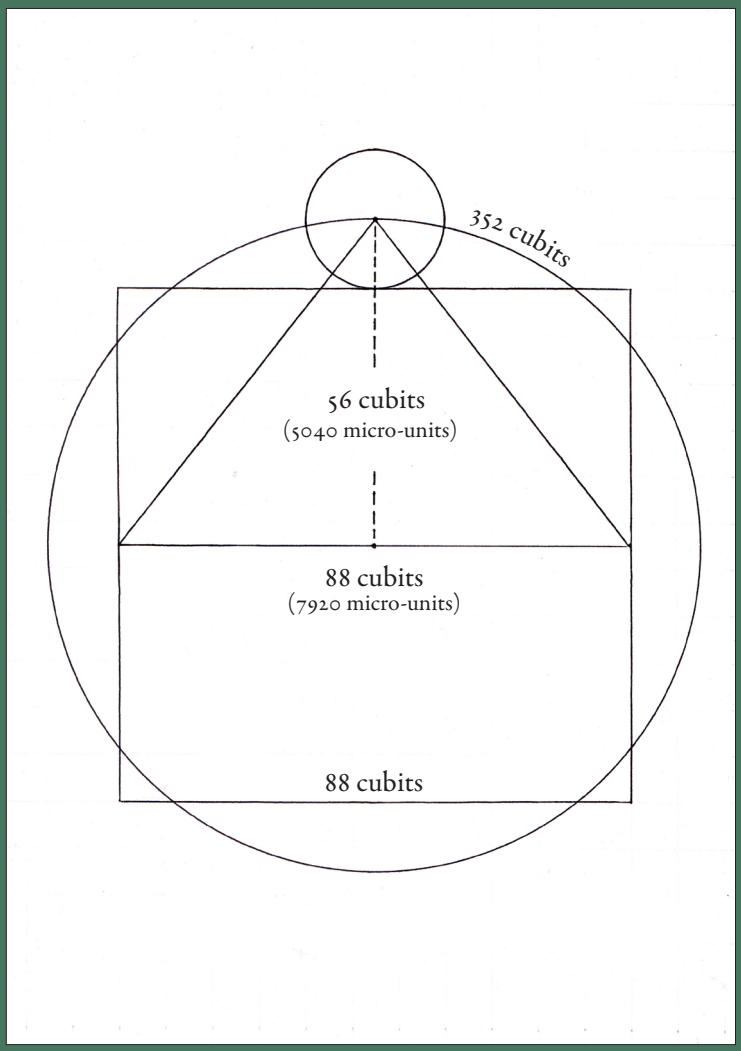
Chapter 14.

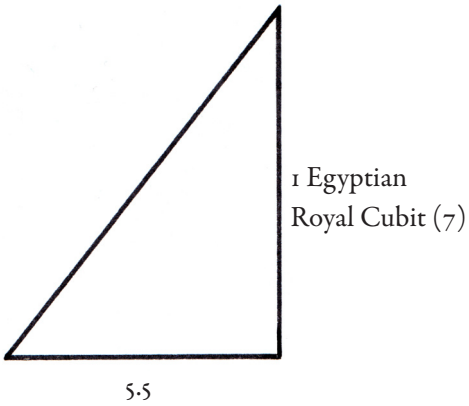
The Great Pyramid, the Earth-Moon Diagram and the Master Diagram of Wells Cathedral



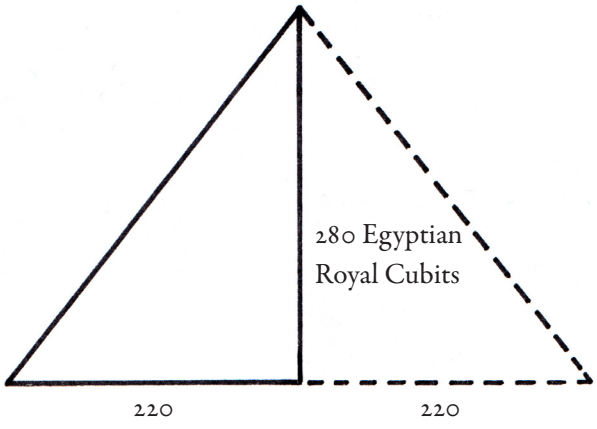
14.1 THE MASTER DIAGRAM AND THE SIZE OF THE EARTH AND THE MOON

There is a particular master diagram used in the Wells design that is based on the Earth-Moon diagram. So the diagram contains the pyramid triangle with a base of 11 and a height of 7. But the master diagram's use of the pyramid triangle also embodies a direct relationship with the size of the equivalent triangle in the cross-section of the Great Pyramid of Giza in Egypt.

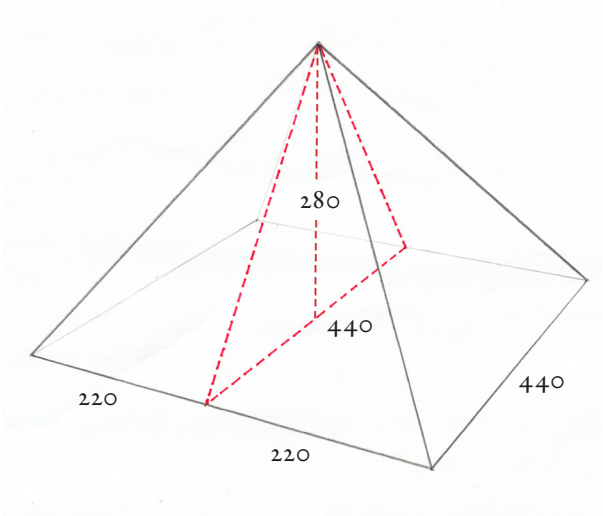
It is well accepted that the Great Pyramid uses a system of *seked* measurement, whereby there are 5½ horizontal units for every Egyptian royal cubit of height (effectively 7 units).



This translates in such a way that the height of the Great Pyramid is 280 cubits, whereas the edges of its square base are each 440 cubits.

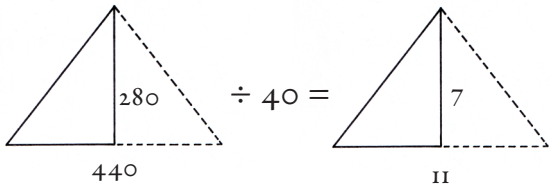


This is then reflected in the pyramid triangle, which also has a height of 280 cubits and a baseline of 440 cubits.



If the numbers 280 and 440 are then each divided by 40, the pyramid triangle's baseline of 11 and height of 7 become apparent.

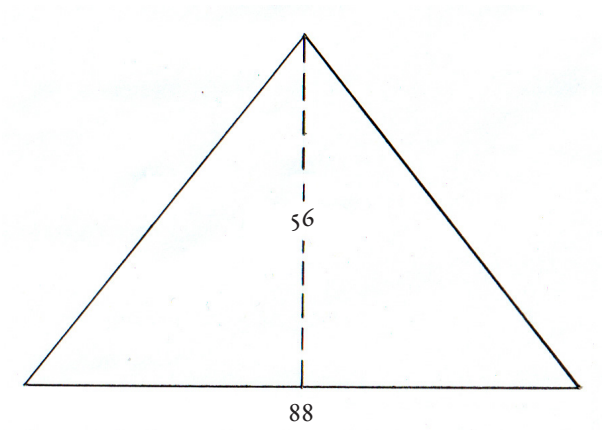
$$280 \div 40 = 7$$
$$440 \div 40 = 11$$



As to the measurements of the pyramid triangle in the master diagram at Wells, they can be derived from either of these two pyramid triangles mentioned above. If derived from the numbers used in the dimensions of the Great Pyramid, the Great Pyramid's number of cubits just need to be divided by 5.

$$280 \div 5 = 56$$
$$440 \div 5 = 88$$

So the master diagram's use of the Earth-Moon diagram is such that its pyramid triangle has a baseline of 88 cubits and a height of 56 cubits, and it is specifically the measurement unit known as the Egyptian royal cubit that is used within the design of Wells Cathedral.

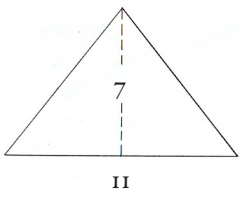


Another way of deriving these numbers 88 and 56 is to begin from the 11 – 7 pyramid triangle, although in this instance there needs to be a multiplication of 8:

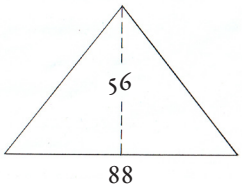
$$7 \times 8 = 56$$
$$11 \times 8 = 88$$

So the inter-relation of the Wells pyramid triangle to the 11 – 7 and 440 – 280 pyramid triangles occurs according to the 'Venusian' Fibonacci numbers 8 and 5, which together produce 40. (see diagrams to the right)

The master diagram is used horizontally in the quire/chapter house area of the Wells design, as well as vertically on the cathedral's west front. It is also used horizontally in the nave in such a way that the triangle shares its baseline with the triangle that is used vertically on the west front. So in effect, the nave triangle is simply the west front triangle that has been laid down flat on to the nave. This technique of having the same diagram in both elevation/section (vertical) and plan



× 8



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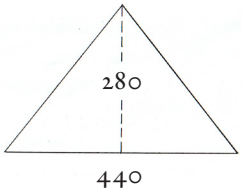
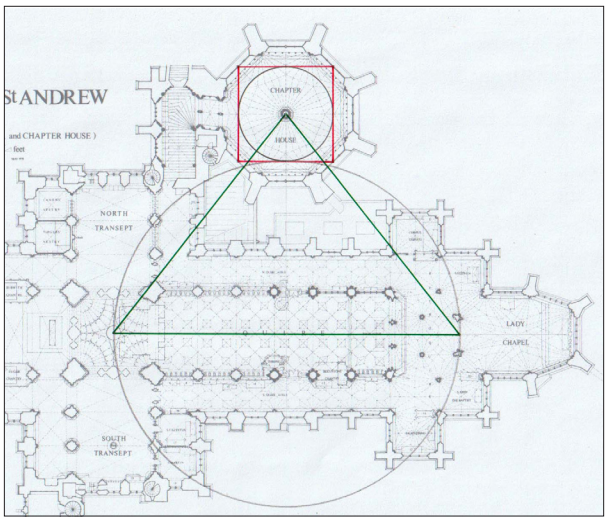
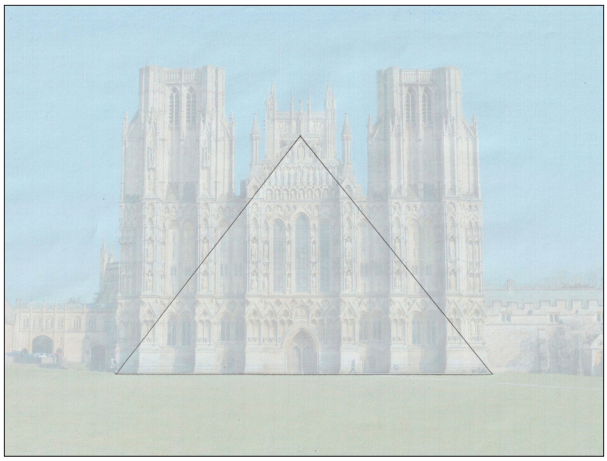


(horizontal) is one of the few design techniques that is actually known to have been used by medieval cathedral designers according to the small number of existing diagrams and written descriptions.[1]

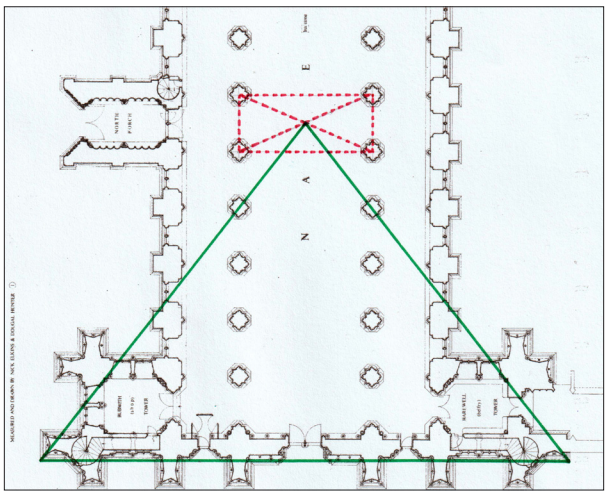


The pyramid triangle Master Diagram used in the quire/chapter house area

1. See *The Secret of the Mediaeval Masons* by Paul Frankl.



The Pyramid triangle Master Diagram used on the west front



The pyramid triangle Master Diagram used in the nave

Returning to the Wells master diagram and its pyramid triangle with a baseline of 88 cubits and a height of 56 cubits, we will now consider one of the most remarkable findings within the whole of this research. The designer of Wells Cathedral appears to have known the precise size in mileage of the Earth and the Moon, and used this knowledge numerically within the design. The reason for suggesting this inevitably links in with the use of the Earth-Moon diagram, and it can be demonstrated very simply with the cubit measurements of 88 and 56.

