Ancient Egypt's Theory of Everything
Part 3
Mathematics & Measurement
Robert Campbell 2009

Introduction:

In Part 1 it was shown how the Ancients Egyptians had insights into the cosmic order that relate to modern scientific knowledge of brain function. In Part 2 it was shown that the great pyramids at Giza reflected insights into scientifically known astronomical proportions between the Earth and the Moon and also to the nine Terms of System 4. Their mathematics is also of interest since they had no number for zero. Instead they designated special symbols for the number 1, 10, 100, 10000, 100000 and 1000000, so they had no need for a special digit for zero. Their number system was also not positional as it is in modern number systems that have a ones column, a tens column, a hundreds column, and so on. Their number system was based on nine. They wrote nine ones up to the symbol for ten, then nine tens up to the symbol for one hundred, then nine hundreds up to the symbol for one thousand and so on. They could express any whole number in this way although it was limited above nine million, since one million was their highest symbol. They probably had little or no use for larger numbers. Addition and subtraction was fairly straight forward but multiplication and division used a strange method of doubling. These methods date back to pre-dynastic Egypt over 5000 years ago.

They saw One as an expression of wholeness and multiples of the Nine Ones etc. as recurring fractals of unity. It is interesting that in decimal notation the number One divided by Nine repeats the digit 1 to infinity. With two exceptions for 2/3 and ¾ used for convenience, they also used only unit fractions of the form 1/n. Any complete fraction less than 1 can be expressed by adding up progressively smaller unit fractions. For example ¾ is equal to ½ + ¼ or to ½ + 1/6 + 1/12 and so on.

There is compelling evidence that Egyptian measurement systems were based on astronomical measurements. Their measurements also clearly indicate that they had a knowledge of Pi and irrational numbers. The Egyptian Royal Cubit is equal to the diagonal of a square with sides equal to one Egyptian Remen. In other words 1 Royal Cubit (RC) equals 1 Remen times the square root of two, which is an irrational number. It is known that the Remen is equal to 1.2165 feet and the Royal Cubit (RC) is 1.720 feet. With the discovery by Alexander Thom of the Megalithic Yard (MY) as a prehistoric unit of measurement it becomes apparent that the English system of measurements is related to the Egyptian system of measurements, since **1MY = 1foot + 1RC = 2.72 feet.**

If it is just coincidence it is remarkable that 1/1000 of one degree of arc around the earth's equatorial circumference is 365.244 feet in length and this is the number of days in a year. This may be related to resonances between celestial cycles of time and celestial dimensions. For example ancient measurement systems in Sumeria were based on the numbers 6 and 10. The number 60 was known as the soss and appeared in clay tablets dating back 5200 years. Our measurements of time, 60 seconds in a minute, 60 minutes in an hour, and also 360 degrees in a circle date from that time. It is a curious fact that the radius of the Earth is 6 x 660 miles. The distance to the Moon is 60 Earth radii or 6 x 60 x 660 miles. The diameter of the sun is 666.6 x 6 x 6 x 6 miles = 864,000 miles. The average orbital speed of the Earth around the Sun is 66,660 miles per hour. If you check a modern table of scientific data you will find that these proportions are quite accurate. Not only is it remarkable that these resonances exist in the heavens it seems that the ancients must have been able to make at least some astronomical measurements with great accuracy and chose their systems of measurements accordingly. Ratios of two thirds (0.666) also stand out between rotation

and revolution periods of the terrestrial planets as will be pointed out below.

Egyptian Calculations:

Egyptian numbers are formed by grouping similar characters. This makes it a simple matter to add and subtract. Multiplication and division are more challenging. They use a method of doubling.

For example to multiply 47 x 24 they would keep doubling 47 until they came to two numbers that corresponded to the numbers of doubling that added up to the other number, namely 24 as listed below:

```
47      1 (not doubled)
94      2
188     4
376     8*
752     16*
```

Since 8 + 16 = 24, which is the doubled addition that is equal to 24, they somehow knew that the corresponding doubled numbers 376 + 752 = 1128 is the correct product of 47 x 24. It is curious that 47 x 8 = 376 while 47 x 16 = 752 and that the sum of these two numbers is the right answer. Mathematicians still puzzle over how they knew this with certainty.

Division was also binary in reverse. For example to divide 329 ÷ 12 they would keep doubling 12 until they came to a number larger than 329. They would then subtract the next smaller number in the list from 329, then subtract the next smaller number that is also smaller than the result, and so on until they subtracted 12 with a number smaller than 12 left over as follows:

```
12      1* (not doubled)        329
24      2*                     -192
48      4                       137
96      8*                      -96
192     16*                      41
384     32                      -24
                                 17
                                -12
                                  5
```

This list indicates that 329 = (16+8+2+1) x 12 + 5
So 329 divided by 12 is 1+2+8+16 or 27 plus 5/12. They would have to express the remainder 5/12 as the sum of unit fractions so the Egyptian answer is 27 + 1/3 + 1/12.

