Understanding the Great Pyramid

Putting its Unique Features in Context

In recent decades, interest in the Great Pyramid of Egypt has reached fever pitch, with new ideas and concepts being generated at an accelerating rate. Conspiracy theories suggest that "the authorities" are concealing some vital truths (aren't they always?) We have had men from Mars, men from Atlantis, deluges in the desert, and the most bizarre methods for constructing the Great Pyramid, including making the stones from water and cement (sic!) Both transcendental numbers, PI and PHI, have allegedly been discovered hidden in its dimensions.

Some of these theories have become widely accepted, with those who disagree even being ridiculed. The notion that the three pyramids of Giza are misaligned in such a way as to represent the Belt of Orion seems to be widely accepted, even although, as the photograph shows, the three pyramids are perfectly aligned along their south-eastern corners. The Great Pyramid of Khufu is on the right,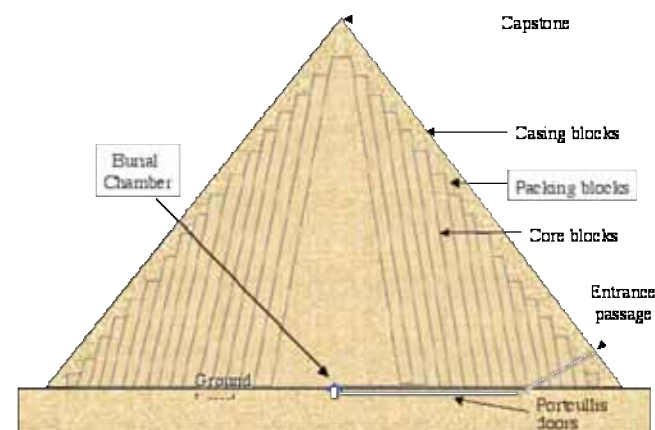 with Khafre's pyramid at centre and Menkaure's pyramid looking rather smaller in the distance. Never mind the rather self-evident facts, the Pyramids of Giza are still widely supposed to be misaligned.

Until recently, it was widely touted that professional Egyptologists knew little, and that the fourth dynasty pyramids had been built using slave labour, probably around 10,500BC. Recent finds of the tombs of the workers showed that the pyramids were, as the Egyptologists had said, built around 2,500BC, and that the labour force had been well fed and looked after, with sophisticated medical treatment. The conspiracy mongers slinked off to dream up yet another money-spinning storyline with which to bamboozle a gullible public.

Not that all the theories were nonsense. The Great Pyramid certainly has some unusual features: to understand just how unusual, it is helpful to see how a more conventional pyramid would have been built.

Archetypal Pyramid Design

The archetypal pyramid was located on the west bank of the Nile. The pyramid was oriented east west. The archetypal pyramid design concept incorporated one or more chambers, often dug down from the rock surface, covered with one or more inverted chevron limestone capstones, the whole covered by a pyramid constructed from horizontal tiers of limestone. The entrance passage may be similarly dug down from the rock surface, and would generally incorporate three portcullis doors, one after the other, to block the passage once the pyramid had been built and the dead pharaoh entombed.

Within the pyramid layers, ashlars and quoins marked out precise sloping columns of stone, with stones of less precision in between. Tiers were finished off with packing blocks and white limestone casing stones, leaving a smooth, pristine pyramid shape.

Reason for Internal Design

The reason for the complexity of the internal design is not known for certain. The practice could have evolved simply from the inward-leaning columns used to construct earlier pyramids. However, the pyramid was believed to symbolize the original Mound of Creation from which all form and life emanated

Viewing the pyramid as a mound bulging out from the ground could explain construction, with internal columns representing rock strata bent upwards…. Whatever the reason, the construction rendered pyramids resistant to earthquakes. Moreover, the use of ashlar-faced internal walls allowed more roughly formed stones to be used as fill. This method became widely used in later times where the gap between solid walls was filled with rubble as a fast and effective building method, e.g., for cathedrals and castles.

Explaining the Unique Features in the Great Pyramid

The Great Pyramid stands in a line of evolving pyramid designs of the 3rd - 6th Dynasties. Many of its features can be seen as consistent with that evolution, e.g. the pyramid shape, orientation and slope

Great Pyramid–View from East, showing Unique Internal Features.
Note: shafts generally referred to as KC(N) for King's Chamber (North), QC(S) for Queen's Chamber (South) etc.

However, the Great Pyramid stands out in having certain features that are unique, occurring neither before nor after in the evolutionary sequence. As the figure shows, the Great Pyramid differs substantially from the archetypal model that both preceded and succeeded it. There is an underground chamber complex at considerable depth (30m) reached by a long tunnel, too narrow to pass a sarcophagus. This complex is incomplete and seemingly abandoned. In addition to a large chamber, there is a small passage travelling horizontally southwards, but with nothing at the far end.

Two chambers are raised high into the main body of the pyramid, interconnected by a Grand Gallery (for which there is a precedent, in a satellite pyramid at Dahshur, south of Giza.) The misnamed Queen's Chamber is set on the centreline dropped from the pinnacle of the pyramid, which also marks the start of the subterranean chamber, so that the latter is entirely under the left hand (southern) half of the pyramid.

Above the Queen's Chamber sits the King's Chamber, also entirely in the southern half of the pyramid, and in which sits a red granite chest, most probably a sarcophagus–although it lacks any markings, or lid.

Each raised chamber has a pair of small shafts running from its North and South walls, heading upwards at different angles

Above the upper, King's chamber is a set of granite "relieving chambers" with an inverted limestone chevron cap redolent of a subterranean chamber cap.

All of the internal structural features lie on a vertical N-S plane through the centre of the pyramid, so that much of the masonry appears to be solid and without spaces.

Neither the King's Chamber nor the Queen's Chamber is cut in half by N-S plane, however. In both instances, there is significantly more of the chamber towards the West than towards the East. In both chambers, too, the entrance is via a door in the eastern end of the south wall.