In section 12.2 the units of measurement were described – specifically three different foot-units and one particular cubit. As already mentioned, the cubit used in the design is the Egyptian royal cubit, and this makes metrological sense considering that the pyramid geometry used at Wells fractionally relates to the size of the Great Pyramid in Giza, which also uses this type of cubit.[2] It was explained in chapter 12 (sec 12.2) that the three foot-units and one cubit all share a very small micro-unit, which is just over 1/5 inch in size. The Wells cubit consists of 90 of these micro-units, and with this simple piece of information it becomes possible to calculate how many micro-units there are within the Wells master diagram mentioned above.

The number of micro-units in the baseline of 88 cubits is calculated in the following way:

88 cubits × 90 micro-units = 7920 micro-units

The number of micro-units in the pyramid triangle's height of 56 cubits can then also be calculated in a similar way:

56 cubits × 90 micro-units = 5040 micro-units

With these calculations it becomes possible to suggest with a certain degree of confidence that the Wells designer knew the Earth-Moon diagram in its entirety – including the mileage measurements of the Earth and the Moon. How the designer would have been in possession of such detailed and seemingly advanced cosmological knowledge is not so easy to say, and perhaps impossible to ever know. However, this should not guide our opinion of whether the designer was actually in possession of this knowledge (or not), because the mathematically provable circumstantial evidence of its use within the design is far too pronounced for it to be passed off as a mere random coincidence.

2. To be precise, the cubit used in the Great Pyramid is enlarged by the micro-variation 440:441. This will be looked at in a little more detail later on.

On a personal note, I was quite surprised to make this discovery, and can guarantee that I did not mathematically arrange for such a cosmic calculation to be present. The size of the micro-unit was actually worked out within a different area of the cathedral. To be precise, it was worked out during the analysis of the nave a few years before discovering the cosmic measurement described above. At a later date I then happened to apply this micro-unit to the pyramid triangle in the Wells master diagram and found by chance that it yielded the numbers associated with the mileage measurements of the Earth and the Moon that are specifically present in the Earth-Moon diagram. Can this possibly be a random coincidence?

The use of the ratio 56:55

Having now introduced the master diagram with its pyramid triangle of 88 – 56 cubits, another level of detail needs to be described in relation to its use. In all three uses of this particular master diagram in Wells Cathedral the pyramid triangle has been altered by the ratio 56:55. In short, the quire/chapter house diagram is enlarged by the ratio 55:56, whereas the nave and west front triangle is reduced in size by 56:55. The pyramid triangle used within the design of the moat walls that surround the Wells Bishop's Palace is also adapted by this ratio.

In all of these architectural examples, the built fabric does actually also include measurements that derive from the original un-adapted master diagram. So for example in the quire/chapter house area, the measurements used in the ground plan reflect both the dimensions of the master diagram, but also the enlarged version of the master diagram. Whereas in the nave and west front area the dimensions of the master diagram are used alongside measurements that derive from a reduced version of the master diagram.

The relationship of 56:55 presents an interesting numerical theme within the overall design. First of all, it expresses a relationship between rational approximations of pi and phi. But more to the point, these approximations of pi and phi become manifest within two particular pyramid triangles that are only very slightly different to one another. Indeed, if one of them has a height of 56 the other has a height of 55. This brings us back to the Wells master diagram, with its triangle that has a baseline of 88 cubits and a height of 56 cubits. As mentioned earlier, this triangle is effectively derived from the pyramid triangle with a base of 11 and a height of 7, which is itself mathematically related to the 22/7 approximation of pi. However, as shown in chapter 7 (p.119), if it were said that the pyramid triangle has a baseline of 88 and a height of 55 rather than 56, this then reflects a Fibonacci pyramid triangle with a base of 8 and a height of 5. This can be shown simply by dividing the numbers 88 and 55 by 11:

$$88 \div 11 = 8$$
$$55 \div 11 = 5$$

Another arithmetic way of looking at this relationship can be demonstrated by using the measurements of these two pyramid triangles. In dividing each triangle's baseline measurement by its height, a decimal calculation is reached:

$$11 \div 7 = 1.571428$$
$$8 \div 5 - 1.6$$

If these two results are now both multiplied by 35 (35 being the product of 7 and 5, which are the heights of the two pyramid triangles) the calculation thus results in the numbers 55 and 56:

$$1.571428 \times 35 = 55$$
$$1.6 \times 35 = 56$$

But perhaps the most intriguing use of the 56:55 ratio along with the Earth-Moon diagram is in what appears to be the intentional locating of St Andrew's Cathedral in St Andrews, Scotland at a particular latitude that is geometrically significant in relation to the spherical

form of Planet Earth. It has been mentioned on various occasions that St Andrew is also the saint to whom Wells Cathedral is dedicated, and so it appears that the use of 56:55 in its geometric design is directly connected to this dedication because it also appears in relation to the latitude of St Andrews in Scotland, where there is an old legend concerning the presence of the Apostle's remains. These two St Andrews cathedrals started to be built at a similar time to one another – St Andrews in Scotland in 1158, and St Andrews in Wells in 1175. The details of this will be dealt with in the next chapter.

Returning to the various adaptions of the master diagram by the ratio 56:55, we will now look at how this occurs.

The Quire and Chapter House Area

To demonstrate these measurement adaptions there is a need to express the measurements in micro-units at first, because the adaptions sometimes cause particular measurements to change the unit by which they can be defined. So for example the pyramid triangle's baseline consists of 7920 micro-units, which as shown earlier calculates as 88 cubits. However, when the baseline is lengthened by 55:56 the total of 7920 increases to 8064, and this new number of micro-units does not resolve into the cubit because 8064 micro-units ÷ 90 micro-units = 89.6 cubits. But 8064 does resolve into the larger of the three foot-units that are used within the design – i.e. the greater foot, which consists of 56 micro-units:

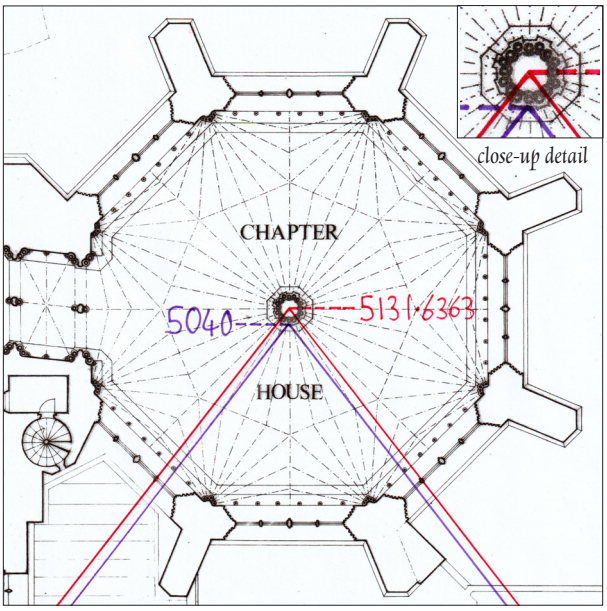
$$8064 \div 56 = 144$$

But as the above calculation makes clear, it doesn't just resolve into that particular foot-unit, it also happens to produce a significant Fibonacci number that is also very significant within the Bible's description of the Heavenly Jerusalem in the Book of Revelation.[3]

However, the height of this enlarged triangle contains a micro-unit total that doesn't resolve into any of the foot or cubit units:

$$(5040 \div 55) \times 56 = 5131.636363$$

The difference between 5131.636363 and 5040 is 91.636363 micro-units, and this difference between the two heights of the pyramid triangle does actually appear to govern the radial measurement of the pillar in the chapter house, which very precisely displays this measurement when taken from the outer edge of the central marble column base. So the height of this pyramid triangle when taken from the outer edge of this marble column base could be described as 5040 micro-units (in purple). Whereas if the measurement goes all the way into the centre of the pillar, it is 5131.636363 micro-units (in red). Herein lies an actual embodied example of the 55:56 ratio in relation to the height of this particular pyramid triangle.



The chapter house pillar defining the difference between the two pyramid triangles with heights of 5040 and 5131,636363 - a difference of 55:56

However, this micro-unit total of 5131.636363 does seem at first to be rather non-descript in the sense that

3. See Revelation 21:17.

it doesn't appear to resolve into any coherent unit of measure. But the apparent resolution of this on the part of the designer is quite brilliant. Rather than micro-varying the measurement itself to conform with a measurement unit of some sort, the designer appears to have micro-varied the cubit in such a way that it ends up producing a very significant measurement indeed. The cubit appears to have been very slightly shortened, which allows for there to be slightly more cubits fitting within the measurement limit of 5131.636363 micro-units. If 5131.636363 is divided into the 90 micro-units of a cubit it produces a measurement of 57.0181818 cubits. But if the cubit is shortened by the musical comma 225:224 the total measurement becomes 57.272727 cubits. This new number is the same as the radius of a circle that has a circumference measuring 360 cubits.

This micro-variation can also be understood through the pyramid triangle's baseline measurement of 8064 micro-units - which, as just recently mentioned, can also be defined as 144 greater-feet.

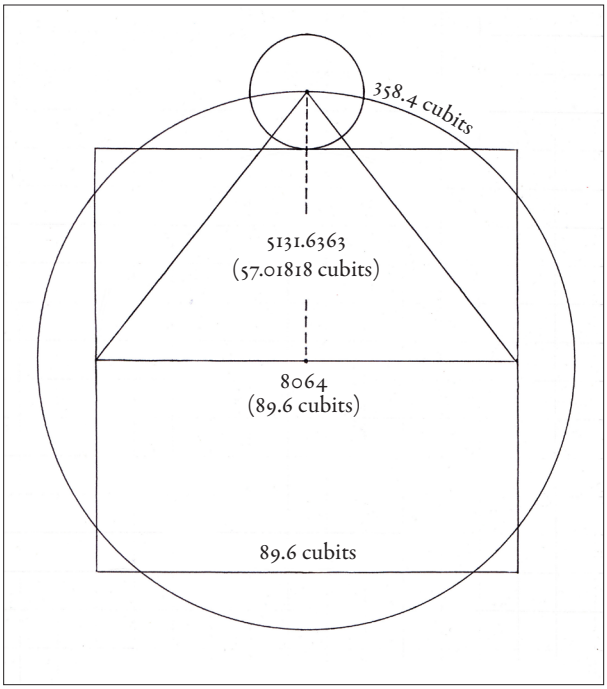
It was shown a little earlier how 8064 micro-units resolves into 89.6 cubits, each consisting of 90 micro-units. If 90 and 89.6 are both multiplied by 2.5, their relationship expresses the musical comma mentioned above – 225:224 – which is known in modern tuning theory as the *septimal kleisma* or *marvel comma*.

But more importantly this musical comma is significant within the musical theory of Ernest McClain, who suggested that Plato's *Laws* dialogue is based on a particular system of seven-limit musical tuning. More will be written about this later, but suffice to say here that McClain's suggested musical tuning system, which he associates with Plato's mythical city *Magnesia*, appears also to have been used in the design of this particular area of Wells Cathedral.

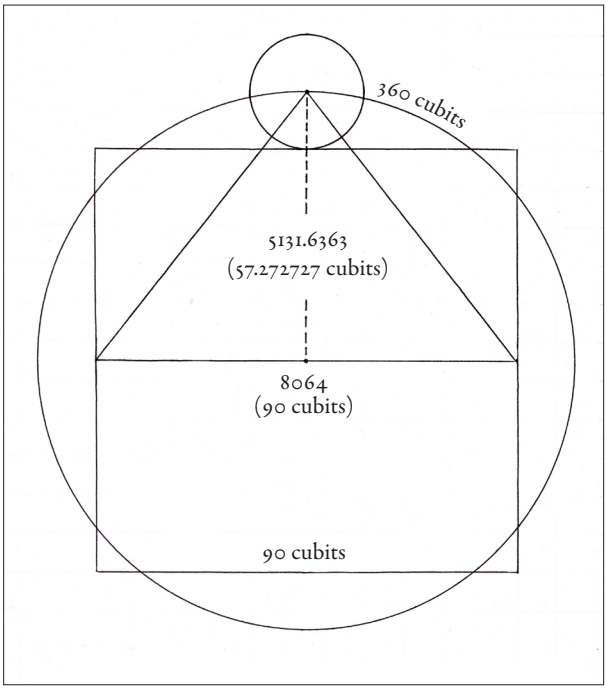
So as mentioned, the relationship of 90 to 89.6 is the same as 225:224. The designer appears to shorten the length of the cubit by this ratio, so that the cubit consisting of 90 micro-units is shortened to 89.6 micro-units. The consequence of this is that, as well as being defined as 144 greater-feet, it can now also be said that there are 90 cubits in the baseline of the enlarged pyramid triangle, rather than 89.6 of them. This little swapping of measurement numbers does something very significant in the wider scheme of the design which again reflects a circle with a periphery of 360. Looking at the Earth-Moon diagram, it first needs to be re-emphasised that the peripheral measurement of the Earth-square is the same as the circumference measurement of the larger circle, thus producing a *squaring of the circle*.

