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# Measuring Egyptian Statues*

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In accordance with one of the objectives of the UOS meeting (i.e. to explore the connection of mathematics with other issues of ancient cultures), I would like to deal with the question of how the Egyptians treated height.[1] Although at first glance this question appears very simple it proves instead to be not at all trivial but has many facets.

At the centre of my paper will be the heights of statues as recorded in the crypts of the temple of Hathor at Dendera in Egypt. This temple was built in the second half of the first century BC and the first half of the first century AD and is very well preserved. Many hidden chambers, so-called crypts, are built into the walls and foundations of the temple. In the subterranean crypts there are hundreds of depictions of divine statues (cf. Figure 1).[2]

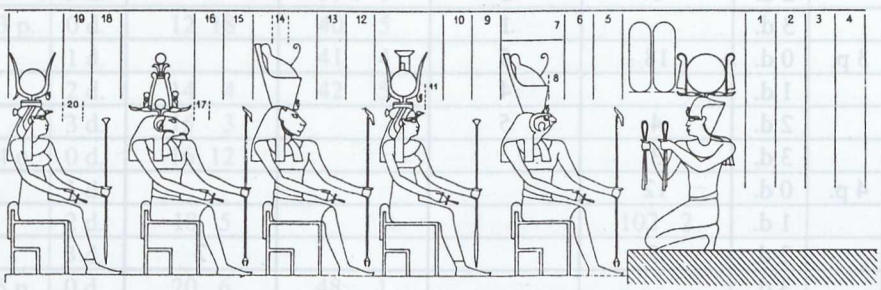


Figure 1

Normally, two types of text accompany these representations. Firstly, as usually found in temple scenes, there are inscriptions indicating the names of the king and the gods who are represented and what they are saying. These texts are arranged in short columns or rows above the figures (Figure 1, columns 1–7, 9–10, 12–13, 15–16 etc.).

Secondly – and this is what interests us here – there are scattered little bits of text floating around these representations, often near the head of a god or behind it,

* I would like to thank M. Meyer and an anonymous person from the audience for correcting my English.

1 I have examined this and other problems in more detail in my still unpublished Habilitationsschrift *Wort und Bild. Texte und Untersuchungen zur ägyptischen Statuenbeschreibung*. Würzburg University, 2001.

2 Taken from CHASSINAT (1947), pl. CCCXXIX.

sometimes also underneath it (Figure 1 columns 8, 11, 14, 17, 20). This second type of inscription names typically the material and height of the statue and might therefore be called a technical description. For example, in Figure 1 we have for each god: "gold; height: 1 cubit".[3]

I would like to concentrate on the different heights only. Before going into details, I think it is useful to mention the Egyptian measures of length used in these texts. The basic unit is the divine cubit (equalling approximately 52.5 cm) which is divided into 7 palms; 1 palm is divided into 4 digits. Thus 1 cubit is equal to 28 digits.

| | | + 0 cubits | + 1 cubits | + 2 cubits | + 3 cubits | + 4 cubits |
|---|---|---|---|---|---|---|
| 0 p. | 0 d. | | 265 | 10 | 6 | 3 |
| | 1 d. | | 4 | 1 | | |
| | 2 d. | | 4 | | | 1 |
| | 3 d. | | | 2 | | |
| 1 p. | 0 d. | | 2 | 4 | 1 | |
| | 1 d. | | 1 | | | |
| | 2 d. | | | | | |
| | 3 d. | 2 | | | | |
| 2 p. | 0 d. | | 5 | | | |
| | 1 d. | | 1 | | | |
| | 2 d. | 1 | 2 | 9 | | |
| | 3 d. | | 1 | | | |
| 3 p. | 0 d. | 18 | 5 | | | |
| | 1 d. | | 4 | | | |
| | 2 d. | 4 | 5 | | | |
| | 3 d. | 3 | | | | |
| 4 p. | 0 d. | 12 | | | | |
| | 1 d. | | | | | |
| | 2 d. | 5 | | | 2 | |
| | 3 d. | | | | | |
| 5 p. | 0 d. | 6 | 1 | | | |
| | 1 d. | | | | | |
| | 2 d. | 2 | | | | |
| | 3 d. | | | | | |
| 6 p. | 0 d. | 2 | | | | |
| | 1 d. | | | | | |
| | 2 d. | | | | | |
| | 3 d. | | | | | |