Northern shafts bend around Grand Gallery to enter chambers on the N-S plane, signifying its importance.
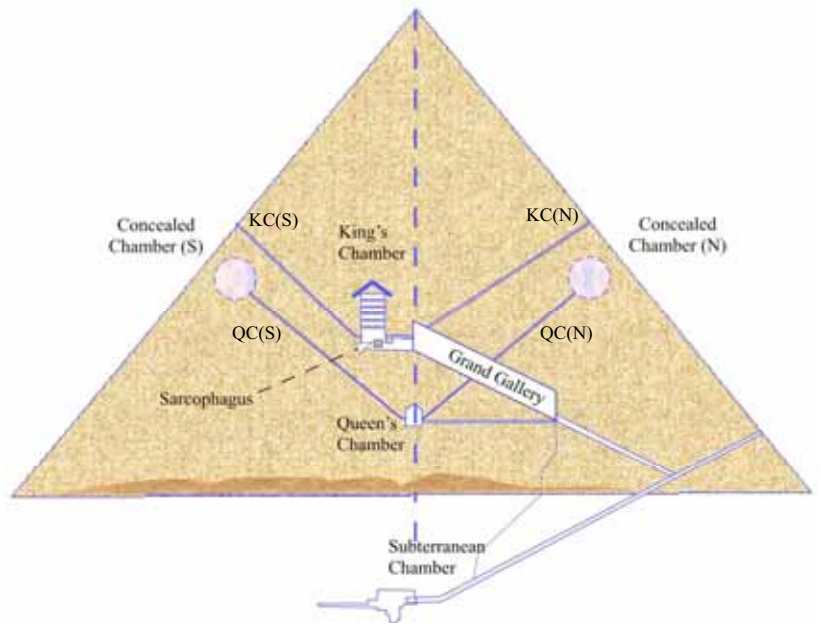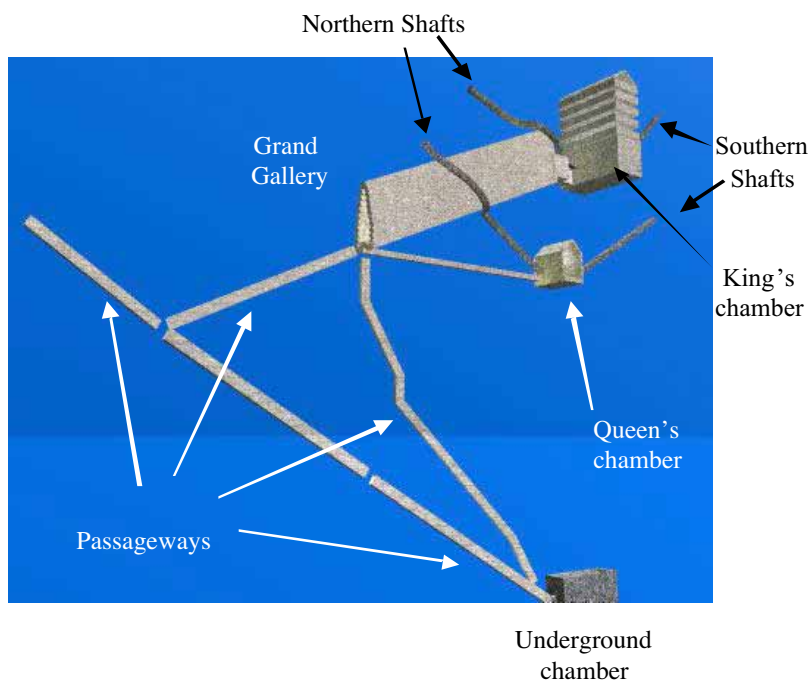
View of Great Pyramid Internal Features from North West

Many explanations have been presented of one or other feature in the Great Pyramid, although none has managed to explain all the unique features taken together

Theories about the Shafts

The four small shafts, for instance have been suggested as a means of ventilation, although Queen's chamber shafts do not reach the outside of the pyramid and the shafts in both chambers were formerly sealed at their respective chamber ends. Besides, who was the ventilation for? The dead King would have had no need of it.

Interestingly, some theorists observe that the four shafts pointed at particular stars in antiquity. However, as the graph at right shows, only KC(S) pointed accurately at a star at the time when the Great Pyramid is believed to have been built

Great Pyramid Shafts - Star-Pointing Inconsistencies.
The four shafts are theorized to have pointed at the four stars,
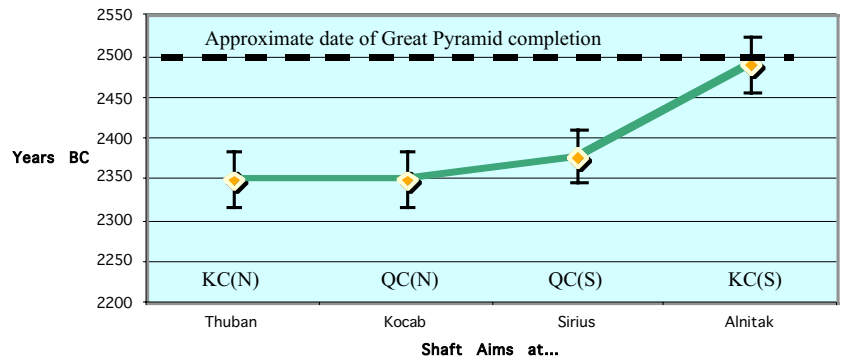Thuban, Kocab, Sirius and Alnitak.

The inaccuracies are significant. If, as suggested, KC(N) pointed at Thuban, the then Pole Star, then it was about 1° off, and 2.5° off the Celestial Pole.

The graph below shows the apparent wander of Thuban over the night sky from 2,800BC to 2,200BC due to precession. Horizontal marker lines also show the fixed elevation of KC(N) as 32.47°, and of the Celestial Pole when viewed from Giza as 29°58'51"; this last is also fixed, being the same as the latitude of Giza.