The key point here is that the baseline of the pyramid triangle is also the same as the edge-length of the Earth-square. So therefore, as a result of the micro-varying of the cubit, if the baseline of the pyramid triangle has been enlarged from 89.6 cubits into 90 cubits it can be pointed out that the edge length of the Earth-square is now also 90 cubits. This in turn means that the entire peripheral measurement of the square is 4×90 cubits, which is equal to 360 cubits. But this then must also mean that the larger circle within the diagram has gone through a similar transmutation into the same measurement of 360, because it has the same peripheral measurement as the Earth-square. This then returns us to the radius of this circle which as just mentioned becomes changed from 57.0181818 cubits to 57.272727 cubits as a result of the shortening of the cubit by 225:224. A circle with a radius of 57.272727 has a circumference of 360.

Over the page there are 'before' and 'after' diagrams - in the sense of 'before the mirco-varying of the cubit by 225:224' and 'after...'



'Before' the cubit is reduced by 225:224 (i.e. from 90 to 89.6 micro-units) the micro-unit numbers 8064 and 5131.63 are defined by a cubit of 90

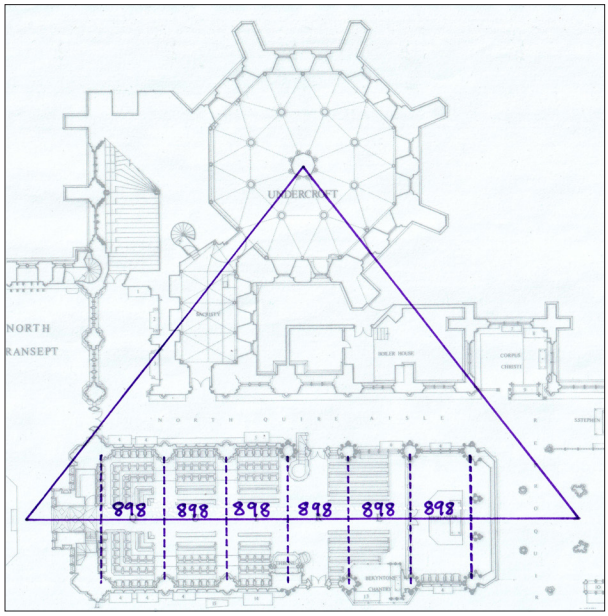


'After' the cubit is reduced by 225:224 (i.e. from 90 to 89.6 micro-units) the micro-unit numbers 8064 and 5131.63 are defined by a cubit of 89.6

With *geo-metria* or 'Earth-Measure' in mind this measurement of 360 reflects the number of degrees in the circumference of the Earth. The measurement of 90 cubits then expresses the number of degrees between the equator and the poles. It also brings the whole diagram into yet more conformity with Ernest McClain's musical theory of Plato's *Magnesia.*

A very reasonable question now arises: how can it actually be known that the designer even made this musical micro-variation between 90 and 89.6? After all, the pyramid triangle's baseline measurement used in the design is 8064 micro-units, and this can be seen as consisting of either a cubit of 90 or 89.6 micro-units – so who is to say that the designer actually made this micro-variation of the cubit? The answer lies in the fact that the use of the cubit in the design of the quire - which lies at the heart of this area of the design - actually embodies the arithmetic mean between 89.6 micro-units and 90 micro-units.

Each of the six bays of the quire has an east–west measurement of 10 cubits, and together these six bays produce the 60 cubit length of Solomon's Temple as it is described in the Old Testament. However, when all six of these bays are measured in-situ, this clearly shows that the size of the cubit used by the builders is 89.8 micro-units. So each 10-cubit bay is 898 micro-units in its east-west measurement.



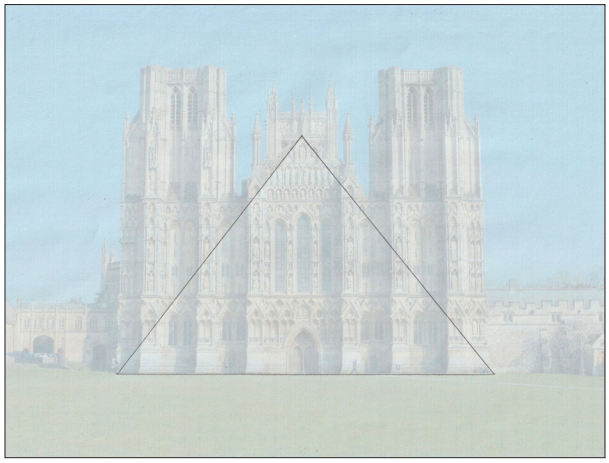
The quire contains six bays with east-west measurements of 10 cubits. The cubit contains 89.8 micro-units which is the arithmetic mean between 90 and 89.6. So each 10-cubit bay accordingly contains 898 micro-units.

In doing this the designer is effectively incorporating both of the theoretical cubit measurements of 89.6 and 90 – or, put another way, the standard cubit size as well as its shortened micro-variation. As shown earlier, 8064 can be produced by multiplying 90 by 89.6. But it can also be produced pretty much exactly via the square of 89.8:

$$89.8 \times 89.8 = 8064.04.$$

The 0.04 excess in the above calculation is the equivalent of around 1/110 inch, and is therefore negligible in practical terms.

The west front



The pyramid triangle underlying the design of the west front

It has already been mentioned that the pyramid triangle used on the west front is also used in the nave in such a way that both triangles share the same baseline. So the nave triangle is simply the west front triangle folded down horizontally on to the nave.

Much like the use of the master diagram in the quire/chapter house area, this triangle that underlies the design of the west front is adapted by the ratio 56:55. As will become clear, this shows itself in the triangle's baseline measurement but seemingly not in the height, which remains as 56 cubits as it is in the unadapted master diagram.

As for the baseline measurement, an extra adaption is seemingly required because the reduction of 7920 micro-units by 56:55 brings about the apparently nondescript measurement of 7778.571428 micro-units. But however nondescript it might seem, this measurement does actually appear in the width of the west front between the north and south side-walls of the west front. Interestingly, such an adaption requires the division of the cubit into 28 'fingers', which is exactly the division used on the Egyptian royal cubit measurement rods that still exist in various museums. But before we look at this detail, we need to look at the bottom of these walls where there is an extra footing that increases the width measurement of the west front, and this actually increases the measurement to a more commensurable number of units – 150 English feet to be precise, which is 7875 micro-units.

The bottom corner of the west front (northern-side). Its footing down on the ground corresponds to the 7875 micro-unit measurement (150 feet) whereas its vertical side-wall further up corresponds to 7778.571428.

This footing of the walls which increases the width of the west front to 150 feet is in fact also a reduction of the original 7920 baseline by 176:175. This ratio will be written about later, but for now it is enough to say that it is one of the few very important ratios in the cosmic canon of measure.

When the master diagram's width of 7920 micro-units is reduced by 176:175 it becomes 7875 – which, as mentioned above, is the same as 150 English feet:

$$7875 \div 52.5 = 150$$

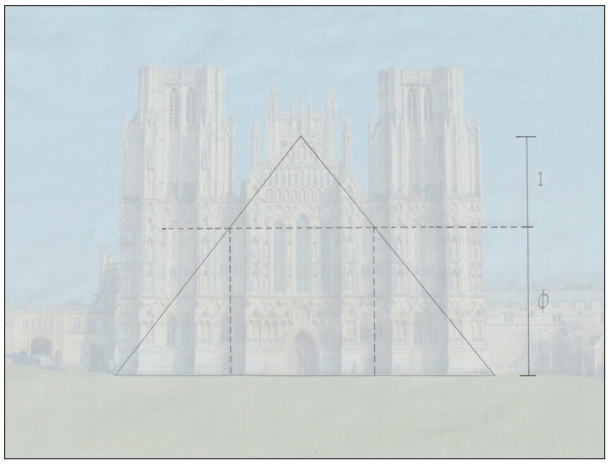
The number 7875 is 45 micro-units smaller than 7920. So it can simply be said that this reduction by 176:175 decreases the master diagram measurement of 7920 by half a cubit. But this half-cubit shows itself in terms of a reduction of a quarter of a cubit (22.5 micro-units) on each side of the west front, which together account for the total reduction of half a cubit.

As already mentioned, this reduction in width-measurement of the west front is present only if the measurement is taken from the footing of the walls that meet with the ground. But the vertical walls that rise up from this footing produce the slightly shorter and seemingly obscure measurement of 7778.571428 micro-units that result from the reduction of 7920 by 56:55. This measurement doesn't reconcile with the cubit or any of the three feet. But the fascinating resolution of the measurement into commensurability takes place through the division of the cubit into 28 fingers.

To begin with it can first be pointed out that the quarter-cubit reduction on each side of the west front is going to measure 7 fingers – because 7 is a quarter of 28 and therefore a quarter of a cubit.

What can then be pointed out is that if a similar reduction on each side of the west front consisted of 22 fingers rather than 7 it would give the measurement 7778.571428 micro-units. So despite appearing at first to be obscure, this measurement can actually be recognised as commensurable if the cubit is divided into 28 fingers – just as the Egyptian royal cubit is. The fact that these two reductions correspond to 22 and 7 is yet another interesting use of the numbers of pi, and as will become clear later on, so is the ratio 176:175.

Having considered the width of the west front, some golden section lines will now be used to define the position of the two smaller west doors on the west front. In section 8 (p. 156) it was pointed out that the pyramid triangle on the west front uses various golden section lines that form a 'square-ish' rectangle. The lines of



The 'square-ish rectangle' formed of golden ratio lines within the triangle

this rectangle divide the height of the pyramid triangle as well as its two half-baselines at their respective golden sections. The golden section division of the triangle's height coincides with the springing line of all the upper arches on the west front, whereas the golden section divisions of the triangle's two half-baselines coincide with the two side west doors.

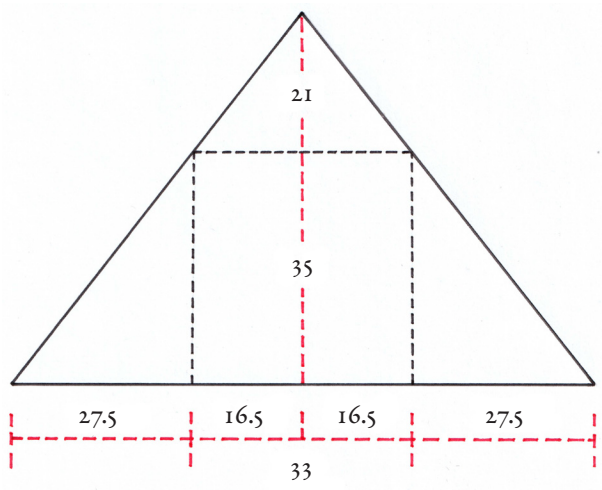
The metrology of these measurements involves a Fibonacci rationalisation of the golden section, in which the lines actually create divisions of 8/5, which therefore rationally reflect the golden section. So for instance the 56 cubit height of the pyramid triangle is divided at 35 cubits because $56 \div 1.6 = 35$. So the springing line of the upper arches is 35 cubits above the ground.

As was just shown, the baseline of the pyramid triangle is shortened by half a cubit, which means that is becomes 87½ cubits – which is also 150 English feet. But in the case of these 8/5 'golden section' lines we need to look upon the baseline of the pyramid triangle as 'theoretically' remaining at 7920 or 88 cubits.

Each half-baseline is accordingly 44 cubits, and when these are divided by 8/5 (i.e. 1.6) they divide each half-baseline of 44 cubits up in 27½ and 16½:

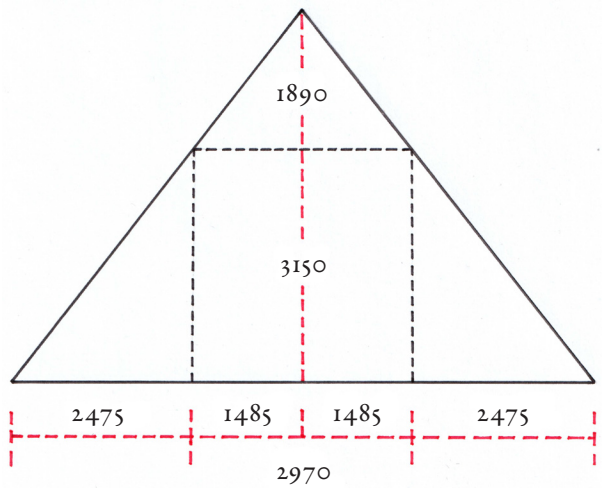
$$44 \div 1.6 = 27.5$$

$$44 - 27.5 = 16.5$$



This then means that the distance between the two vertical lines of the 'square-ish' rectangle is 33 cubits, because 2 × 16.5 = 33. (see diagram above)

The square-ish rectangle is 35 cubits in height and 33 cubits wide. This 33-cubit measurement is the distance between the middle vertical axes of the two side west doors. The fact these two doors both divide their respective half-baseline of the pyramid triangle at the 8/5 division means that the mid-vertical axis of each doorway divides each half-baseline of 3960 into 2475 and 1485. So it could be said that these two doorways are both 'theoretically' 2475 micro-units from their respective extreme ends of the west front, and they are also 1485 micro-units from the middle of the main west door in the middle of the west front.



The word 'theoretically' was used because the distance of 2475 is not materially present due to the reduction in width of the west front. So the side door's 8/5 divisions of the west front occur in relation to an 'imagined' measurement of 7920. But having said this, both a golden section and an 8/5 are also expressed in relation to the shortened version of the west front's width.