Figure 2 (p. = palms, d. = digits)

Collecting together *all* the indications of the heights of statues in the Dendera temple we obtain the result represented in Figure 2. This table displays the frequency of all heights ranging from zero to 4 cubits 6 palms 3 digits. There are for example 265

[3] Cf. CHASSINAT (1947), pl. CCCXXXIV.

occurrences of statues that are exactly 1 cubit high, only four that are 1 cubit and 1 digit high, two that are 1 cubit 1 palm, and five that are 1 cubit 3 palms 2 digits in height, etc.

It is obvious that some heights occur more often than others – indeed many do not show up at all. The most commonly occurring height is 1 cubit. In view of the fact that this is the basic unit of the Egyptian system of measuring lengths, this is not unexpected. For the same reason the integer multiples 2, 3 and 4 cubits are quite frequently given as well.

| | | + 0 cubits | + 1 cubits | + 2 cubits | + 3 cubits | + 4 cubits |
|---|---|---|---|---|---|---|
| 0 p. | 0 d. | | 28 265 | 56 10 | 84 6 | 112 3 |
| | 1 d. | | 29 4 | 57 1 | | |
| | 2 d. | | 30 4 | | | 114 1 |
| | 3 d. | | | 59 2 | | |
| 1 p. | 0 d. | | 32 2 | 60 4 | 88 1 | |
| | 1 d. | | 33 1 | | | |
| | 2 d. | | | | | |
| | 3 d. | 7 2 | | | | |
| 2 p. | 0 d. | | 36 5 | | | |
| | 1 d. | | 37 1 | | | |
| | 2 d. | 10 1 | 38 2 | 66 9 | | |
| | 3 d. | | 39 1 | | | |
| 3 p. | 0 d. | 12 18 | 40 5 | | | |
| | 1 d. | | 41 4 | | | |
| | 2 d. | 14 4 | 42 5 | | | |
| | 3 d. | 15 3 | | | | |
| 4 p. | 0 d. | 16 12 | | | | |
| | 1 d. | | | | | |
| | 2 d. | 18 5 | | | 102 2 | |
| | 3 d. | | | | | |
| 5 p. | 0 d. | 20 6 | 48 1 | | | |
| | 1 d. | | | | | |
| | 2 d. | 22 2 | | | | |
| | 3 d. | | | | | |
| 6 p. | 0 d. | 24 2 | | | | |
| | 1 d. | | | | | |
| | 2 d. | | | | | |
| | 3 d. | | | | | |

Figure 3 (p. = palms, d. = digits)[4]

But is it not strange to also find many other heights – some of them occurring rather frequently – such as, for example, 1 cubit 2 palms or 1 cubit 3 palms 2 digits, and others? On the other hand, many numbers do not occur at all, although at first sight they seem as probable as those attested. Why? I think it is because the figures that do

[4] The individual entries represent 1) the height in digits, 2) the frequency of this height.

occur represent a coherent system.[5] In order to make this more transparent, I have converted all measures to the smallest unit, the digit, and I have listed them in a modified table (Figure 3).

Now it is easier to see the relationships. We have for example 88, 66, 33 and 22 digits, apparently forming a series of multiples of 11. There is also a series with 7: 7, 14, 28, 42, 56, 84 and 112; another with 10: 10, 20, 30, 40, 60, into which should be included also 15, the half of 30. Yet another series starts with 12: 12, 24, 36, and 18, half its value, then 48 and 60; another with 16: 16, 32, 48; and there is a 38-series: 38, 114 and 57, its half. We are only left with 6 numbers that cannot be linked to any series: 29, 37, 39, 41, 59 and 102 digits.