By the time that the Great Pyramid was built, Thuban no longer coincided with the Celestial Pole, having done so some 300 years earlier, in 2,800BC. Another 150 years would pass after construction before the elevation of KC(N) coincided with that of Thuban.
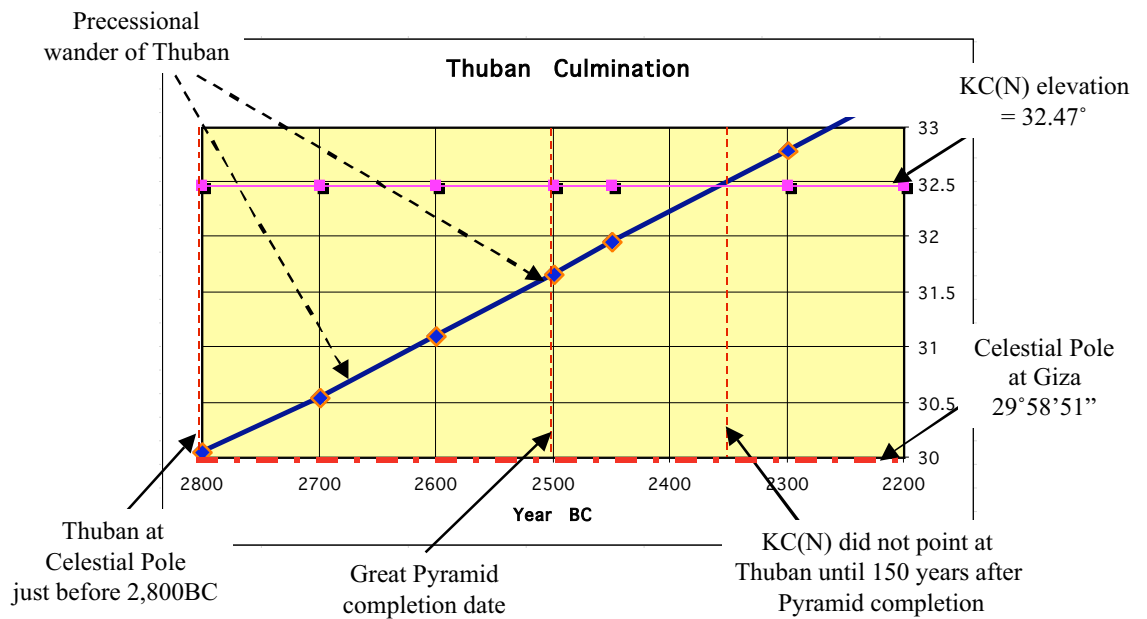
To assume that, at the time of the Great Pyramid's completion, KC(N) pointed at either at Thuban, or at the Celestial Pole, may seem unreasonable in such circumstances. Unless, that is, one attributes the ancient Egyptian architects with inferior measurement skills, which goes against the evidence of the Great Pyramid's accuracy of construction.

In any event, the star-shaft theory has been shaken to its uncertain foundations by the discovery, first of a chamber inside the Pyramid at the end of QC(S) and latterly of a matching chamber at the end of QC(N).

Wander due to Precession of Thuban, the supposed Pole Star of the Third Millennium BC

The so-called Relieving Chambers above the King's Chamber

The relieving chambers are neither proper chambers, nor do they relieve. The massive structure, weighing in at some 2,500 tonnes, is an enigma. Individual granite beams weigh some 60-70 tonnes, about the weight of six or seven buses. The layer roofing the King's Chamber has 9 beams. Thereafter, the numbers of beams per layer going upwards are 8, 9, 9, and 8. Successive layers are cribbed at the ends, directing down thrust on to the walls of King's Chamber. The upper surfaces of the beams are undressed, indicating that they were never intended as the floors of chambers. Moreover, there was no access to the chambers until archaeologists took to dynamiting their way in…So, relieving chambers are not chambers and they do not relieve pressure on the King's Chamber walls
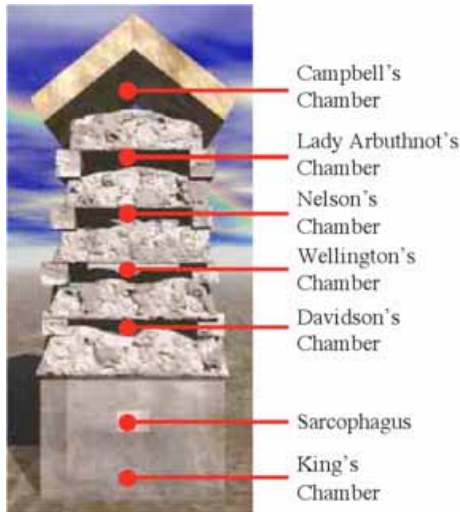
Great Pyramid "Relieving Chambers" above the King's Chamber with its Sarcophagus

At the top of the stack of granite layers is an inverted chevron of limestone. This has been assumed to be a device for diverting down thrust from the remaining superstructure of the pyramid, and so it does. However, that assumption rests on a belief that the builders were interested in diverting down thrust, which somewhat flies in the face of the 2,500 tonnes of granite in the chambers.

An enigma such as the Relieving Chambers begs for explanation, but there are few offers. One suggestion posits that they were some form of ancient resonator, designed to amplify the sounds of earthquakes under the Libyan Desert and to transmit those sounds via KC(N) and KC(S) over the desert.

Looking for an Explanation

Now Derek Hitchins, a retired professor researching in darkest Wiltshire, reckons that he might have the answer, and it has nothing to do with sonic resonators, ventilation, star-shafts, or any of the other way out ideas.