As was just mentioned, the width of the west front has been reduced so that it is a quarter of a cubit shorter at either end. A quarter of a cubit is 22.5 micro-units, so there is a need to reduce the 2475 measurement by 22.5, which results in an actual in-situ measurement of 2452.5, and this is then the actual material measurement between each doorway and its particular extreme end of the west front.

The reduction of each half-baseline by 22.5 micro-units reduces 3960 to 3937.5.

If there were going to be a measurement made that involved these adapted measurements of the pyramid triangle baseline, it would be as follows:

$$3937.5 \div 2452.5 = 1.6055$$

This closely reflects the 1.6 measurement of 8/5, but is no longer precise due to these micro-variations in the width of the west front. Something quite brilliant then seems to happen in the design, which involves a coinciding of the golden section of each actual doorway hole itself with the golden section divisions that the doors produce on the west front.

The width of the doorway holes are just a few micro-units more than 150. One is around 152 micro-units and the other around 153.5. This presents a question as to why they are not closer to either 150 micro-units, which is 3 lesser feet, or 157.5 micro-units, which is 3 English feet. A measurement this small is presumably a lot easier to make very accurate in the building process, so the fact that it is seemingly a few micro-units off suggests an intentional micro-variation.

It might at first appear to be a mean of some sort between the two different 3-foot measurements that were just described, but this would take the measurements into quite a fragmented state because, for instance, the arithmetic mean between 150 and 157½ is 153¾. So in the end it seems more likely that the intended measurement on the part of the designer was 152 micro-units, and the rationale for suggesting this particular measurement will now be explained.

The 'original' measure of the doorway hole could be said to be '8/5 cubits' – or in other words 1.6 cubits. This use of 8/5 is naturally in keeping with the general system of measure that is being used here even if 1.6 cubits may at first sound a little unconventional.

$$1.6 \times 90 = 144$$

So the 'original' width of the doorway hole could be described as 144 micro-units, which is a significant number within the description of the Heavenly City – into which this very doorway symbolically leads. But for reasons that will soon become apparent this measurement appears to have been increased by a ratio of 18:19, whereby the 144 increases to 152. The designer's brilliance now becomes clear: if this measurement of 152 is itself divided by 8/5, it divides into 95 and 57. This dividing of the doorway hole's width by 8/5 involves a shift of 19 micro-units away from the mid-vertical axis of the doorway to its golden section, and therefore also 19 micro-units closer to the extreme end of the west front. So the measurement of 2452.5, between the middle axis of the doorway and the extreme end of the west front, needs to shortened by 19.

$$2452.5 - 19 = 2433.5$$

So the final calculation can then be made, showing the golden section division of each half-baseline of the west front pyramid triangle. It involves a single measurement that coincides both with the 8/5 division of the doorway hole as well as an exceedingly close golden section division of the half-baseline itself:

$$3937.5 \div 2433.5 = 1.6180399$$

This rational approximation of the golden ratio is so very close as to accurately reflect it to five decimal places. The closeness of this approximation appears to be the reason why the doorway hole was increased by a ratio of 18:19 from 144 to 152. If the doorway hole had remained at 144 micro-units, there would not be such an accurate golden section division. It would have been 1.61738, which is still a very good approximation, although it only reflects the golden section to two decimal places rather than five. As to the numbers 18 and 19 they are both cosmologically significant in relation to the Saros and Metonic cycles.

The nave

We will now look at the way in which this pyramid triangle interacts with the nave. The triangle is effectively horizontalised from the west front down to the ground so that it now covers the western half of the nave. But having done this, we first need to return to the west front to consider an apparent idiosyncrasy that it contains. The reason for this idiosyncrasy can immediately be seen when viewed from inside the cathedral building in the nave.

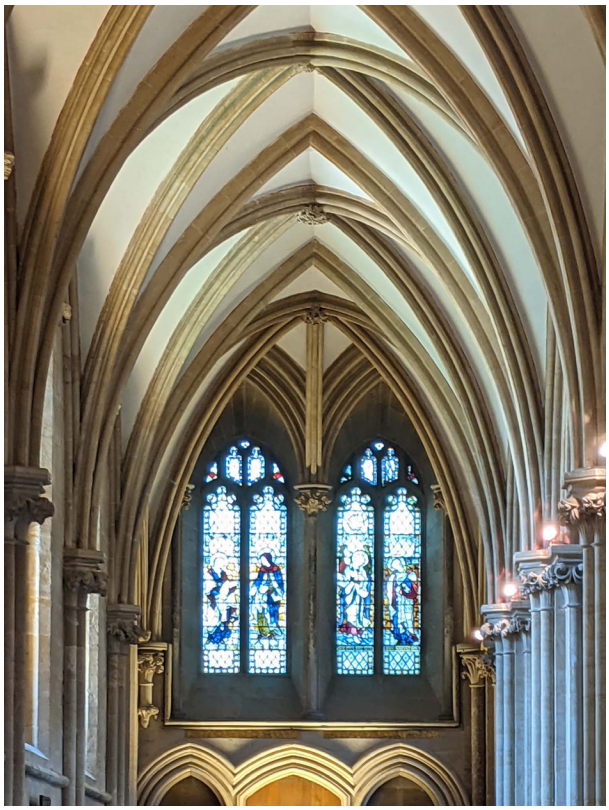
When standing outside and in front of the side west doors it becomes apparent that the two windows immediately above each doorway are not centred above it. But having said this, when one looks even further up and above these two windows, the axis of the architecture returns back to being aligned with the middle axis of the doorway again. This happens in an inversely similar way with both side doors. (see images on the next page)

When viewed from the inside of the building, the reason for this becomes clear. It is because the windows are actually in line with the middle axes of the side aisles. This was presumably a decision on the part of the designer concerning 'visuals', in the sense that it would have stood out as more of an irregularity from the inside if the windows had been in aligment with the west front rather than the internal side aisles. From inside the cathedral the windows are much more visible as a result of the light they let in, compared to when

The north-west side-door and its windows directly above which are out of alignment with the door as well as the architecture above the windows….

….the inverse equivalent misalignment occurs with south-west side-door

Looking at the north-west door from the inside, its misalignment in relation to the windows is visible. But the windows can be recognised as being in alignment with the central axis of the side aisle as seen within the vault.



This image shows a close up of the south west door area. The door arches are illuminated by a spotlight and are clearly out of alignment with the windows which again are in alignment with the vault's central axis.

they are seen as part of a very elaborate west front. Along with this, and when viewed from the inside, the relatively small doorway below the windows may be out of line with the windows, but the light passing through them makes the door and its irregularity of position less prominant. The irregular position of these windows when viewed from the outside is therefore not as obvious as it would have been had an irregularity been visible from the inside.

But the question we are left with is why this irregularity is present in the design at all. It wouldn't have been particularly difficult to take account of such an irregular meeting of two different parts of the cathedral to make the irregularity less noticeable. So we are again left with the possibility that it is an intentional irregularity used to express a particular principle of measurement.

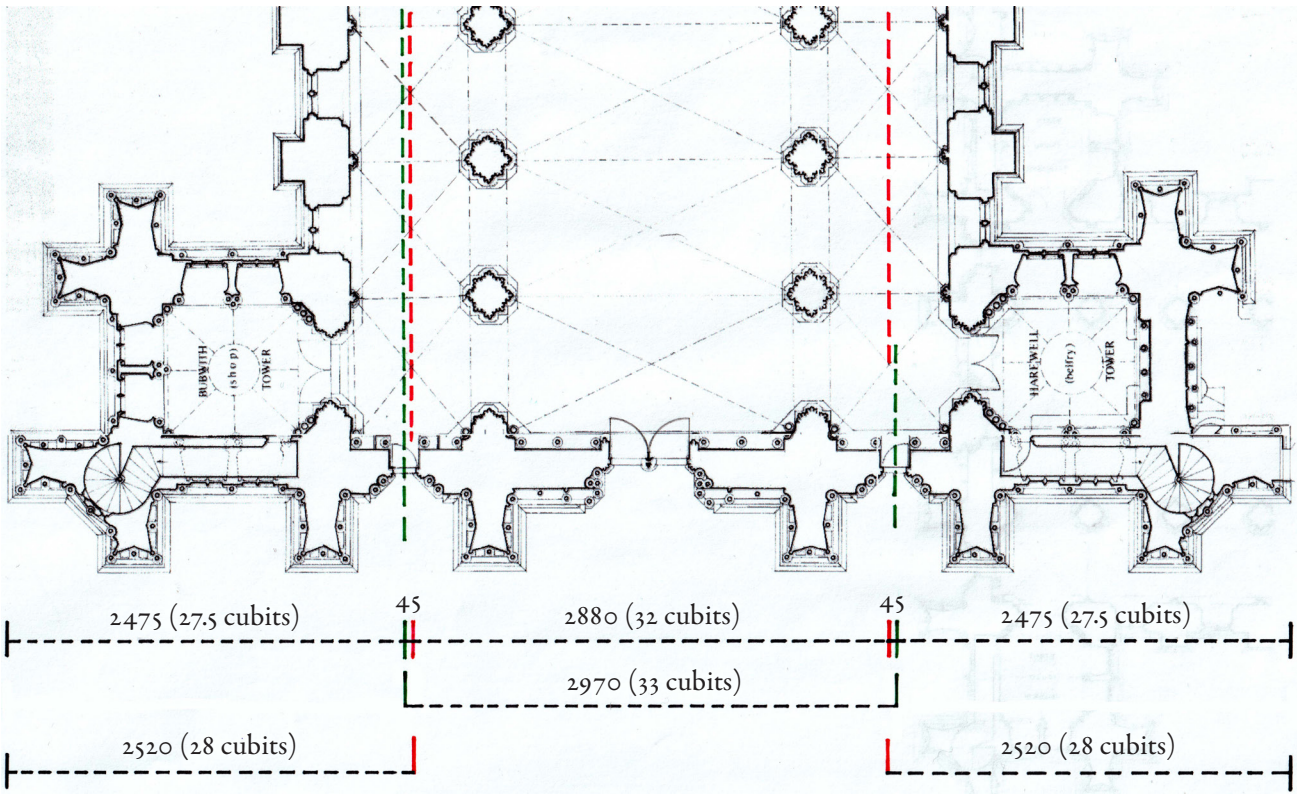
When the measures are checked, this does seem to be the reason. The irregularity appears to result from an intentional use of measures that revolve around the relationship between 8/5 and 11/7. These are the two ratios that relate to one another as 56:55. This brings us back to the cubit measurement, because the difference between the middle axes of these two windows and the middle axes of the doorways below them is actually half a cubit, or 45 micro-units. This is the same measurement used in the reduction of the width in the west front when it is reduced by 176:175.

To see what effect this has, we need to return to the idea that the baseline of the pyramid triangle is the full 88 cubits, which then means that the middle axes of the side doors are at the 8/5 division of each half-baseline. The calculation for this was 3960 ÷ 2475 = 1.6.

But if this figure of 2475 has 45 micro-units added to it becomes 2520.

So the middle axis between the windows, which is also the middle axis of each side aisle, can be calculated in the following way:

3960 ÷ 2520 = 1.571428



The width of the west front as 'theoretically' understood to measure 7920 micro-units (88 cubits). The green dotted lines mark the middle axes of the two side west doors whereas the red dotted lines mark the slightly different middle axes of the windows above the doors. These windows are also in alignment with the central axes of the side aisles - which are also marked with the red dotted line. The distance between each red and green dotted line is 45 micro-units - ($\frac{1}{2}$ cubit).

This new calculated result is expressed in ratio form as 11/7, and herein lies yet another relationship between 8/5 and 11/7 – or in other words 56:55. Whereas the side doors on the west front are positioned according to 8/5, the windows above the side doors – and thus also the central axes of the side aisles – are positioned according to 11/7.

Another way of looking at this relationship between 2520 and 2475 is that they are effectively the same relationship as 56:55. If the numbers 56 and 55 are both multiplied by 45 they become 2520 and 2475. Herein lies the 45 micro-unit difference between these two different measurements from the west front. The difference between these measured positions is caused by a difference of half a cubit on each side (i.e. 45 micro-units), which means that it is a total of one cubit of difference altogether. So while the two doors are 33 cubits apart from one another, the side aisles are 32 cubits apart from each other.