The fact that the vast majority of numbers can be grouped into only a few series of numbers shows, in my opinion, that Egyptian statue heights conform to a system. The depictions prove that the several series do not depend on the depicted deity, their kind of representation (e.g., standing or sitting) or their material. Therefore, the relationship between the series can be found only in the numbers themselves. And it is not difficult to find their connection. By means of multiplication by a different multiple of one seventh, one can reach *each* series directly starting from the 7-series or the number 28 – i.e., 1 cubit – respectively:

$$\mathbf{28} \text{ (28 digits = 1 divine cubit)}$$

$$28 \cdot \frac{3}{7} = \mathbf{12}$$

$$28 \cdot \frac{4}{7} = \mathbf{16}$$

$$28 \cdot \frac{5}{7} = \mathbf{20}$$

$$28 \cdot 1\frac{2.5}{7} = \mathbf{38} \left(\frac{2.5}{7} \text{ cubits} = 10 \text{ digits}\right)$$

$$28 \cdot 3\frac{1}{7} = \mathbf{88}$$

No doubt, departing from 1 cubit by using sevenths suggested itself to the Egyptians because the (divine) cubit was divided into 7 palms.

The few numbers that do not fit into this overall system can be explained very easily by looking at the relevant pictures. To take just one example: 41 digits is the height of the statue represented in Figure 4.[6]

This statue is a combination of a falcon body and a human head. Most of the figures with irregular heights are representations in which human and animal parts are combined as in this example. Another type of irregular representation shows a divinity in an awkward body position like this semi-raised Osiris (Figure 5).[7] It is not

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[5] The distribution is definitely not simply by chance ($p < 0.001$). The One-Sample Kolmogorov-Smirnov Test was used to compare the observed cumulative distribution function of the data with a uniform distribution. I would like to thank A. Spahn of the Computing Centre of Würzburg University for his kind help.

[6] Taken from CHASSINAT (1935), pl. CLXXVIII; for the wording of the accompanying text see below, note 18.

[7] After CAUVILLE (1997), pl. 107 (by kind permission of the Institut français d'archéologie

here the combination of different elements but rather the extraordinary position that appears to be responsible for the unusual height.

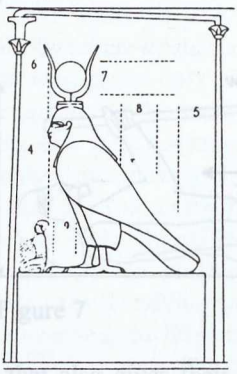


Figure 4

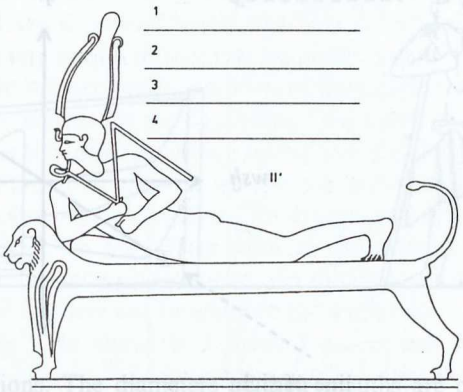


Figure 5

But, as I said, the very large majority – in fact much more than 95% – fall into one of the series of heights.

One very important point needs to be stressed here. The heights given in the Dendera temple are not the heights of real statues that had been measured, but rather theological models and holy plans. This is shown by a note referring to a textual variant,[8] which is only plausible if the texts were handed down independently of any existing statues (otherwise one could have checked doubtful specifications against the statues), therefore proving that these texts are definitely not the result of any kind of inventory taken from existing objects, at least not at the time when the temple was built. Of course, statues *could* be created according to the texts. But it is important to realize that the texts are primary and the statues only secondary. This means that the measures are exactly what they are meant to be and not the outcome of accidental or incorrect work by the sculptor.

In order to approach the question of the intention of these heights, two points must be clarified. First, is the Egyptian word that I have been translating tacitly as "height" really the expression for the perpendicular dimension of the statues? Second, which parts of a statue did the Egyptians include into its height?