According to Hitchins, who is a systems architect, the ancient pyramid architects conceived and constructed each pyramid as an integrated system. The keys to unlocking the mystery of the Great Pyramid are, therefore, fivefold:

1. Use the same measurement units and methods as the 4th dynasty architects; happily these are recorded, with worked examples, in the Rhind Papyrus contained in the British Museum
2. Recognise that all the unique features in a pyramid are very probably related, so…
3. use all the evidence in creating a single explanation for all the unique features at once. Trying to explain separate parts really does not solve the overall mystery, and simply leads to confusion
4. Employ Occam's Razor, i.e., when faced with options, choose the simplest explanation, and avoid complex, unlikely, unsupportable notions
5. Try to see things through the eyes of the ancient architects, working with their culture wherever possible, and with their beliefs and principles.

Symmetry and Duality

The propensity of the ancient Egyptians to make great use of symbolism in their hieroglyphics and architecture is well recognized. Duality was a dominant theme, where things generally existed or occurred in pairs: heaven and earth; up and down; red and white; life and afterlife; east and west; and so on. Along with duality went symmetry. Symmetry appears to have been associated not only with duality, but also with purity and perfection. That should not surprise us; even today, the bases of beauty are balance and symmetry.

Hitchins suggests that symmetry may also have been taboo in some situations, particularly in connection with numbers. Some numbers appeared to be "special" For example, the number seven was associated, *inter alia*, with magic and medicine.

The Rhind Papyrus shows that they had a sophisticated mathematics. Along with linear addition and subtraction as we have today, they employed binary multiplication and division. Generally, fractions had to be unitary, i.e., with unity numerator. (e.g. $\frac{1}{8}$, $\frac{1}{2}$). $\frac{2}{7} \neq \frac{1}{7} + \frac{1}{7}$, because of the symmetry in the sum, but instead $\frac{2}{7} = \frac{1}{4} + \frac{1}{28}$. Similarly, $\frac{2}{5} \neq \frac{1}{5} + \frac{1}{5}$, again because of the symmetry, but instead $\frac{2}{5} = \frac{1}{3} + \frac{1}{15}$. This procedure could result in some lengthy calculations resulting in strings of unitary fractions, so scribes used to learn them by heart during their training. (Some frequently occurring fractions, such as $\frac{2}{3}$, were given their own hieroglyphic symbol to ease matters. Otherwise, $\frac{2}{3} = \frac{1}{3} + \frac{1}{5} + \frac{1}{9} + \frac{1}{45}$, which would be cumbersome especially in hieroglyphics.) This obsession – for such it seems to have been – for avoiding symmetry suggests that, while symmetry had sacred implications, steps were taken to *avoid* symmetry in secular usage.

Part of the "game" of avoiding symmetry may have been to only just avoid it, by using successive integers in measurements. The diagram shows the Queen's Chamber dimensions. Measuring in metres shows nothing unusual. Measuring in the ancient Egyptian royal cubit of 52.3 cm, however, reveals that the chamber is 10 x 11 x 12 cubits to the ridge of the pitched roof. This is one example of the use of successive integers in orthogonal measurements; there are many more.
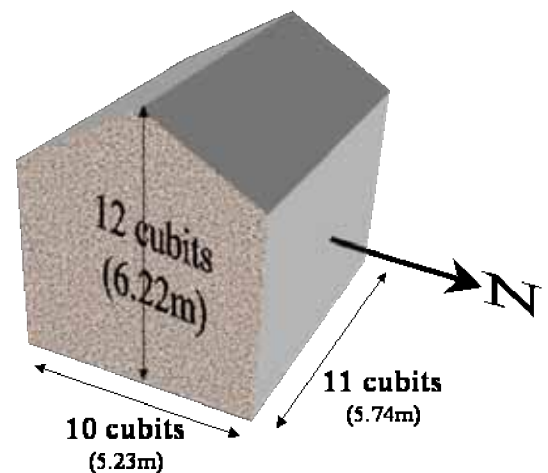
Queen's Chamber Dimensions in metres and in *seked*

Measuring Slopes

Slopes of inclines, passageways and pyramids were measured using a "slope unit" called the *seked*. The ancient Egyptians had no concepts of angles or degrees. To calculate a slope in *seked*, take a horizontal distance, *x*, divide by

vertical distance of fall, y and multiply by 7. Converting slopes from today's degrees to the ancient Egyptian *seked* uses the relationship slope in *seked* = 7÷ tan θ, where θ is slope in degrees: e.g., for the Great Pyramid, x = 11, y = 14, so pyramid slope = $\frac{11}{14} x 7 = 5\frac{1}{2}$ *seked*.

Using the *seked* to measure slopes works well for some pyramids, while for others the slope is best given by the ratio of two successive integers e.g., Red Pyramid slope = $43°22' \equiv {}^{17}\!/_{18} \equiv 7\frac{2}{5} \equiv 7+\frac{1}{3}+\frac{1}{15}$ *seked*. In this instance, successive integers are used to define the slope of the Red Pyramid with singular accuracy.

Measurements of Pyramid Slopes

Pharaoh	Angle: degrees	Tan (angle)	Opposite	Adjacent	Opposite/Adjacent	Slope in *seked*
Snefru (Meidum)	51˚50'35"	1.2727	14	11	1.2727	5 1/2
Snefru (Bent A)*	54˚27'44"	1.4000	7	5	1.4000	5
Snefru (Bent B)	43˚22'	0.9446	17	18	0.9444	7 2/5
Snefru (Red)	43˚22'	0.9446	17	18	0.9444	7 2/5
Khufu	51˚50'40"	1.2728	14	11	1.2727	5 1/2
Djedefre	52˚	1.2799	32	25	1.2800	5 1/2
Khafre	53˚10'	1.3351	4	3	1.3333	5 1/4
Menkaure	51˚20'25"	1.2500	5	4	1.2500	5 3/5
Userkaf	53˚7'48"	1.3333	4	3	1.3333	5 1/4
Sahure	50˚11'40"	1.2000	6	5	1.2000	5 5/6
Neferirkare	53˚7'48"	1.3333	4	3	1.3333	5 1/4
Niuserre	51˚50'35"	1.2727	14	11	1.2727	5 1/2
Djedkare-Isesi	52˚	1.2799	32	25	1.2800	5 1/2
Unas	56˚18'35"	1.5000	3	2	1.5000	4 2/3
Teti	53˚7'48"	1.3333	4	3	1.3333	5 1/4
Pepi I	53˚7'48"	1.3333	4	3	1.3333	5 1/4
Merenre	53˚7'48"	1.3333	4	3	1.3333	5 1/4
Pepi II	53˚7'48"	1.3333	4	3	1.3333	5 1/4