The one-cubit difference can also be seen through the division of the whole baseline of the pyramid triangle by these two different ratios in their decimal form:

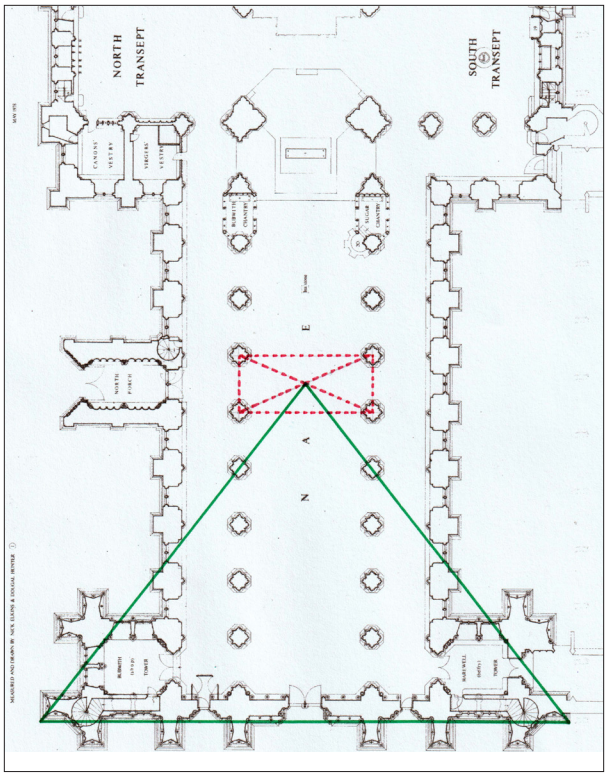
$$7920 \div 1.6 = 4950$$

$$7920 \div 1.571428 = 5040$$

$$5040 - 4950 = 90$$

The measurement of 32 cubits between the middle axes of the two side aisles will present itself again later on in relation to the pentagram that forms the pentagonal east end of the cathedral. The reader may recall the image in chapter 5 (sec 5.4) in which the legs of this pentagram mark the middle axes of the side aisles up at the east end of the cathedral. As will be shown, this measurement up at the east end is also 32 cubits.

Returning to the nave, the next design feature to look at is the inclusion of the pyramid triangle within the measurements of the nave. It was shown earlier that when the west front pyramid triangle is laid down horizontally on to the nave, its apex coincides with the



The west front pyramid triangle, laid flat onto the nave, reaches the sixth bay.

centre of the sixth bay. This is the same bay in which the north side canon's entrance is situated. Bearing in mind that the pyramid triangle is 56 cubits – or 5040 micro-units – in height, we can see how this measurement inter-relates with the east–west measurement of each bay. It has already been shown that this bay measurement is 15 greater feet – which is also 16 English feet. This is the same as 840 micro-units. The pyramid triangle effectively covers five and a half of these bay measurements – or in other words, the first five bays plus half of the sixth bay. However, the first of these bay rectangles could be said to begin further east than the baseline of the pyramid triangle. This shows itself in the comparison of the pyramid triangle's height to the bay measurement:

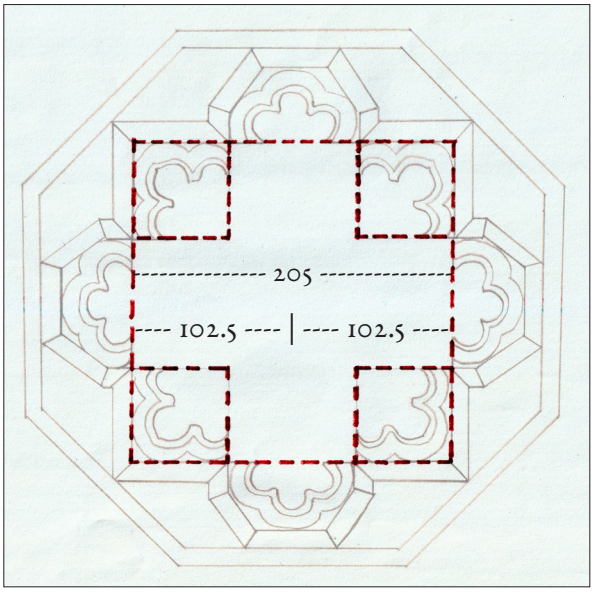
$$5040 \div 840 = 6$$

This means the pyramid triangle is effectively six bays in height. This includes five and a half actual bays within the cathedral's design, although it could be said that there is half a bay of difference between the baseline of the pyramid triangle and the beginning of the first

actual bay in the cathedral, and this is what makes up the extra half-bay of difference between 5½ and 6.

The next aspect of the design to look at is the apparent inclusion of the Moon-square within the pyramid triangle. On the west front the pyramid triangle had its golden ratio measurements highlighted. It does look quite likely that the Moon-square is also used in the design of the west front, but in the absence of very accurate measures this research is holding its judgement on that at the moment. However, we will now look on the Moon-square as being used with the pyramid triangle in the ground plan of the nave. This use of the Moon-square thus makes the pyramid triangle correspond to the Earth-Moon diagram.

The cross-section of the nave pillars contains a very clear square/cruciform core, marked here in the diagram.



Cruciform core of a nave pillar with a measurement of 205 micro-units

This square/cruciform core has a measurement of 205 micro-units, which again presents an interesting quandary in relation to which foot-unit is being used. The number 205 is between four lesser feet (200) and four English feet (210), and as is clear 205 is the arithmetic mean between these two foot measurements. But why use this mean measurement rather than either a lesser foot or an English foot?

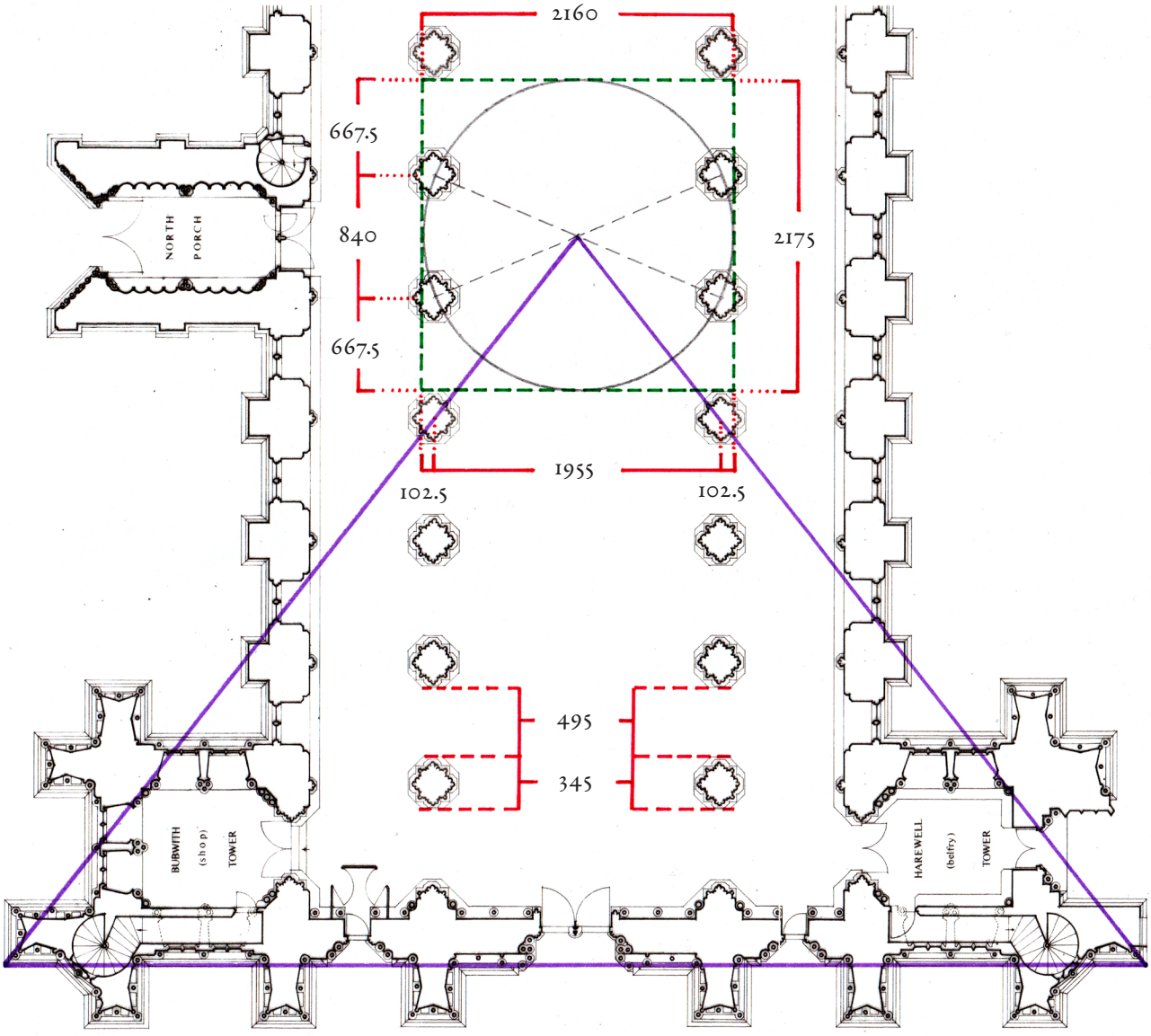
The answer to this becomes apparent when the 205 measurement is included in the measurement of the whole bay. Half of this 205 micro-unit measurement from each pillar is included within the bay rectangle itself, whereas the other half is not. So if we look to either end of the bay it could be said that there is half of this pillar core measurement that needs to be added on to either end of the bay, i.e. 2 × 102.5. Two half pillar cores is accordingly the same as a one whole pillar core that measures 205 micro-units. Then all that is required is simply to add these 205 micro-units on to the bay measurement, which as mentioned earlier is 1955 micro-units:

$$102.5 + 102.5 + 1955 = 2160$$

2160 micro-units is 24 cubits. But more importantly, this measurement corresponds to the size of the Moon if the pyramid triangle is understood to be the Earth-Moon diagram. This measurement is in fact 277,200 times smaller than the Moon itself quite simply because this is the number of micro-units in one mile.

This pillar core measurement accounts for the east-west side-edges of the Moon-square (see diagram on next page) but the pillar measurements appear also to relate to the top and bottom -north-south- edges of the Moon-square too. The platform stones upon which the pillars stand are slightly irregular octagons (see diagram to the left). The distances between these various platform stones seemingly connect with the Moon-square albeit via a particular micro-variation. The diagram on the following page shows that the top and bottom edges of the Moon-square appear to touch these octagonal platform stones that are situated in the next-door bays. But in actual fact they just miss this by 7.5 micro-units in each case. This total of 15 means that the platform stones would essentially mark out a Moon-square with a height of 2175 micro-units. When this measurement is compared to the 2160 width of the Moon-square it creates a ratio of 145:144. If both of these numbers are multiplied by 15 then 145:144 increases to 2175:2160 which can accordingly be looked upon as the measurement of the Moon-square.

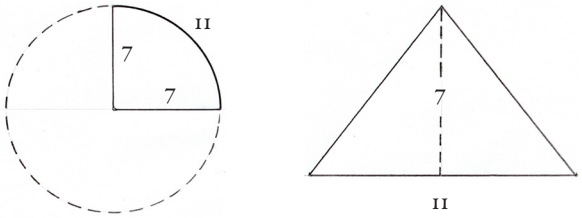
The reason for this increase of 15 micro-units is not entirely clear but it also shows itself in the more general layout of the nave's pillars. The diagram below shows how the pillar's platform stones are 345 micro-units in their east-west measurement whereas the distance between each one of them is 495 micro-units. If both 495 and 345 are divided by 15 they reduce to the not so simple ratio of 33:23. However, if 15 micro-units were taken away from 495 and then added to 345 it would create the much simpler ratio of 480:360 which reduces all the way down to 4:3. If the platform stones and the distances between them had this simple 4:3 relationship the Moon-square would also measure 2160 × 2160. So the reason for this apparent micro-variation involving 15 micro-units is not entirely clear - suffice to say that the full moon takes place on the 15th day of the lunar cycle. But more generally the inclusion of all of these lunar numbers and geometries symbolically suggest that when someone stands at the centre of any one of the bays in the nave they are symbolically standing at the centre of a Moon. It will be shown in Part 4 in the section 'The Initiatic Descent of the Moon into the Earth' how this adds to a symbolic reading of the nave's design which concerns the symbolic journey of the Moon through the underworld in which it goes through a process of death and resurrection.



14.2 THE LATITUDE GEOMETRY OF ST ANDREWS CATHEDRAL IN SCOTLAND

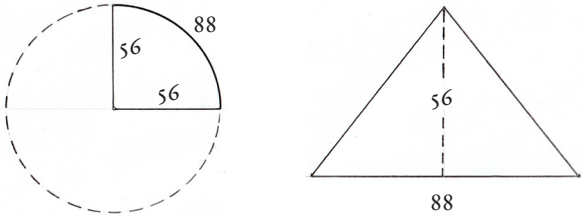
It was suggested in the previous section that the use of the 56:55 ratio appears to be related to the latitude measurement of St Andrews Cathedral in St Andrews, Scotland. What is more, this whole system of *geo-metria* also relates directly to the Earth-Moon diagram.

The circle that becomes 'squared' within the Earth-Moon diagram has a radius of 7 and a circumference of 44. If this circle is seen as a profile view of Planet Earth, it can be suggested that the distance between the equator and the north or south pole - i.e. one quarter of the circumference - is 11 units. Herein lie the two numbers that define the pyramid triangle used in the Earth-Moon diagram.