Lack of space prevents me from demonstrating in detail that the Egyptian word *q3*, which is used in the Dendera texts and also elsewhere to indicate the most important dimension of statues, normally refers to their height. The matter is somewhat more complicated than the dictionaries make us suppose. For as I have shown in another paper,[9] the use of the Egyptian words for the dimensions depends on the line of sight (cf. Figure 6). *q3* means what is perpendicular in relation to the line of sight.

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orientale).

[8] CHASSINAT (1934), p. 194, lines 3–4: "Harsomtus ...; gold – variant: iron – ; ..."

[9] Presented on July 3rd, 1999 during the Ständige Ägyptologenkonferenz at Trier.

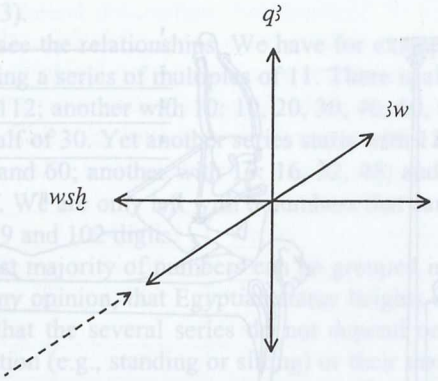


Figure 6

The main reasons for assuming such a relative system are the following: There is firstly an inscription of the famous architect and sage Amenophis, son of Hapu. He tells of a colossal royal statue whose three dimensions *wsḫ*, *3w* and *q3* are given as:[10]

> "large in respect to the *wsḫ* ("breadth"),
> *q3* ("high") to its pillar, ...
> its *3w* ("length") 40 cubits".

It is absolutely impossible that these 40 cubits of the *3w* "length" are anything but the actual height. Even this – more than 20 m – is gigantic. But we can safely exclude that it refers to the distance from toe to heel or from the front edge of the base to its rear edge. But if *3w* is used here for the height, *q3*, normally translated as "height", must refer to this extension from toe to heel. How could this happen? Well, the text states clearly that this is "to its pillar" (*r jwn=f*). This used to be translated incorrectly as "more than its pillar". But for Egyptian statues it is normal that the head of the depicted is higher than the back pillar. So, this should not be worth mentioning in an architect's inscription. It had not been taken into account in translations so far that the Egyptian preposition *r* can also refer to the meeting of dimensions in a right angle:[11] *q3* stands in a right angle to the back pillar and the whole of the shift in the words for the dimensions "height" and "length" can be explained on the assumption that the statue is still lying in the quarry when it is described (cf. Figure 7).[12] In fact, the transport to and the erection in a temple are narrated later on in the text.

The second instructive evidence occurs in the *Embalming Ritual for the Apis Bull*. For embalming this animal, many large vessels are used and enumerated in the

[10] Helck (1958), p. 1822, line 19 – p. 1823, line 2.

[11] Cf. Peet (1923), pp. 85–86 (no. 45).

[12] I have combined one figure from Épron (1939), pl. LIII with another one from Wild (1953), pl. CXXIII.

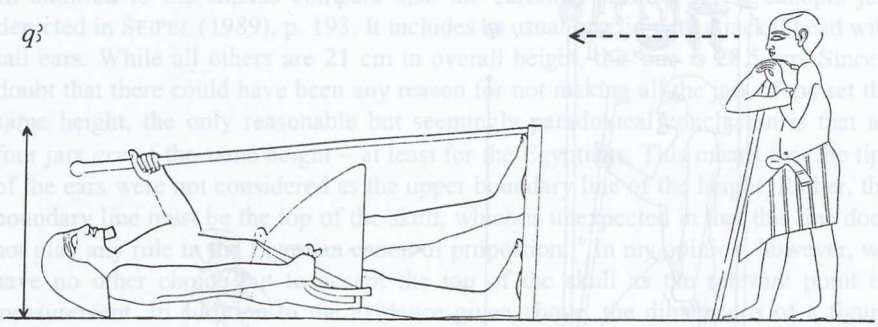


Figure 7

text that also gives their dimensions. The diameters of their mouths are called *q3* "height".[13] In the light of what I said before this can easily be understood (cf. Figure 8).[14]

Looking to the vessels from above is not at all unusual for the Egyptians as these scenes from the tomb of Ti prove. This position, however, means that the mouth of a vessel is perpendicular to the line of sight. Therefore the diameter is called *q3* "height".