Pyramid Slopes in *seked*

As the table suggests, some pyramid slopes were evidently formed using the ratio of two integers—often two successive integers. Sometimes, where the integers were not successive, the slope then gave a sensible value when measured in *seked*. This suggests, perhaps, that different architects had different preferences. After all, the *seked* is also a ratio or proportion of horizontal to vertical, so it is reasonable to assume that some architects were happy about not having to introduce the factor 'seven' into all their calculations, as required for *seked*. Tools such as setsquares and inclinometers would use the horizontal to vertical proportion, too.

Closer examination of the table reveals that three pyramids have the proportions 14:11. In the case of the Great Pyramid, this proportion has been used to "prove" that the ancient builders hid the transcendental number PI in the dimensions. Their argument goes thus. If the horizontal dimension is 11, then each side is 22, and the square perimeter measures 88. Dividing 88 by 14 gives 2 x 22/7 which, as every modern school child undoubtedly knows, approximates to 2π.

These mathematicians overlook the two other pyramids with the same ratio of 14:11, and they ignore all the other pyramids where the same calculation as above of perimeter ÷ height produces nonsense answers.

If these omissions are accounted for, we would be expected to believe that the ancient Egyptians discovered π three times altogether, but that they also forgot it three times, too, the last time permanently. It is nonsense of course. The ancient Egyptians had an excellent method of estimating the area of a circle, which is once again to be found in the Rhind Papyrus. Area = $\left(\frac{8}{9} diameter\right)^2$, i.e., take one-ninth off the diameter and square the result. The result is some 0.6 % accurate, quite good enough for most practical purposes.
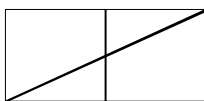
Bisecting Slopes

The ancient architects saw perfection in shape and form. They saw the square as a perfect shape: it had four equal sides, and its perfection made it ideal as the base of the pyramid. The Great Pyramid was built from over 200 such perfect squares set concentrically one above the other. The Pyramid was then "smoothed with packing and casing stones to create another perfect shape – the square-based pyramid.
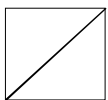
The square was also perfect in that a diagonal cut the square into two identical triangles. Here were both perfect symmetry and duality in one. With a square set in the vertical plane, the slope of the diagonal was seven *seked*. Whether the method of calculating the *seked* was established so that the "perfect" slope measured seven *seked*, or whether there was some other reason for the method of calculation, is not known.

The diagonal across two abutted squares give a slope of 14 *seked*, or 26.6˚. This slope was commonly used for internal passages in many pyramids besides the Great Pyramid. (Halving slope in this way is quite different from today's method of bisecting angles, where half of 45˚ would be 22.5˚. Working in degrees misses the point.)

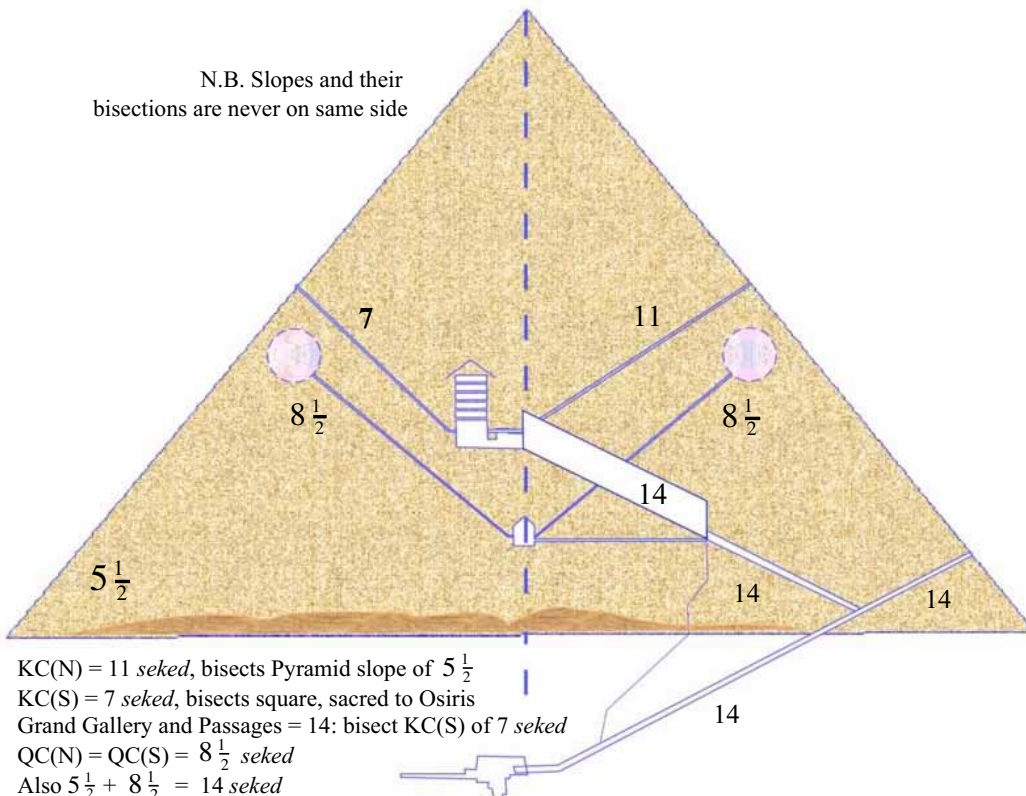Where slopes are measured in *seked*, "halving" a slope can be achieved simply by dividing the vertical in two, giving the two slopes as 7 * y/x *seked* and 7 * y/2x *seked,* respectively. Paradoxically, the steeper slope gives the smaller number.
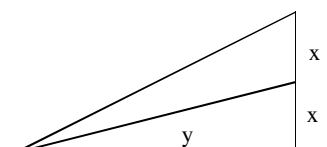
Principal Structural Slopes

