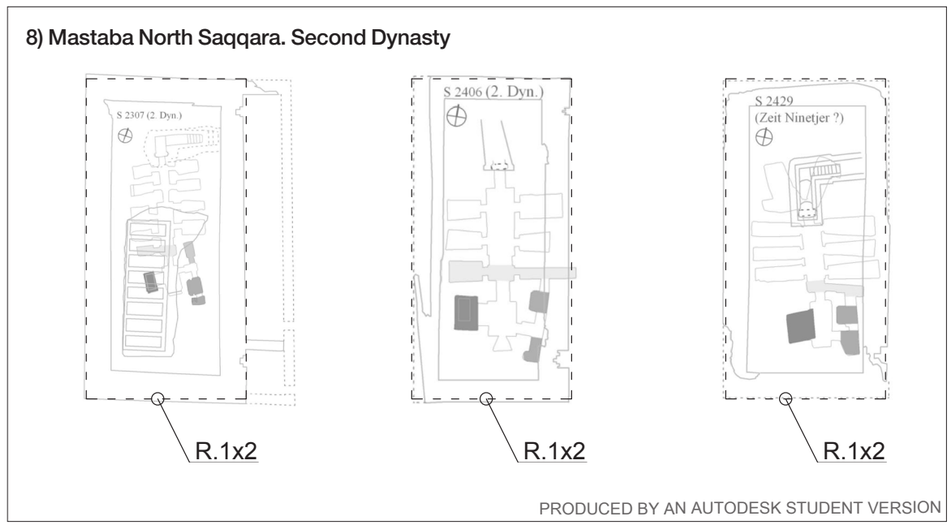



Figure 8. Architecture of the great mastabas at Saqqara. Figure made by the author.

## 3 | Conclusions

It seems to be clear that the upper classes during the Thinite Age could have access to the GPAD. After all, high functionaries were part of the royal court. Besides, the funerary architecture of the great tombs began to take its first steps then and it is very possible that the architects and team of constructors in charge of building private constructions were the same ones in charge of building the royal tombs and temples.

Figures 3, 4 and 5 (tables 3, 4 and 5) show how funerary private architecture at Helwan during the First and Second Dynasties were designed, applying the same principles of proportion as the royal tombs at Umm el-Qa'ab and funerary enclosures at Abydos (tables 1 and 2). The builders of these private tombs at Helwan has been proved in several studies. When both designs are compared geometrically, it seems clear that the royal tomb designs suffered through imitations by private ones during this period.

Figures 6 and 7 and tables 6 and 7 present the main proportions used by ancient architects to design the mastabas at Tarkhan and Saqqara during the First Dynasty. Again, both designs seem to be based on the GPAD. The peculiarity in these designs is that the mastabas at Tarkhan probably used the rectangles R.ß' (and R.1x3 to a lesser extend) to specify the main wall incoming outer face (Serekh façade), while the mastabas at Saqqara were more inclined to apply rectangle R.1x3 to achieve the same design. Following a thorough study of these designs, it is possible to propose that the great mastabas at Saqqara were also built by the highest class of functionaries, or even by members of the royal court. It is very likely that these mastabas were constructed by the same architects who built the royal constructions during the Thinite Age at Umm el-Qa'ab and Abydos. Nevertheless, the fact that the architects of the great mastabas at Saqqara so assiduously used rectangle R.1x3 could be a definitive proof to support this conclusion, because this proportion was used





during the Old Kingdom's royal architecture only once - for the design of the surrounding wall of Sekhemkhet's funerary complex at Saqqara.[33]
In order to eliminate the possibility of the proportions of rectangles R.ß' and R.α being just a geometrical coincidence, it is necessary to check the lengths of these rectangles for multiples of 14. If they are, their measurements would be based, almost certainly, on the GPAD. Figures 7a, 7c, 7f and 7h present the proportions of these rectangles, based on their original plan scales, and in the lengths of rectangles R.ß' and R.α , multiples of 14, can be observed. The same must be done to the private tombs at Helwan, and the rectangles R.ß' and R.α and their lengths are also multiples of 14 (see figs. 3, 4, 5 and tables 3, 4, 5).[34]

One particular case is mastaba S.3038 at Saqqara (fig. 9).[35] Some scholars have pointed out that its design, with steps, is a clear reference to the serekh design of Andjib[36] and probably a pioneering design. Later architects could have been inspired by this to conceive the royal pyramidal architecture. Nevertheless, after having verified the high degree of imitation of pharaonic funerary architecture, it is not surprising to see that a high functionary, very close to the court and even to the pharaoh, made reference to the serekh's design of the monarch who governed the country during his life.

Then, in the Early Dynastic Period, the combination of the process of solarisation of Egyptian kingship and the evident imitation phenomenon that was impacting on royal funerary architecture by private tombs provoked the necessity of a revolutionary design in the royal architecture. It is very possible that Nerjetkhet understood this necessity and fixed this problem.

## Bibliographical references

Allen, J.P.
1988 *Genesis in Egypt. The Philosophy of Ancient Egyptian Creation Accounts* (*Yale Egyptological Studies* 2). New Heaven.

Bard, K.A.
1999 *Encyclopaedia of the Archaeology of Ancient Egypt*. London.

Cervelló-Autuori, J.
2011 "The Sun-Religion in the Thinite Age", in: R.F. Friedman, and P.N. Fiske (eds.): *Egypt at Its Origins 3* (*Orientalia Lovaniensia Aanalecta* 205). Paris: 1125–1149.

Gardón-Ramos, V.
2021a "Origin of the Geometrical Pattern in the Royal Architecture of Ancient Egypt during the Thinite Age and Old Kingdom", *Historiae* 18: 1–43.

Grajetzki, W.
2008 "The Architecture and the Signification of the Tarkhan Mastabas", *Archéo-Nil* 18: 103–112.

Hendrickx, S.
2008 "Les Grands Mastabas de la Ire Dynastie à Saqqara", *Archéo-Nil* 18: 60–88.

Kemp, B.
2006 *Ancient Egypt. Anatomy of a Civilization*. New York.

33 Gardón-Ramos 2021a: 27.

34 Some of these measures may seem incomprehensibly accurate; however, they can be achieved by simple arithmetic operations, as it happens in some royal tombs at Umm el-Qa'ab. See, Gardón-Ramos 2021a: 24.

35 Lehner 1997: 81.

36 Stadelmann 1997: 22–24; Cervelló-Autuori 2011: 1139.

Köhler, C.
2008 "The Helwan Cemetery", *Archéo-Nil* 18: 113–130.

Lacher, C.
2008 "Das Grab des Hetepsechemui/Raneb in Saqqara Ideen zur Baugeschichtlichen Entwicklung", in: E.M. Engel, V. Müller and U. Hartung (eds.): *Zeichen aus dem Sand. Streiflichter aus Ägyptens Geschichte zu Ehren von Günter Dreyer* (*Menes* 5). Wiesbaden: 427–451.

Lehner, M.
1997 *The Complete Pyramids*. New York.

Love, S.
2004 "Stones, ancestors, and pyramids: investigating the pre-pyramid landscape of Memphis", in: M. Bárta (ed.): *The Old Kingdom Art and Archaeology,* Prague: 209–218.

Lull, J.
2016 *La Astronomía en el Antiguo Egipto*. Valencia. 3rd ed.

Rossi, C.
2003 *Architecture and Mathematics in Ancient Egypt*. New York.

Stadelmann, R.
1997 *Die ägyptischen Pyramiden: vom Ziegelbau zum Weltwunder*. Mainz am Rhein.

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