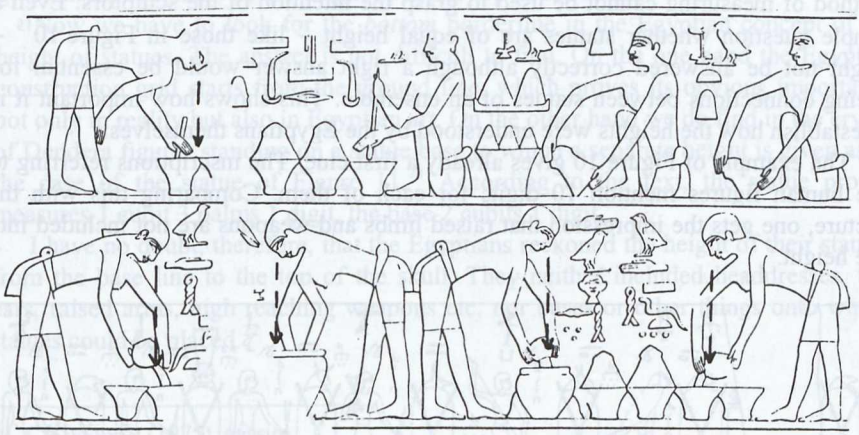

Figure 8

Let us now return to the statues in the Dendera temple that are not lying. Since they are on the contrary in the normal position of statues and since they are normally seen from the side, from the front or from behind, but not from above or from below, *q3* indeed refers to the height of these statues (cf. Figure 9).

[13] Vos (1993), pp. 169ff.

[14] Taken from Épron (1939), pl. LXVII and modified.

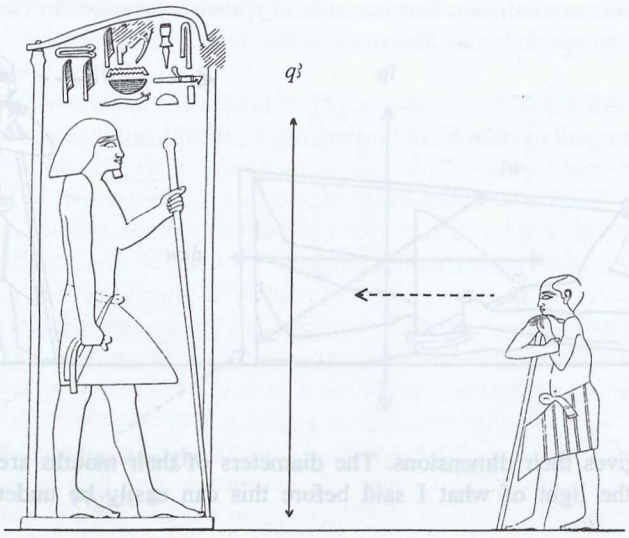


Figure 9

Let us now turn to the second question: What is included into the height of a statue by the Egyptians? Modern art historians are accustomed to give the *total* height of Egyptian statues. But is this also what the Egyptians meant? If not, the modern method of measuring cannot be used to grasp the intention of the sculptors. Even a simple question whether statues are of equal height – like those in Figure 10[15] – might not be answered correctly although a right answer would be essential for seeing connections between statues of an ensemble. This shows how important it is to establish how the heights were understood by the Egyptians themselves.

The example of Figure 10 gives already a first clue. The inscriptions referring to the human figures mention 10 digits for each of them. Comparing this with the picture, one gets the impression that raised limbs and weapons are not included into the height.