With these simple ideas of symmetry, duality, geometry and slope calculations, we are now ready to re-examine the Great Pyramid's principal features. Several related features stand out:

1. The slope of KC(S) is 7 *seked*, the slope associated with purity, perfection and, as we shall see, Osiris, the God of the Netherworld. This particular slope is rarely used. It is not used as the slope for any pyramids. It is, in fact, difficult to find any other use of this particular slope. It occurs only once in the Great Pyramid, and then only in a location where it cannot be seen or traversed by the living. This may be suggestive of powerful magic. It also occurs, significantly perhaps, in the southern half of the pyramid

2. Passageways and the Grand Gallery are all 14 seked, i.e. half the slope of KC(S), and they all occur in the northern half of the pyramid. There is an implication that, being derived from the "sacred seven", a slope of 14 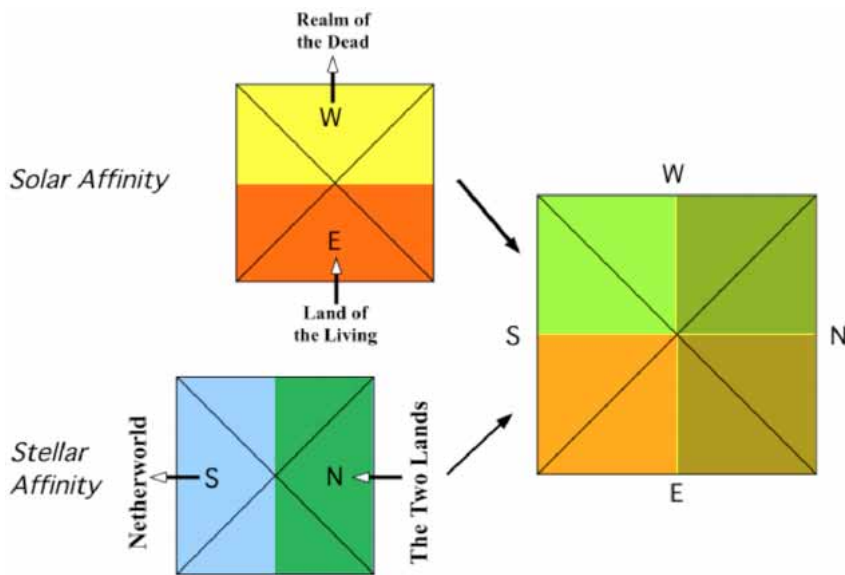*seked* is also sacred to Osiris, but having been bisected it looses some of its potency and may be trod by humans. Besides being god of the Netherworld, Osiris was also a chthonic local god associated with agriculture and annually recurring natural events.

3. The Pyramid slope itself is $5\frac{1}{2}$ *seked*. This slope occurs, of course, on all four sides, and is a slope selected and decided upon, not by Osiris, but by the living.

4. KC(S) is 11 seked, and that bisected slope occurs only in the northern half of the pyramid. It is also chosen by the living.

5. The two shafts emanating from the Queen's Chamber are laterally symmetrical around an east west plane, and are both at. $8\frac{1}{2}$ *seked*

6. $8\frac{1}{2}$ *seked* would appear to be an unusual slope to choose, until it is noticed that $5\frac{1}{2} + 8\frac{1}{2} = 14$ *seked*. Symbolically, this may suggest that the Queen's Chambers shafts are designed to complement, or act as a conceptual bridge between, the manmade pyramid slope ($5\frac{1}{2}$) and the Osiris-related slope of 14. This would be consistent with the perception of the Queen's Chamber as a *serdab*, or kiosk, a place for the *ka* of the pharaoh to rest and relax, and perhaps to replenish itself.

7. Note that all the derived slopes, i.e., those achieved by bisection, are confined to the northern half of the pyramid, suggesting that the pyramid is divided on a north south basis

8. Note also that the pyramid faces the rising sun, i.e. east, and the far side faces the setting sun in the west. This appears to be recognition of the solar cult that was gaining ascendancy over the stellar cult at the time. There is a clear sense in which the pyramid is divided on an east west basis, too.

N.B. Slopes and their bisections are never on same side

KC(N) = 11 *seked*, bisects Pyramid slope of $5\frac{1}{2}$
KC(S) = 7 *seked*, bisects square, sacred to Osiris
Grand Gallery and Passages = 14: bisect KC(S) of 7 *seked*
QC(N) = QC(S) = $8\frac{1}{2}$ *seked*
Also $5\frac{1}{2} + 8\frac{1}{2} = 14$ *seked*

Great Pyramid Slopes in *Seked*

So, we see that slopes occur in pairs, that the four shaft slopes are not intrinsically related to individual stars, nor are they for ventilation, but they are mutually related internally to other slopes in a very simple and direct manner. The interrelationships do not occur by chance: they are repeated as if to emphasise the point, and according to simple rules. Why have these rather obvious and extremely simple relationships not been noticed before? Possibly they have, but have not been thought significant, or perhaps they have not because theorists have not been using ancient Egyptian measuring units. It seems that the ancient Egyptians may have had an interest in numerology. There is, however, rather more to the story than slopes and their simple relationships.