Egyptian Fractions:

The Egyptians were able to write any fraction as a sum of unit fractions where all the unit fractions are different. Mathematicians have proven that there are an infinite number of ways to do this. For example consider the fraction 521/1050. 521 is less than ½ of 1050 so the largest unit fraction that can be subtracted is 1/3.

521/1050 - 1/3 = 171/1050 = 57/350

Repeating the process on the remainder 57/350 the largest unit fraction that is smaller is 1/7.

57/350 - 1/7 = 57/350 - 50/350 = 7/350 =1/50.

So the fraction 521/1050 may be written 1/3+1/7+1/50. Note that although the denominators of the remainders are getting bigger, the numerators are getting smaller and must eventually reduce to 1 and stop.

Also note that the same fraction can be expressed by any number of additional unit fractions. For example we can write the fractions that add up to one as 1 = 1/2 + 1/3 + 1/6.

- So if 3/4 = 1/2 + 1/4, we can expand 1/4 by dividing the fractions that add up to 1 in the equation above by 4. Thus 1/4 = 1/8 + 1/12 +1/24.
- Then we can write 3/4 = 1/2 + 1/3 + 1/8 + 1/12 + 1/24.
- We can then repeat the process by diving by the equation for 1 by 24 and so on.
- Although there are unlimited ways to expand unit fractions there are also methods to find the shortest possible series of unit fractions.

English Measurements & the Giza Pyramids:

At first glance one might be inclined to think that 12 inches to a foot, 3 feet in a yard, 1760 yards in a mile, 5.5 yards in a rod, and so on, were arbitrarily picked out of the air. Why have such strange relationships lasted for so long? There is a certain symmetry to the measurements however as noted below:

1760 yards (1 mile) divided by 5.5 = 320 = 8 x 40 rods = 80 x 22 yards.
220 yards (1 furlong) divided by 5.5 = 40 rods.
22 yards (1 chain) divided by 5.5 = 4 rods
1 acre = 22 x 220 yards = 4 x 40 square rods.

In researching the work of various others Ralph Ellis in his article on *Egyptian Measurements* suggests that the rationale behind the English system of measurements is based on Pi and is also related to the pyramids. The fraction which closely approximates the value of Pi and is often used is 22/7 = 3.1429. This compares with the actual value of Pi to five figures of 3.1416 so the error is only 0.04138 %. In examining the list above the number 22 stands out, as does the number 40.

As was pointed out in Part 2, Sir Flinders Petrie's very accurate survey of the Giza pyramid complex showed that the height of the Great Pyramid of Khufu (Cheops) was constructed such that its height (280 Royal Cubits) was the radius of a circle whose perimeter is equal to the perimeter of its base (4 x 440 = 1,760 Royal Cubits). Since the circumference of a circle is 2Pi x Radius this reflects the value of Pi as the fraction 22/7.

From measurements of the King's chamber and other dimensions in the Great Pyramid by John Greaves, Sir Isaac Newton realized that the King's Chamber was 10 x 20 Royal Cubits (or Thoth Cubits) so that the Royal Cubit is determined as equal to 1.719 (1.72) feet. (This is explained in his Dissertation on The Sacred Cubit of the Jews which is available on the net.)

It is apparent from Sir Flinders Petrie's survey that the perimeter of the base is 1760 Royal Cubits, which is also the number of yards in a mile. Although the units are not the same, the number 1760 is. Taking into account that the Megalithic Yard is one Royal Cubit plus one foot, a connection between the English system of measurements and Pi as it relates to the Giza pyramids is clear.

The Relationship of Various Ancient Systems of Measurement:

In his remarkable book *City of Revelation* (Ballantine Books 1972) the author John Michell points out the geometric relationship between the Megalithic Yard, the Remen, and the Royal Cubit. If a square is drawn with each side equal to one Remen, then the diagonal of the square is the hypotenuse of a right triangle and is equal to one Royal Cubit (RC). If the base of the square is bisected and that point joined to the opposite vertex of the right triangle, then the length of that line is equal to the radius of a circle with a diameter of one Megalithic Yard (MY).
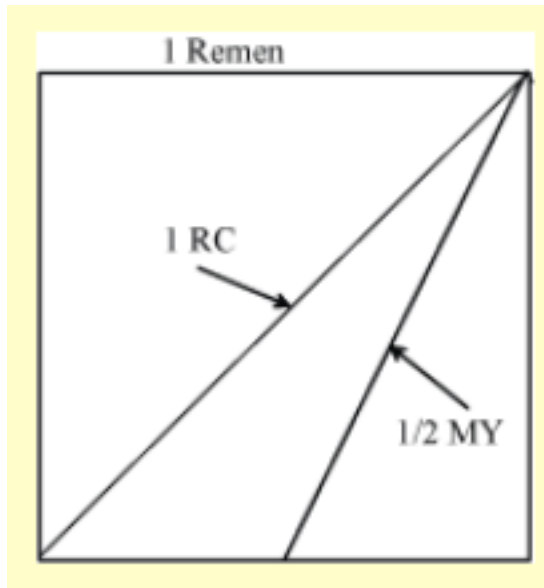