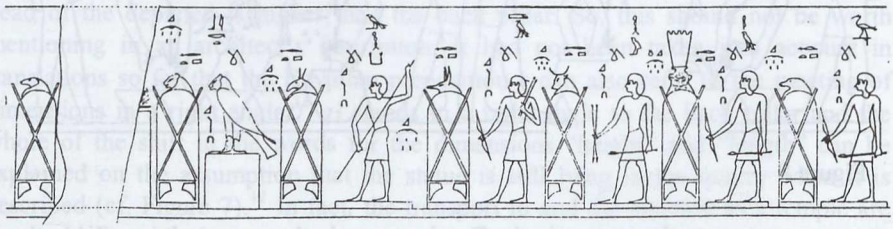

Figure 10

The same seems to be true of crowns. The last but one shield has a head with a high feather crown. But here again the text gives the same height for all shields. So the crown is obviously not considered as part of the height.

[15] Taken from NAVILLE (1888), pl. 6.

Even ears were not included into what the Egyptians considered to be the height. In addition to the shields compare also the carefully worked set of canopic jars depicted in SEIPEL (1989), p. 193. It includes as usual one lid with a jackal head with tall ears. While all others are 21 cm in overall height, this one is 28.5 cm. Since I doubt that there could have been any reason for not making all the jars of the set the same height, the only reasonable but seemingly paradoxical conclusion is that all four jars *are* of the same height – at least for the Egyptians. This means that the tips of the ears were not considered as the upper boundary line of the height. Rather, the boundary line must be the top of the skull, which is unexpected in that this line does not play any role in the Egyptian canon of proportion.[16] In my opinion, however, we have no other choice but to accept the top of the skull as the relevant point of measurement. In addition to the evidence given above, the dimensions of a figure and its naos found in the crypts of Dendera can be adduced (cf. Figure 4).

According to the inscriptions[17] the statue is 1 cubit 3 palms and 1 digit in height,[18] its naos 1 cubit 3 palms 2 digits.[19] So the statue is only 1 digit shorter than the naos into which it can be placed. Given the proportions of the statue, this implies, firstly, that it was to be put into the naos without its headdress. Secondly, 1 digit or less than 2 cm are less than the distance from the root of the nose, which marks the uppermost line of the late canon of proportion,[20] to the top of the head. The statue measures 1 cubit 3 palms and 1 digit, that is 76.9 cm. Of these roughly $\frac{1}{10}$ (or more than 7 cm) constitute the distance from the root of the nose to the crown, which is obviously much more than 1 digit. Therefore it is evident that the height of the statue given in the text must be the height up to the top of the skull.

Now we have to look for the *bottom* borderline in the Egyptian concept of the height of statues. The answer is not difficult to find. On the one hand the Egyptian construction grid starts from the ground line, which proves its obvious importance not only in reality but also in Egyptian art. On the other hand we do find in the crypts of Dendera figures standing on a statue base to which a separate height is given as in the case of the statue of Figure 11.[21] According to the text, the statue proper measures 1 cubit 3 palms 1 digit, the base 2 cubits 1 digit.

I have no doubt, therefore, that the Egyptians reckoned the height of their statues from the base line to the top of the skull. They neither included headdresses, tall ears, raised arms, high reaching weapons etc. nor bases or other things onto which statues could be placed.[22]

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[16] Cf. IVERSEN (1975), passim.

[17] CHASSINAT (1935), p. 39, lines 9–12 and p. 150, lines 3–5; CHASSINAT (1952), p. 15, lines 10–11 and p. 124, lines 7–9.

[18] I would reconstruct the text referring to the statue as "Hathor – solar disk of god –; painted wood; height: 1 cubit 3 palms 1 digit".

[19] In my opinion the text referring to the naos is to be understood as: "stone – doors: fir-wood; height (of the doors): 1 cubit 1 palm –; breadth: 1 cubit 2 palms; length: 2 cubits; height 1 cubit 3 palms 2 digits".

[20] Following IVERSEN (1975), pp. 75ff.

[21] Taken from CHASSINAT (1952), pl. CCCCXLIII.

[22] At least in the Greek period during which the Dendera temple was built.