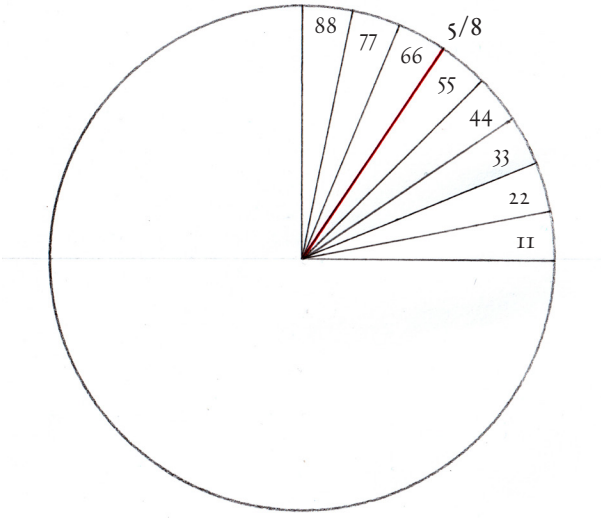
If Earth has a radius of 7 the distance from the equator to either pole is 11. These same two numbers are also present within the Pi Pyramid Triangle.

Multiplying these numbers by 8 produces the Wells master diagram, in which the pyramid triangle has a baseline of 88 and a height of 56. If these two enlarged numbers are then reapplied to the profile view of Earth it can be said that the radius of Earth is 56 and the equator-to-pole measurement 88.

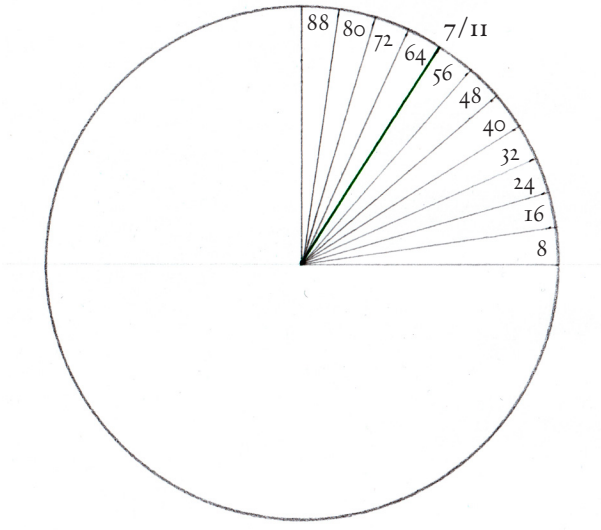


Multiplying by 8 increases the numbers from 7 & 11 to 56 & 88

Of the 88 units between equator and pole, St Andrews Cathedral in St Andrews, Scotland falls between the 55th and 56th divisions of the Earth circle. The 55th division (red line) is 5/8 of the distance between equator and pole, whereas the 56th division (green line) is 7/11 of the distance between equator and pole. And herein lie the numbers of the Phi and Pi Pyramid Triangles described in the previous section.

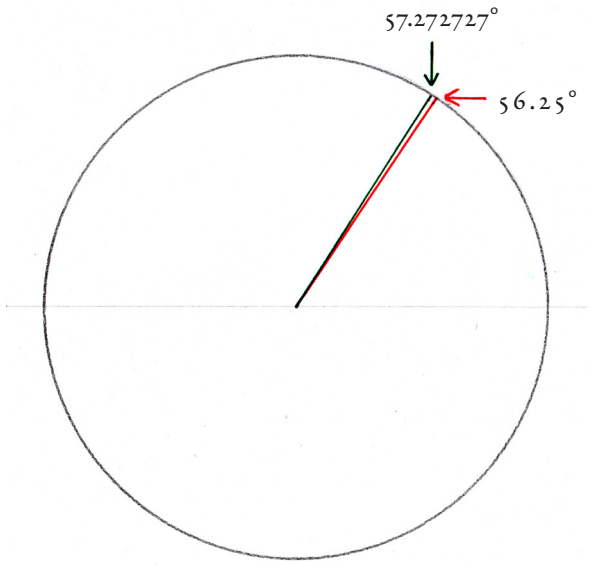


The red line marks 5/8 of the quarter-circle which is also 55 of 88 units



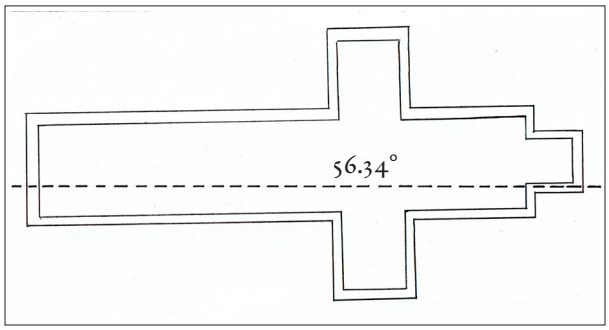
The green line marks 7/11 of the quarter-circle which is also 56 of 88 units

In geographical degrees of latitude, the 56th unit is 57.272727° north of the equator, whereas the 55th unit is 56.25° north.



The 55th unit has a latitude of 56.25°... the 56th unit is 57.272727°

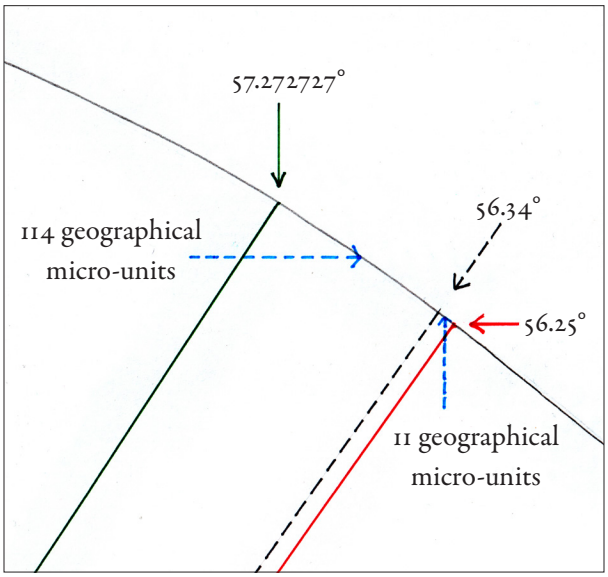
St Andrews Cathedral is located precisely at a latitude of 56.34°



The ground plan of the ruin of St Andrew's Cathedral in St Andrews Scotland along with the line latitude - 56.34° - that runs through the building

The locating of St Andrews Cathedral at this precise latitude divides the 55th unit up into 125 geographical micro-units.

Between 56.25° and 56.34° there are 11 of these micro-units, which also happens to be 1/1000 of the distance between equator and pole (see section 7.5 about the latitude of Oxford). Between 56.34° and 57.272727° there are 114 of the micro-units.



A close-up of the curve of Earth around the 11/7 and 8/5 latitudes. The black dotted line marks the latitude of St Andrew's Cathedral at 56.34°. The inclusion of this particular latitude divides the distance between the 11/7 and 8/5 latitudes into a total of 125 geographical micro-units which consist of one set of 11 and another set of 114.

This geographical micro-unit can now be applied to the circumference of the Earth. If there are 88 units between Earth's equator and its poles it could be said that a great circle going around the whole of the Earth is 352 units (4 × 88). If each of these units can then be looked upon as being made up of 125 geographical micro-units ...

$$352 \times 125 = 44{,}000$$

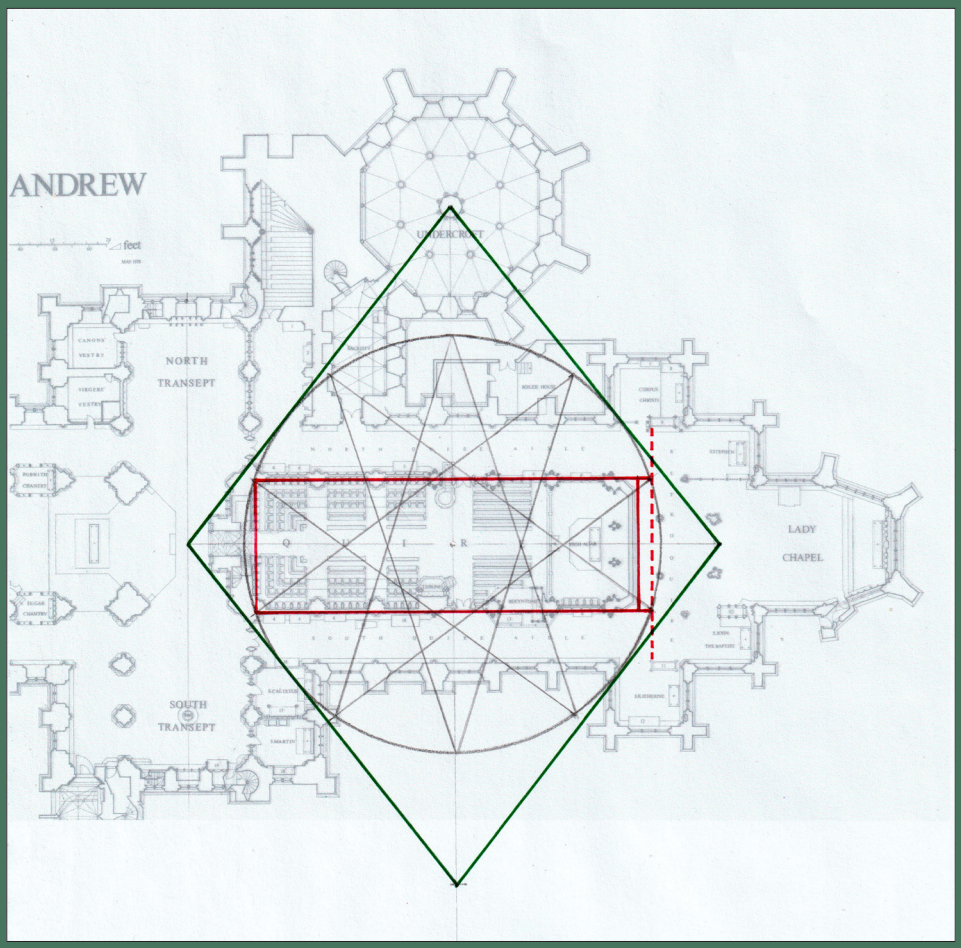
... the circumference of Earth is thus divided up into 44,000 micro-units, and this corresponds via a ratio of 1000:1 to the Earth-Moon diagram in which the circle has a circumference of 44 units.

So the precise latitude of St Andrews Cathedral effectively embodies mathematical principles that exist within the Earth-Moon diagram through being built in its particular geographical location. In this sense the cathedral building is in cosmic participatory accord with the mathematical relationship that exists between the Earth and the Moon.

In a world of a-spiritual meaninglessness – in which mere practicality is generally the motivating factor that leads to action – the question that would inevitably be asked is *why on earth* would such a process of measurement be adhered to by medieval Christian builders, or anyone else for that matter. There could be many reasons why, but from a perspective of contemplative mathematics it must be re-emphasised that for an artist to enact cosmically beautiful mathematical principles is to embody the eternal numerical thoughts of the Divine Mind. In doing this, the artisan's soul contemplatively accords its actions and intentions with the Divine Mind, and this in itself is a sacramental act. It encourages the soul to 'remember' and accord with that which is cosmically harmonious and unchanging in its being. Such theurgic acts are much like the enactment of the Christian liturgy, or indeed a ritual in any religion, which may appear to be useless and fruitless activities when viewed from an a-spiritual perspective. But they are profoundly meaningful for those who are contemplatively engaged in them because, both inwardly and outwardly, they enact the movements of Heaven down here on the Earth.

Chapter 15.

The Quire as the Central Place on Earth



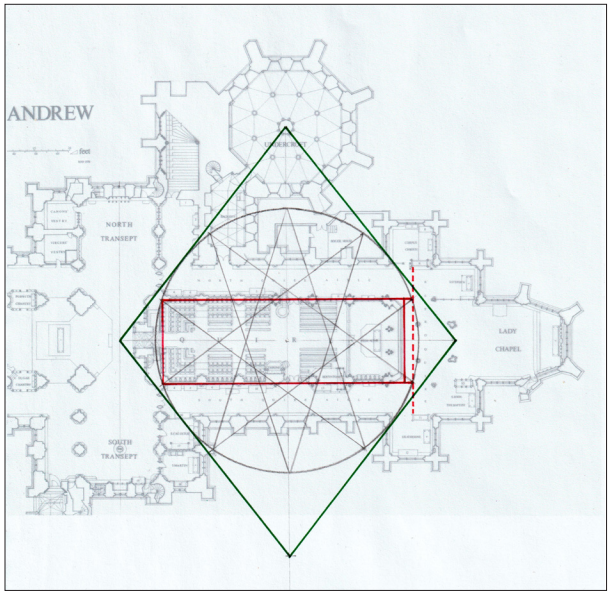
15.1 THE SOLOMONIC QUIRE AND THE MUSICAL MEASURES OF MAGNESIA

It has been mentioned on various occasions in this book that the measurements of the rectangular quire/presbytery in Wells Cathedral embody the same shape and dimensions as the Temple of Solomon according to how they are described in the Book of Kings. The Bible's description of the ground plan relates to a 1 × 3 rectangle measuring 20 × 60 cubits. But as happens elsewhere in the cathedral's measurements, there are various overlaid grids used in the design of this area of the building, and so the biblical dimensions of the temple are but one of the quire's measured design features.