Figure 1

Michell further points out that if an arc with radius equal 1 RC is scribed using the left hand corner of the base as centre and the process is repeated as shown below (not to scale) then a series of square root relationships is derived that corresponds to various ancient systems of measurement as follows:
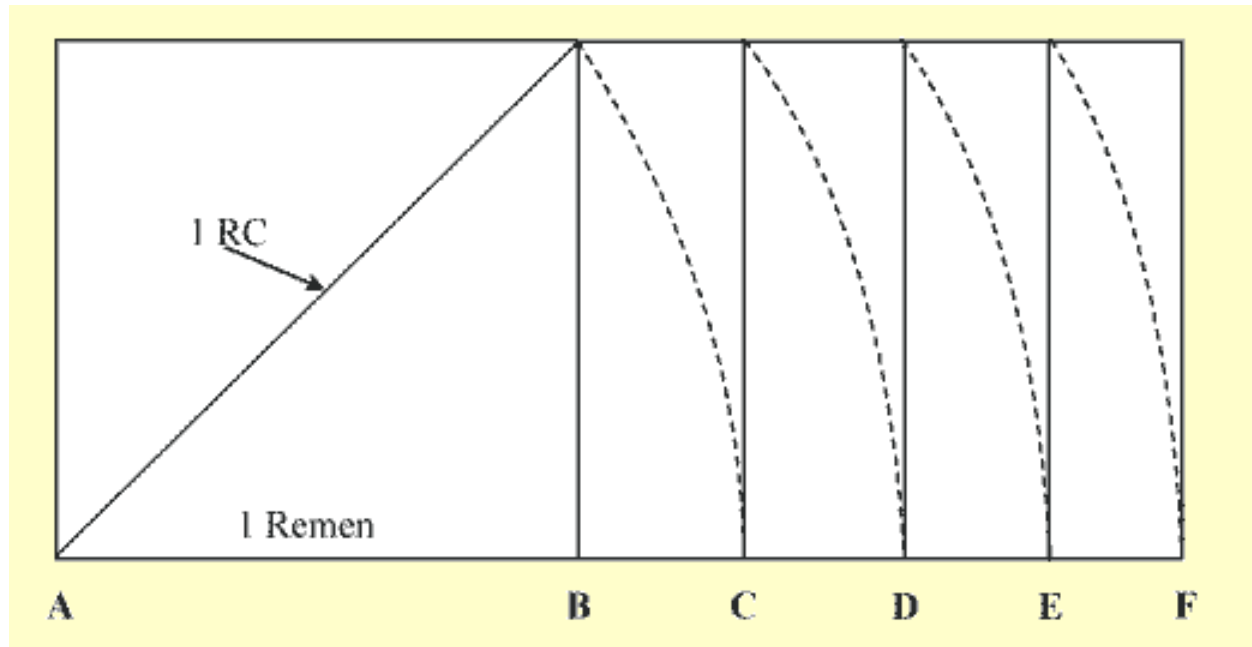
Figure 2

From Figure 2 above Michell points out the following:

AB = 1.2165 feet   = 1 Remen
AC = 1.2165 x root 2   = 1.72 feet = 1 Royal Cubit
AD = 1.2165 x root 3   = 2.107 feet = 1 Palestinian Cubit
AE = 1.2165 x root 4   = 2.433 feet = 1 Roman Pace
AF = 1.2165 x root 5   = 2.72 feet = 1 Megalithic Yard

Although the square root, cube root and fifth root are irrational their squares are not. The squares of the five units above are related by the product of 0.74 feet times 2, 4, 6, 8, and 10 respectively. Michell points out various significances of the number 74 as related to a series on which sacred numbers were built.

Michell claims that all over the world traditional units of measurements are related. He goes on to point out the value of the *pu* that still survives in Indo-China is given in L.D'A. Jackson's *Modern Metrology (available on the net)* as 2.7272 miles with the fraction repeating. Without knowledge of the pu's existence its former use in Britain was deduced by J. F. Neal, who called it the Megalithic Mile because the ratio is similar to that between the foot and the Megalithic Yard. Since the ratio between the dimensions of the Earth and Moon is 10:2.7272 the following relationships unambiguously exist.