Figure 11


Figure 12

Here I should mention some extremely exceptional instances, where one depiction is provided with *two* heights. At Dendera these are only figures of falcons with crowns, like a representation of the god Somtus as a recumbent falcon with a double feather crown (Figure 12).[23] The text[24] runs as follows:

> "Somtus; gold (and) painted wood;
> height: 3 palms;
> height: 1 cubit 3 palms 2 digits".

In solving this riddle we must resort to actual statues of lying falcons with such a crown – the relief representations are not really reliable, because they exhibit much shorter feathers. The actual figures, however, make us realize that the proportion of the body to the crown varies extremely because the feathers can be of very different height. The crown can take up even nearly 70% of the overall height of the crowned statue.[25] In light of this information I would suggest to interpret the measures as follows: 3 palms, the height given first, is – as usual – the height of the body only. The second one, the 1 cubit 3 palms 2 digits, is the total height including the crown, which in this case would constitute 71% of the total height – a number that fits quite well, I think.

What I wanted to demonstrate in discussing this exceptional case is that even here my idea, that the Egyptians considered the height of the body as the all important measure, works. It is only when the crown is higher than the body itself, that a second way of measuring was sometimes considered necessary.

To conclude, I would like to stress that in connection with statues, the Egyptians worked with a *structural tallness* of the *body* of the one depicted and not with a simply *physical height* of the statue. Crowns, weapons, and bases, and even ears, arms etc. are a sort of addition to the statue proper. Art historians should take this into account when dealing with Egyptian sculpture. This is not only a vital point for

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[23] Taken from CHASSINAT (1934), pl. CL.

[24] CHASSINAT (1934), p. 194, lines 1–2.

[25] Cf. e.g. the falcon Cairo RT 18.11.24.46 (SALEH and SOUROUZIAN (1986), no. 268).

a correct understanding of Egyptian art, the more so as according to the texts of the late temples the heights of Egyptian statues are not accidental but seem to be themselves elements of a close-knit theological system, as their connection by multiples shows.

## References


CAUVILLE, Sylvie. 1997. *Le temple de Dendara: les chapelles osiriennes.* (Bibliothèque d'Étude 117–119). Cairo: Institut Français d'Archéologie Orientale

CHASSINAT, Émile. 1934. *Le temple de Dendara.* Volume 2. Cairo: Institut Français d'Archéologie Orientale

CHASSINAT, Émile. 1935. *Le temple de Dendara.* Volume 3. Cairo: Institut Français d'Archéologie Orientale

CHASSINAT, Émile. 1947. *Le temple de Dendara.* Volume 5 (Plates). Cairo: Institut Français d'Archéologie Orientale

CHASSINAT, Émile. 1952. *Le temple de Dendara.* Volume 5 (Text). Cairo: Institut Français d'Archéologie Orientale

ÉPRON, Lucienne et al. 1939. *Le tombeau de Tî.* Fasc. 1. Cairo: Institut Français d'Archéologie Orientale

HELCK, Wofgang. 1958. *Urkunden der 18. Dynastie.* No. 21. Berlin: Akademie Verlag

IVERSEN, Erik. 1975. *Canon and Proportions in Egyptian Art.* 2nd edition. Warminster: Aris and Phillips

NAVILLE, Edouard. 1888. *The Shrine of Shaft el Henneh and the Land of Goshen (1885).* London: Trubner

PEET, Tomas Eric. 1923. *The Rhind Mathematical Papyrus. British Museum 10057 and 10058.* London: Hodder and Stoughton Limited

SALEH, Mohamed and SOUROUZIAN, Hourig. 1986. *Die Hauptwerke im Ägyptischen Museum Kairo.* Mainz: Philipp von Zabern

SEIPEL, Wilfried. 1989. *Ägypten. Götter, Gräber und die Kunst. 4000 Jahre Jenseitsglaube.* Volume 1. Linz: Landesmuseum Linz

Vos, René L. 1993. *The Apis Embalming Ritual. P. Vindob. 3873.* Leuven: Uitgeverij Peeters and Departement Orientalistiek

WILD, Henri. 1953. *Le tombeau de Ti.* Fasc. 2. Cairo: Institut Français d'Archéologie Orientale