The cubit measurements of the temple show themselves in the east–west bay measurement. As mentioned in chapter 14, this bay measurement is 10 cubits and because there are six bays in the quire this makes a total of 60 cubits, which is the length of the temple in the biblical description. However the temple's 20-cubit width is not materially present in any built feature within the quire, and so again the designer's technique of multi-layering grids is used here, whereby the single measurement reference of '6 × 10 cubits = 60 cubits' is enough to suggest that all of the temple measurements are indirectly or at least 'theoretically' present, through the overt inclusion of the 60-cubit measurement. Having said this, there is a measurement that derives from the polygonal geometry of the east end Lady chapel which does appear to point towards a 20-cubit measurement in relation to the quire. It specifically suggests a cubit consisting of 89.8 micro-units, which has already been described as the one that is actually used in the 60-cubit measurement of the six quire bays. This will be returned to briefly at the end of chapter 17.

Beyond the 60-cubit measurement of Solomon's temple, there is one other measured reference to the temple in the form of a 1 × 3 rectangle that is generated from the pyramid triangle diagram. This is the same version of the master diagram that covers the quire and chapter house area – which, as mentioned in chapter 14, is enlarged by the ratio of 55:56. It is this rectangle that defines the width of the quire/presbytery, and indeed its overall boundary. The six bays that measure 10 cubits each then fit, according to definable measurements, within this other, slightly larger, 1 × 3 rectangle.

The rectangle itself is generated from two overlapping pentagrams, or in other words a decagram star. This 'double pentagram star' was shown in chapters 7 and 8 (p.115 & p.152-4)as being generated from within a pyramid rhomb. The rectangle that can be derived from this star is effectively the same type of rectangle that exists within a decagon, in the sense of two opposite edges of a decagon being the two shorter edges of a long thin rectangle that passes through the decagon from one side to the other. If this rectangle has a short edge of 1 its long edge is 3.078.



The 1 × 3 rectangle derived from a decagram star. The star is generated from within a pyramid rhomb. The six bays create the 60 cubit length of Solomon's temple whereas this rectangle creates the quire's width.

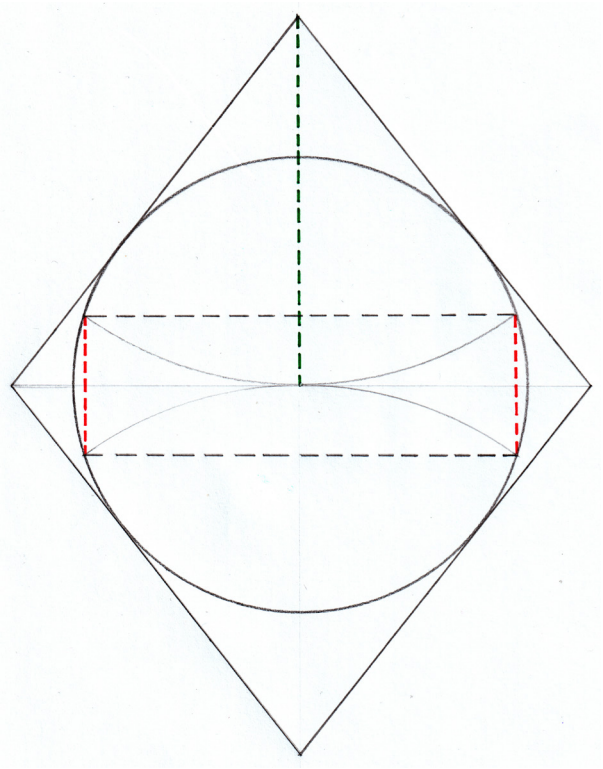
However, the designer appears to have truncated the eastern end of this rectangle to make a shorter rationalised 1 × 3 rectangle, which allows it to conform to the shape of the Temple of Solomon. This truncation is marked by the position of the feretory wall immediately behind the high altar. But as mentioned in chapter 8 (p.152) the geometrically true eastern end of this rectangle – if it did actually measure 3.078 rather than 3 – coincides *precisely* with the easternmost extremity of the foundations of the earlier east end of the cathedral. These foundations were discovered by the master mason of Wells Cathedral – Bert Wheeler – when the retroquire floor was taken up during the 20th century. Such a geometric connection again suggests that the original design of the cathedral's ground plan was always intended to go beyond this eastern extremity of the earlier foundations. The pyramid triangle from which this quire rectangle itself is generated goes all the way up to the threshold of the current Lady chapel, which is beyond the easternmost extremity of the earlier foundations.

Returning to the 1 × 3 truncated rectangle, we will now look at its measurements and how they are calculated.

First of all, the way in which the decagram star is generated within the pyramid rhomb is such that the vertical height of the rhomb needs to be divided in half. This effectively defines the height of each of the two pyramid triangles that together form the rhomb. The height of this pyramid triangle then needs to be divided by Φ + 1 (i.e. 1.618033 + 1 = 2.618033).

Looking at the diagram on the right, by dividing the height of the pyramid triangle (shown in green dotted line) by 2.618033 the short edge of the 1 × 3.078 rectangle (red dotted line) is obtained. However, this calculation uses an incommensurable number (i.e. Φ + 1... or 2.618033) and so a commensuration is required to transmute the golden number into one of its many rational equivalents.

The Fibonacci numbers 144 and 55 are used for this. It was pointed out in section 7.3 that the multiplication of



The Pyramid Rhomb with its relationship of 2.618 to 1 (green/red dotted lines)

these two Fibonacci numbers brings about the number of miles in the mean diameter of the Earth:

$$144 \times 55 = 7920$$

However, in this particular instance the larger number is divided by the smaller one, which then gives a rational approximation for the irrational 2.618033...

$$144 \div 55 = 2.618181818...$$

So now it is possible to demonstrate the rational calculation of the pyramid triangle's height along with the relationship it has with the north–south width of the quire's 1 × 3 rectangle.

It was mentioned in chapter 14 (p.246) that the height of the pyramid triangle in the Wells master diagram is 56 cubits, which is 5040 micro-units. But the measurement that is actually used within the fabric of the building is 55:56 bigger than this. As shown earlier, the

micro-unit measurement of the pyramid triangle's height therefore increases from 5040 to 5131.636363:

$$(5040 \div 55) \times 56 = 5131.636363$$

However, both of these measurements appear to play their part in the final design and this can be seen through using the heights of both of these triangles to calculate the final measurement:

$$5040 \div 2.6181818 = 1925$$

$$5131.636363 \div 2.6181818 = 1960$$

These two calculations yield simple whole-number micro-unit measurements that correspond respectively to the lesser foot and the greater foot.

1925 micro-units is 38.5 lesser feet, whereas 1960 micro-units is 35 greater feet.

But within the fabric of the building itself it is actually the arithmetic mean between these two measurements that is used and, quite remarkably, this mean measurement then corresponds to the English foot. The arithmetic mean between 1960 and 1925 is 1942.5. When this seemingly obscure micro-unit measurement is divided into the English foot it yields the final result.

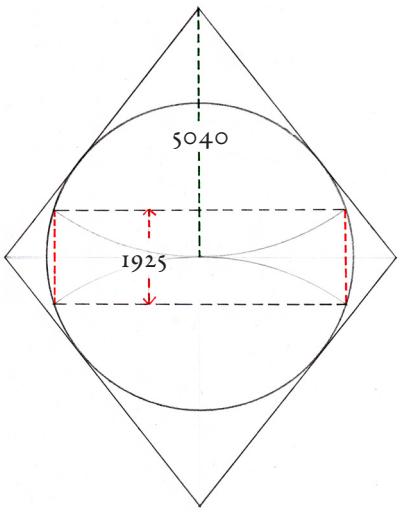
$$1942.5 \div 52.5 = 37 \text{ feet}$$

The measurement between the central vertical axes of opposing north–south pillars in the quire – or in other words, the width of the quire – is 37 English feet, and as shown in the diagrams below this is the arithmetic mean between the two calculations that are made using the two slightly differing heights of pyramid triangle.

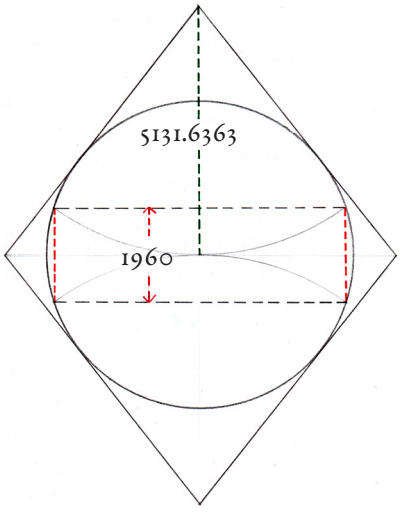
But the other interesting thing about the number 37 is that, much like the number 5040 and the musical comma 225:224, it is another significant number associated with Plato's *Laws* dialogue, which is described by the musicologist Ernest McClain as containing references to a particular seven-limit musical tuning system. Such a seven-limit system of tuning clearly also appears to be present within the musical measurement units used in the design of Wells Cathedral.

In the *Laws* dialogue Plato cites the number 5040 as being the ideal number by which to order a society. On several occasions he also mentions the 37 Guardians of Magnesia, which McClain translates as symbolising a collection of 37 musical notes within a tuning system that is micro-varied by the 225:224 musical comma.

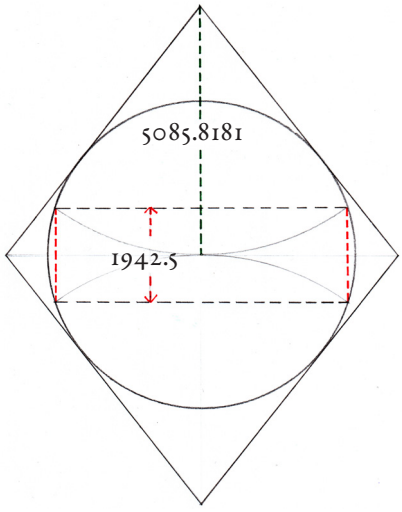
The question then arises of why such a musical system would be used in the design of a medieval Christian



The calculation of the quire's width using 5040. 1925 micro-units are the same as 38.5 lesser-feet.



The equivalent calculation increased by 55:56. 1960 micro-units are 35 greater-feet.



The actual width is the mean between 1925 and 1960. This is 1942.5 micro-units or 37 English feet.

cathedral. The possible answer to this again lies in the symbolism of the Heavenly Jerusalem with its twelve-fold layout in the form of its twelve gates – each with its own apostle. This description of the Heavenly City reflects the layout of the twelve tribes of Israel encamped around the Tabernacle in the desert, and each gate of the city analogously corresponds to a tribe within the desert encampment.

A particularly important detail here is that the Tabernacle effectively has the same measurements as the Temple of Solomon, albeit half the size. Rather than measuring 20 × 60 cubits, it is described as measuring 10 × 30 cubits. So both the Heavenly Jerusalem and the Temple of Solomon are effectively modelled on the description of the Twelve Tribes of Israel encamped around the Tabernacle. Therefore the fact that the measurements of Magnesia appear to be present within a cathedral design that is intended to be an architectural image of both Solomon's Temple and the Heavenly Jerusalem seems to resonate with the overarching organisation of Plato's *Magnesia,* which is also based around a twelve-fold division of its land among its twelve tribes as described in Book 6 of *The Laws.*

'We have marked out the whole country as nearly as possible into twelve equal portions: to each portion one tribe shall be assigned by lot.'

760b

Such a description recalls the biblical description of the twelve tribes of Israel encamped around the 1 × 3 rectangle of the Tabernacle's ground plan. Plato's description continues ...

'To these groups of twelve the twelve portions of the country shall be assigned, one to each in rotation for a month at a time, so that all of them may gain experience and knowledge of all parts of the country... From the portion in which they are stationed first by the lot they shall pass on month by month to the next district... in a direction from left to right, and that will be from west to east.'

760c–d

This description reflects the seasonal/temporal symbolism that is associated with the twelve 'monthly' gates – of which there are three on each of the four 'seasonal' sides of the Heavenly City.

St John's vision of the Heavenly Jerusalem and Plato's description of Magnesia both concern the establishment of a city down here on Earth. Whether this correlation is an appropriate one to be making is a theological question that goes beyond the scope of this book. But the apparent measures of Wells Cathedral suggest that such a correlation existed in the artistic imagination of its designer.

There are various other interesting threads that could be followed here, including Magnesia's 360-day year, which is also reflected in the 360-cubit measurement used in the Earth-Moon diagram at Wells. Indeed, it is through the use of the 225:224 musical comma that this 360-cubit circle actually becomes established through micro-variation. Also the analysis of Jay Kennedy in which he concludes that Plato's *Laws* contains 14,400 lines. Such a number inevitably reflects the number 144 that is so significant in the description of the Heavenly City. Another very interesting connection is the recognition and acceptance of the part that Pluto/Hades plays within the lives of the Magnesians – which, as we shall see in Part 4, chimes with the Christian story of Lucifer and the Harrowing of Hell. This is the description of Christ's descent into Hades prior to his Resurrection and Ascension.