Earth's diameter = 7920 miles
Moon's diameter = 792 megalithic miles
Perimeter of the square containing the circle of the Earth = 31,680 miles
Perimeter of the square containing the circle of the Moon = 3,168 megalithic miles.
Sun's diameter = 864,000 miles = 316,800 megalithic miles.

Although Michell goes on to point out many other relationships, this should be sufficient to show that the English system of measurements has cosmological origins in common with other measurement systems in the ancient world. This is especially so when understood in conjunction with the Squaring

of the Circle as described in Part 2 and its direct relationship to the dimensions of the Earth and Moon as they relate precisely to the proportions of the Giza Pyramids of Khufu and his son Khafra.

Resonances of the Terrestrial Planets:

It is worth briefly reviewing some extraordinary resonances between the inner four terrestrial planets as they relate to one another and the sun. These resonant relationships have only become apparent since accurate measurements have been possible in recent times. They generally reflect the ratio 2/3 between rotation and revolution periods. This is significant to ancient systems because of the special status accorded the numbers 6 and 10.

The same side of the moon always faces the Earth, so that it must rotate exactly once for each revolution. The scientific explanation is that gravitational torque on the moon's slightly out of round shape is believed to hold it in auto-rotation. The same was believed to hold Mercury in auto-rotation about the sun until it was discovered that its rotation period is 58.65 days which is 2/3 (0.6667) of its revolution period of 87.97 days. A year is precisely half a day on Mercury since it exposes opposite faces to the sun on each revolution. This defines night as opposed to day as one revolution each. It has no tilt to its axis and no seasons. One Venus day (117 Earth days) is 2/3 (0.665) of a Mercury day (175.94 Earth days). Now the rotation period of Venus is (243.17 Earth days) is 2/3 (0.666) of an Earth Year (365.24 days). Moreover Venus is in retrograde rotation and every time it comes directly between the Earth and the sun it exposes the same face toward the
Earth, even though exactly five Venus days have elapsed between such conjunction. Mars is outside of Earth without direct resonances with other planets, however there are 666.8 Mars solar days of 24.6587 hours in a Mars year. It is an extraordinary coincidence that resonances such as these should arise with the terrestrial planets. There is no explanation for them in classical dynamical theory or in theories of planetary formation.

There is also no convincing reason as to why the poles of the sun rotate in 33 days while the equator rotates in 25 days, contrary to traditional physics. The center should be rotating faster than the periphery when it accreted, just as skaters will spin faster when pulling extended arms in close to their sides. Is it coincidence that the average is close to the revolution period of the moon about the Earth? Also 98 % of the angular momentum in the solar system resides in the planets even though over 99 % of the mass resides in the sun.

Current scientific theories are based on the assumption of a continuous universe and there is very strong evidence that space and time are discontinuous. For example Zeno's arrow would never reach the target if space and time could be infinitely divisible. There must be a minimum increment to the differential in the calculus so that the arrow moves a discrete distance in a discrete increment of time. This is why position and momentum do not commute in Quantum Mechanics accounting for the Uncertainty Principle. In 1888 the mathematician Richard Dedekind showed that any defined continuous space is riddled with irrational discontinuities. In a discontinuous universe atoms are synchronously projected as a succession of independent space frames linked by light that together define space and time. This is necessarily so according to System 3 on the website. Universals interact with particulars is such a way that the same ratio of 2/3 crops up, just as it does in quark theory. A structural reason for this is indicated in the Conjugate and Triadic Identities associated with System 3.

Conclusions:

The Ancient Egyptian worldview was clearly related to profound insights into the cosmic order that resonates with the System of delineating the structural dynamics of how it works as described on this website. Their insights probed the structural workings of the human mind as outlined in Part 1.

And they reached out to astronomical proportions in the linear dimensions and related dynamics of the solar system as outlined in Parts 2 and 3. They were deeply concerned with a living methodology of integrating the subjective and objective aspects of phenomenal experience as one eternal whole. This theme is also apparent in their numerical system, mathematics, and system of measurements that indicates a common origin to all ancient measurement systems. The success of a worldview that prevailed for nearly 3000 years and that transcends our brief sojourn on this remote planet Earth is truly remarkable. It stands in stark contrast to modern scientific attempts to develop a Theory of Everything. The Big Bang creation of the universe from absolutely nothing, together with accidental random mutation and natural selection as the sole mechanism of evolution ultimately leaves us spiritually and morally bankrupt. Egyptian iconography clearly portrays our animal evolutionary roots but it aspires to bring these Earthly origins to a sustainable eternal balance with the cosmic order through a light hearted yet morally responsible approach to every aspect of living in keeping with how it works.