Solar Affinity

Realm of the Dead
W
E
Land of the Living

Stellar Affinity

Netherworld
S
N
The Two Lands

W
S
N
E

Pyramid Divisions

The pyramid seems to be conceived within the spirit of duality. The pyramid was divided between the land of the living (east) and the realm of the dead (west), and it was also divided between the earth to the north and the Netherworld, or heavens, to the south. The subterranean chamber and the King's Chamber were both located in the southern half, as the dead king wished to ascend to the Netherworld. The king's sarcophagus was in the western half of the chamber – and of the pyramid – because of its association with the realm of the dead.

The Queen's Chamber, on the other hand, sat precisely on the cusp, divided between north and south and between east and west. In this position,

it reconciled all four aspects of living and dead, earth and heaven. The tall niche in the east wall of the Queen's Chamber probably held, or was intended for, a statue of the king as Horus, with the winged falcon at his neck. The photograph shows Khafre's famous statue in the Cairo Museum with the falcon at his neck, and there is a second example of this configuration for King Ranefere. While none has been found for King Khufu, it seems likely that one such was intended for the niche.

Pyramid Texts (Faulkner Translation)

To find out what else might have been in the minds of the architects of the Great Pyramid, we may examine the Pyramid Texts. These were written over several hundred years at a time when ideas about the Netherworld and the afterlife were developing. Under the stellar cult, the opportunity for an afterlife was essentially confined to the King, who would find his final resting place among the stars, from whence he would use his godly powers to ensure the annual Inundation upon which Egypt depended for life.

It is by no means clear what the Netherworld meant to the architects and designers of the Great Pyramid, although there are clues in the Pyramid Texts. The Netherworld was seen as a place where the dead king would go to become a ruler in the afterlife:

> *Sarcophagus text:* "The King is my son of desire. I have given to him the Netherworld that he may preside over it as Horus who presides over the Netherworld §5 (the references are to section numbers of the hieroglyphic text)

This text, apparently spoken by Osiris, goes to the legitimacy of the dead king, and of his location, inheritance and authority in the afterlife.

> *The king as a star fades at dawn with the other stars:* "Orion is swallowed up by the Netherworld. Pure and living in the horizon. Sothis (Sirius) is swallowed up by the Netherworld. Pure and living in the horizon" §151. i.e. the stars vanish at dawn into the Netherworld (Faulkner's note.)

This text suggests that the Netherworld is in (the direction of) the sky above us by day, and that it is where the stars go to as the sun emerges and the stars disappear. (Hitchins: 'The ancient Egyptians were also aware that it was possible to see stars during the daytime from the bottom of deep wells. It would be reasonable for them to deduce that such visibility into the Netherworld by day was due to the exclusion of rays of sunlight, and that being deep underground somehow brought one into closer affinity with the Netherworld, at least during the daytime.')

The reference to Orion is common in the Pyramid Texts, but it is imprecise. In 2,500BC, the belt stars in Orion had culminated at some 45˚, which the ancient Egyptians would have seen as 7 *seked*, or 1 to 1. Since this coincided with the diagonal across a vertical square, it seems possible that one or more stars in Orion's belt may have been associated with Osiris. Which came first, the diagonal across a square, or the elevation of Orion's Belt, is uncertain, but Hitchins puts his money on the diagonal across the square. As to the mention of Sothis, or Sirius, Hitchins points out that, being the brightest star in the sky, it would be the last to disappear as the

sun rose, and would show more than any other star where the Netherworld might be. Sirius was important, too, because its dawn rising in early July (at the time when the Great Pyramid was built) heralded the annual Inundation of the Nile.

As the texts progress, and as later texts are written, the role of the dead King changes:

> *The king becomes the supreme deity*. "Lift up your faces, you gods who are in the Netherworld, for the King has come that you may see him, he having become the great god" §272

There is no room for doubt here – the king is all-powerful. However, his association with the sun starts to emerge. In the following text, he *is* the sun:

> *The king is identified with the sun:* "The king takes possession of the sky…the king rests in life in the West, and the dwellers in the Netherworld attend him. The king shines anew in the East… §306

Later texts show the king as subservient to Re, the sun god, and the king is one among many:

> *The king joins the solar barque*. " I am pure, I take my oar to myself, I sit in the bow of the ship of the two Enneads, I row Re to the West and he establishes me above the doubles, he records me above the living."§906-907 (This text had appeared by the reign of King Pepi II.)

Evidently, the status of the dead king as a sole supreme deity has been prejudiced with the advent of the solar theology. The following text may throw some light on the ritual or cultic functions of the shafts in the King's Chamber:

> *A resurrection text:* "Betake yourself to the waterway, fare upstream to the Thinite nome, travel about Abydos in this spirit form of yours which the gods commanded to belong to you; may a stairway to the Netherworld be set up for you to the place where Orion is, may the Bull of the sky take your hand…§1716-§1717

So, the dead king has two roles:

1. First he is to travel to Abydos, the Holy City of his ancestors. There is no indication in this text as to how that was to be done, but it seems likely that the dead king would need some kind of boat for the journey.
2. Second, a stairway is to be provided for him to reach Orion in the Netherworld. Preceding texts have pointed out that Orion is in the Netherworld only by day, when Ra, the sun god, is shining. So, there more than an implication that KC(S), the 7 *seked* shaft, is intended as a stairway, the first part of a stairway, or that it leads to a stairway to the realm of Osiris in the Netherworld. Moreover, this journey may be made on any day, particularly when Re, the sun god is shining.
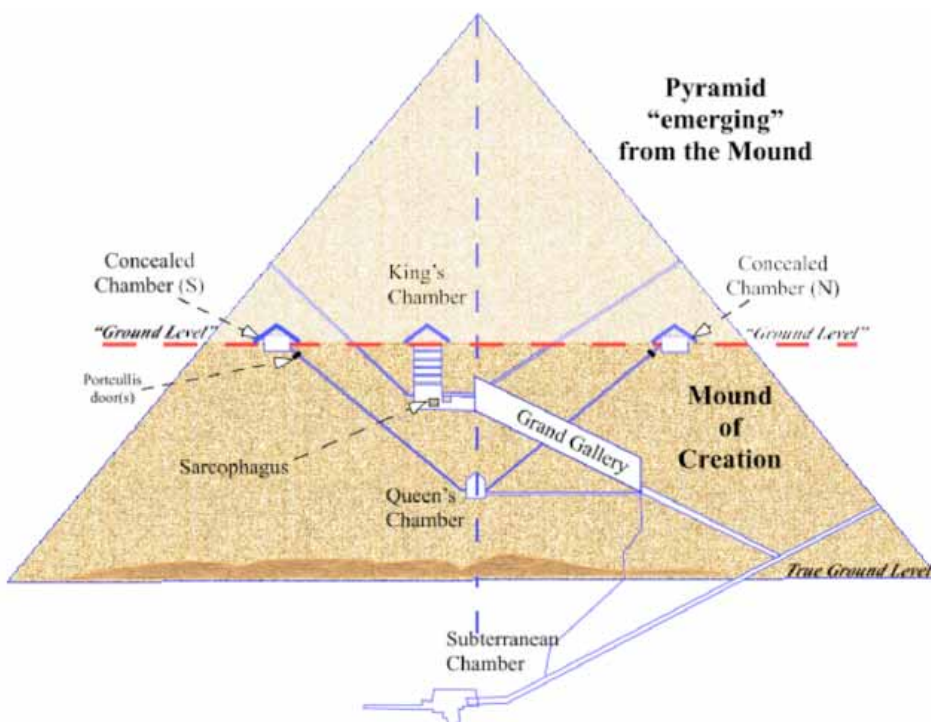
Pyramid on the Mound of Creation

According to Hitchins, there had to be an event or sequence of events that led to the purposeful design of the Great Pyramid. The Underground Chamber was dug out via a very long, and remarkably straight tunnel either to get as far away from the sun, or to get as near to the Netherworld as possible; these two may have been perceived as much the same thing. The construction of the underground chamber could not be completed, and the chamber was abandoned. With it went the protection from the sun's rays that the 30 m of limestone strata, and the natural mound on which the pyramid was built, afforded. That lost protection would have to be reconstituted if the dead king was to be able to see and reach the Netherworld, and to "preside as Horus presides."

The manner in which the protection was reconstituted is evident in the so-called relieving chambers.

These layers of granite were placed above the King's Chamber and above his sarcophagus so that many layers of rock protected king's *ka* as it would have been protected deep underground.

Granite may have been used as it was a harder, denser rock than limestone; less depth of granite might be expected to afford the same protection as the original 30 metres of limestone and the mound.

With this new protection, he would be able to both see and access the Netherworld via KC(S), or he could go to Abydos and the Land of Egypt via KC(N). Boats were provided, presumably for these journeys, buried in the boat pits on the southern side of the Great Pyramid.

The capstone on top of the relieving chambers, so redolent of the capstones of chambers dug from ground level, was designed to show the top of the Mound of Creation – see the figure above. Above the mound of creation was built a scaled down version of a full pyramid. Access to and from the King's Chamber was by passageways, suitable only for the king's *ka*, which entered the exterior sides of the scaled down pyramid, penetrated through the masonry and had a short horizontal section (like any other passageway) before entering the King's Chamber.

The figure shows two concealed chambers reached by passageways from the Queen's Chamber. These passageways are symmetrically placed about an east west axis, and the portcullis doors in both passageways are some 64 metres from their respective openings in the north and south walls of the Queen's Chamber. This puts the concealed chambers, if there are any, at about the same level as the capstones over the King's Chamber, offering some circumstantial support to the notion that this level represents a revised "ground level." The figure speculatively shows concealed chambers with their own capstones.

The QC(S) chamber is in the southern half of the pyramid at the junction between east and west, i.e., the living and the dead. It resolves their duality (brings them together) in the Netherworld. Similarly, the QC(N) chamber is in the northern half of the pyramid. It is also at the junction between the living and the dead, and resolves their duality on earth.

The figure also shows a portcullis door in each passageway. Portcullis doors generally appeared in threes at the time. There are remnants of three portcullis doors at the entrance to the King's Chamber, for instance. It would not be unreasonable, therefore to anticipate three portcullis doors in each of the Queen's chambers *ka* passageways, for that is what they appear to be.

According to Hitchins' explanation, the design reconciled the stellar and the emerging solar theologies. Khufu's Pyramid was designed to look from above, from the perspective of Ra, the sun god, as a simple pyramid emerging from a Mound of Creation. The chamber cap(s) showed where an underground chambers, or chambers, had been dug into the mound.

Khufu, however, still wanted to access the Netherworld and to take up his position as a god among the stars. He therefore protected, even perhaps *concealed*, his sarcophagus chamber from the penetrating rays of the sun god so that he, Khufu, could see and go to the Netherworld by day, even when the sun was overhead at its brightest and hottest. It was an ingenious solution, no doubt created by his chief architect Hemiunu.

Are there any concealed chambers? If so, what is likely to be found in them? Hitchins is uncertain. There is sufficient room for hidden chambers, and they could even be interconnected by passageways dug into the pseudo-ground-level. It is conceivable that Khufu's real burial is in one, and his canopic jars in the other. The chambers could contain early forms of the Pyramid Texts, to guide the king on his journeys, or even ritual food, wine and clothing. The two previous pyramids, both built by Khufu's father Snefru, had three chambers each, so it is unlikely that Khufu would settle for less: the two concealed chambers may have been simply for show, to have one more than his father. "The walls are of polished marble as the passageways approach the portcullis doors, indicating something important, and a degree of reverence; just what, remains to be seen. My best guess is that each of the chambers might contains some writing or sacred statues concerned with reconciling the living with the dead, most probably therefore representations of, or writings about, Horus and Osiris."

Derek Hitchins