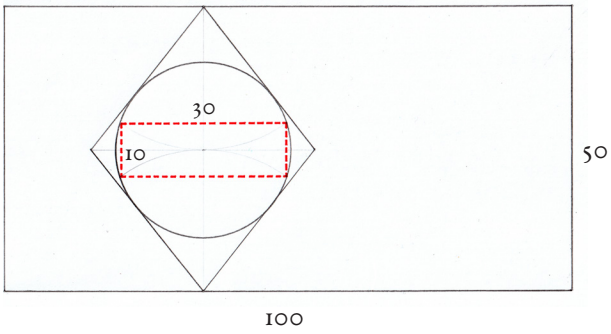
To go any further into all of these apparent connections between Magnesia, the Heavenly Jerusalem and the design of Wells Cathedral would take us too far away from the main focus of this book. But hopefully there is enough basic information here for a musicological symbolist somewhere to launch into a deeper study of the apparent connection. The connection between Magnesia and the Heavenly Jerusalem is certainly one that was part of John Michell's research. But perhaps the first point of interest in relation to all of this is that a Latin translation of Plato's *Laws* dialogue is not even supposed to have been available to Europeans at the time that Wells Cathedral would have been designed.

15.2 THE PYRAMID RHOMB DIAGRAM IN THE DESIGN OF THE TABERNACLE

The pyramid rhomb diagram that produces the 1 × 3 rectangle, described in chapter 7 (p.115), very neatly fits the biblical description of the desert Tabernacle via an interesting interplay between pi and phi as well as between pi and 3.

The Tabernacle was the portable temple used by the nomadic Hebrews. After settling in Jerusalem the Temple of Solomon was eventually built with dimensions that were double those of the Tabernacle. So the Tabernacle also had a 1 × 3 ground plan, although it measured 10 × 30 cubits rather than 20 × 60.

The Tabernacle is also described as being set within an enclosure that is effectively a double square measuring 50 × 100 cubits. So let this 50 cubit north–south width be used to define the height of the pyramid rhomb.

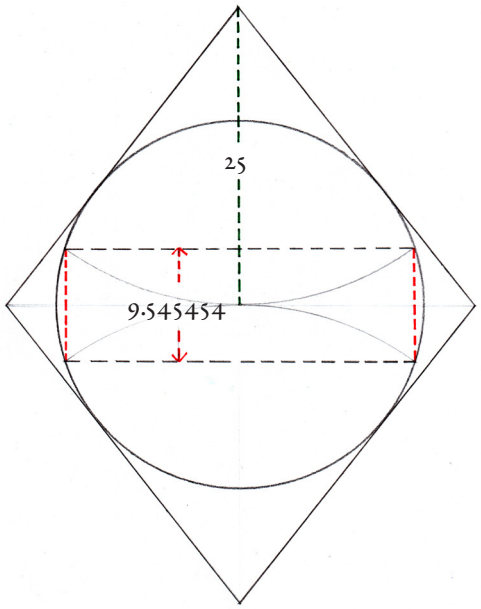


The Tabernacle as a 10 x 30 cubit rectangle set within an enclosure that measures 50 x 100 cubits. The pyramid rhomb and circle fits the design.

The Tabernacle's rectangular plan is shown in red dotted line. The particular Fibonacci approximation that can now be used to generate its width is 55/21. In the design of the quire at Wells it is the 144/55 approximation that is used to obtain its width.

In relation to the following diagram, if the 25-cubit measurement that defines half the height of the rhomb is divided by 55/21, the rectangle produced by the decagram star has a width of 9.545454 cubits:

$$25 \div 2.6190476 = 9.545454$$



The pyramid rhomb diagram as apparently used in the Tabernacle

This measurement reflects a 6:5 mean of 11 micro-units between the external and internal width measurements of the Tabernacle. The external measurement is 10 cubits and the internal measurement is 9 cubits. If this single cubit of difference is divided up into 11 equal parts - i.e. micro-units - then 6 of them would be expressed in decimal terms as 0.545454. The remaining 5 micro-units would be 0.454545 and together these 6 + 5 micro-units make up the one cubit of difference. So the 9.545454 measurement can also be expressed as 9 cubits and 6/11 of a cubit.

Interestingly this relationship between 6 and 5 is the first indication of a relationship between pi and phi because the ratio 6:5 reflects the rational relationship between pi and phi-squared (2.618..).[1]

If 22/7 is 6 then the Fibonacci relationship 55/21 is 5. As a decimal calculation this can be expressed as...

$$(3.142857 \div 6) \times 5 = 2.6190475$$

A similar thing happens with various other rational approximations of Pi. For example if 864/275 is 6 then the Fibonacci relationship 144/55 is 5. Another example of this uses the number 377 within both the pi and phi-squared relationships at the same time because if the pi approximation 377/120 is 6 then the Fibonacci relationship 377/144 is 5.

Returning to the 6:5 relationship that exists between 22/7 and 55/21 this is the one that appears to be used within the Tabernacle. As was mentioned a little earlier the first calculation involves the dividing of the pyramid triangle's height of 25 by 55/21 which gives the width measurement of 9.545454 cubits which then forms the mean of 6:5 between the external and internal measurements of the Tabernacle. Having used 55/21 to get this far it is now the 22/7 approximation of pi that is used.

The relationship between 9.545454 and 10 is the same as 21:22, which is essentially a rational relationship of 3 to pi.[2] If 21/7 is equal to 3 then 22/7 rationally approximates pi. This 22/7 version of pi now shows itself quite clearly in the 30-cubit length of the Tabernacle when it is multiplied by 9.545454:

$$9.545454 \times 3.142857 = 30$$

So the width of the Tabernacle's rectangular ground plan is obtained through a rational approximation of Phi-squared (55/21) and its length through a rational approximation of pi (22/7).

The numbers 21 and 22 in these two ratios then reflect the relationship between 3 and Pi. Indeed if these two numbers were swapped, the Fibonacci ratio would become the much simpler ratio of 55/22, which essentially is 5/2, and the pi ratio would become 21/7, which is the same as 3/1. If the calculations were then repeated with these new ratios the 5/2 would bring about a 10-cubit width of the ground plan rather than 9.545454, and the 3/1 ratio would increase those 10 cubits to 30 cubits for the length.

A possible reason for this 'swapping' of the numbers 21 and 22 is to do with the fact that the true geometric length of the rectangle, as it derives from the decagon or decagram star, is very close to the arithmetic mean between 3 and Pi. This can be seen through doubling the numbers that form these ratios.

The relationship of 21/7 is the same as 3 but so is 42/14 quite simply because the numbers in the ratio have been doubled. If the same doubling takes place with the 22/7 approximation of pi it becomes 44/14. It can then be shown that between the numbers 42 and 44 there is the number 43 and 43/14 is a very close approximation of the rectangle's true geometric length because 43/14 is the same as 3.071428 whereas the rectangle's true dimensions are 1 × 3.0777...

So through the interaction of both pi and phi-squared, within the Pyramid Rhomb diagram, the Tabernacle comes to reflect the ideal dimensions of 1 × 3.

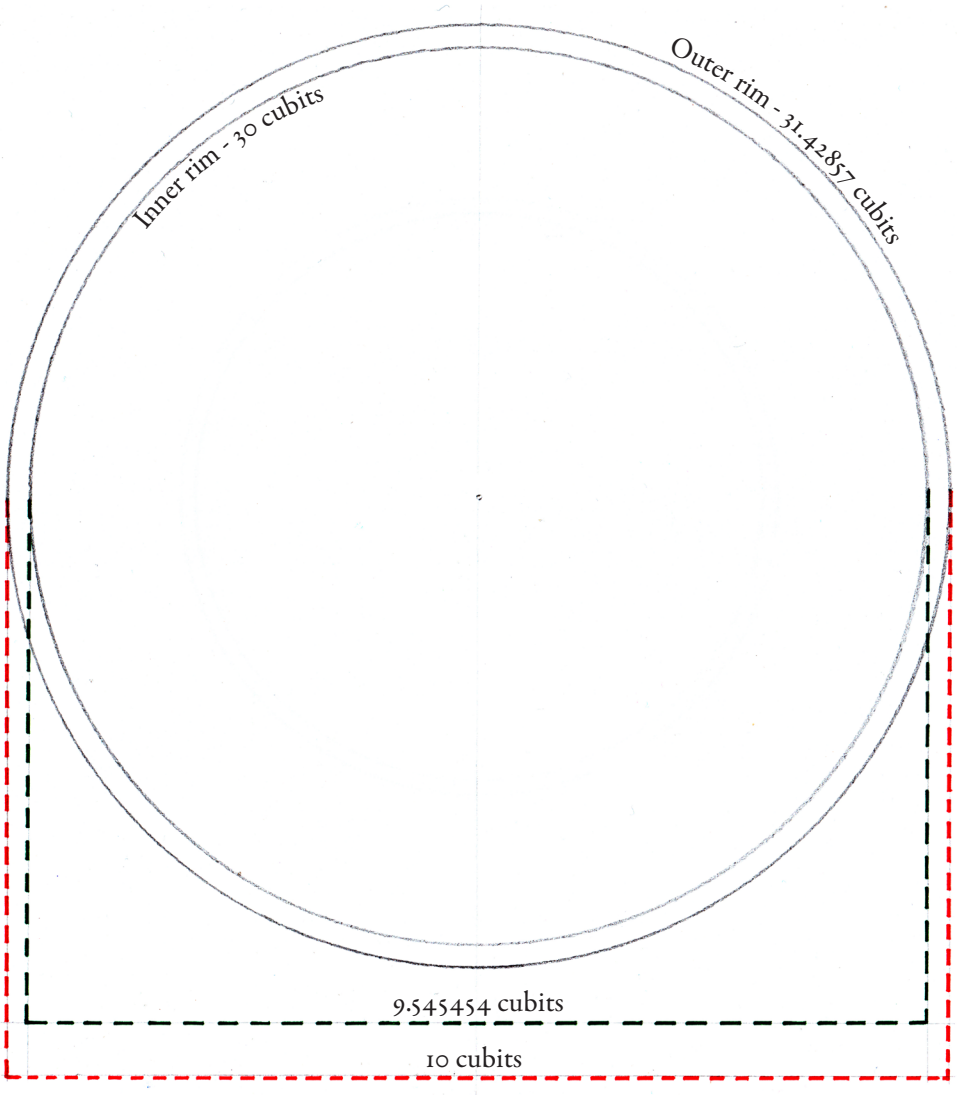
1. See essay by Adam Tetlow entitled *Ancient Metrology and the Golden Section*.

2. This relationship of 22 to 21 or 'pi-to-3' can be found in the 22/7 peripheral measurement of a circle in relation to the peripheral measurement of the hexagon contained within the circle. Each edge of the hexagon is the same as the circle's radius of 3.5. So 6 × 3.5 = 21. This expresses a periphery-to-diameter relationship of 21 /7 (i.e.3/1), whereas the circumference of the circle in relation to its diameter is 22/7, which is pi to 1.

15.3 PI AND THREE IN THE MOLTEN SEA

The relationship of pi to 3 is also suggested by the biblical description of the Molten Sea, which was a large metal basin in the Temple of Solomon used for priestly ablutions. It is described as having a diameter of 10 cubits and a circumference of 30 cubits, which has sometimes been misunderstood as suggesting that the Hebrews thought pi was equal to 3. The diameter is actually suggested to have been measured from the outer rim (10 cubits), and the circumference measured around its inner rim (30 cubits).

So the measurements of the outer rim compared to the inner rim can accordingly be understood as corresponding to a relationship of 22:21 – or more specifically 31.42857 cubits to 30 cubits. If the circumference of 30 is then divided by 22/7 the diameter becomes 9.545454, which is the diameter between opposite sides of the inner rim. So in this sense the Molten Sea appears to contain similar numerical relationships to the Tabernacle, in which there is a relationship between pi and 3.[3]



3. The golden ratio is also suggested here in that the circumferences of the outer and inner rims closely approximate the circumcircle and incircle of a decagon. This again is due to the rectangle, derived from the decagon, containing a length that approximates the arithmetic mean between 42/14 and 44/14 (i.e. 43/14)

15.4 THE GOLDEN SECTION IN THE SACRISTY'S TWO DOORWAYS

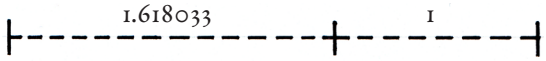
Despite the significant use of the golden ratio within the underlying geometric design of Wells Cathedral there are only a few visually obvious examples of it in the fabric of the building. Pentagonal symmetry is one such geometric embodiment of the golden ratio, and so accordingly it is present within the pentagonal east end of the Lady chapel as well as in the pentagonal pillars that are located in the retroquire. These pillars will be described in more detail in Part 4. But there is one particularly striking use of the golden ratio in the form of what appears to be an overt and intentional use of the 'off-centre' golden section or golden mean.

The golden ratio itself embodies a particular type of relationship that can be seen as existing between a smaller and a larger segment of a line. One way in which this is geometrically understood is through the unequal division of a line into this particular relationship of smaller and larger parts and the cut or 'section' of the line that brings about these two unequal parts is then described as a 'golden section'. One description of this relationship speaks of these smaller and larger parts as the 'lesser' and the 'greater'.

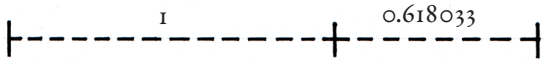
'If the lesser is to the greater as the greater is to the whole, then it is the golden ratio.'

So the size relationship of the lesser segment of the line to the greater segment is the same as the size relationship of the greater segment to the whole line.

If the lesser segment of the line measures 1, then the greater segment measures 1.618033...



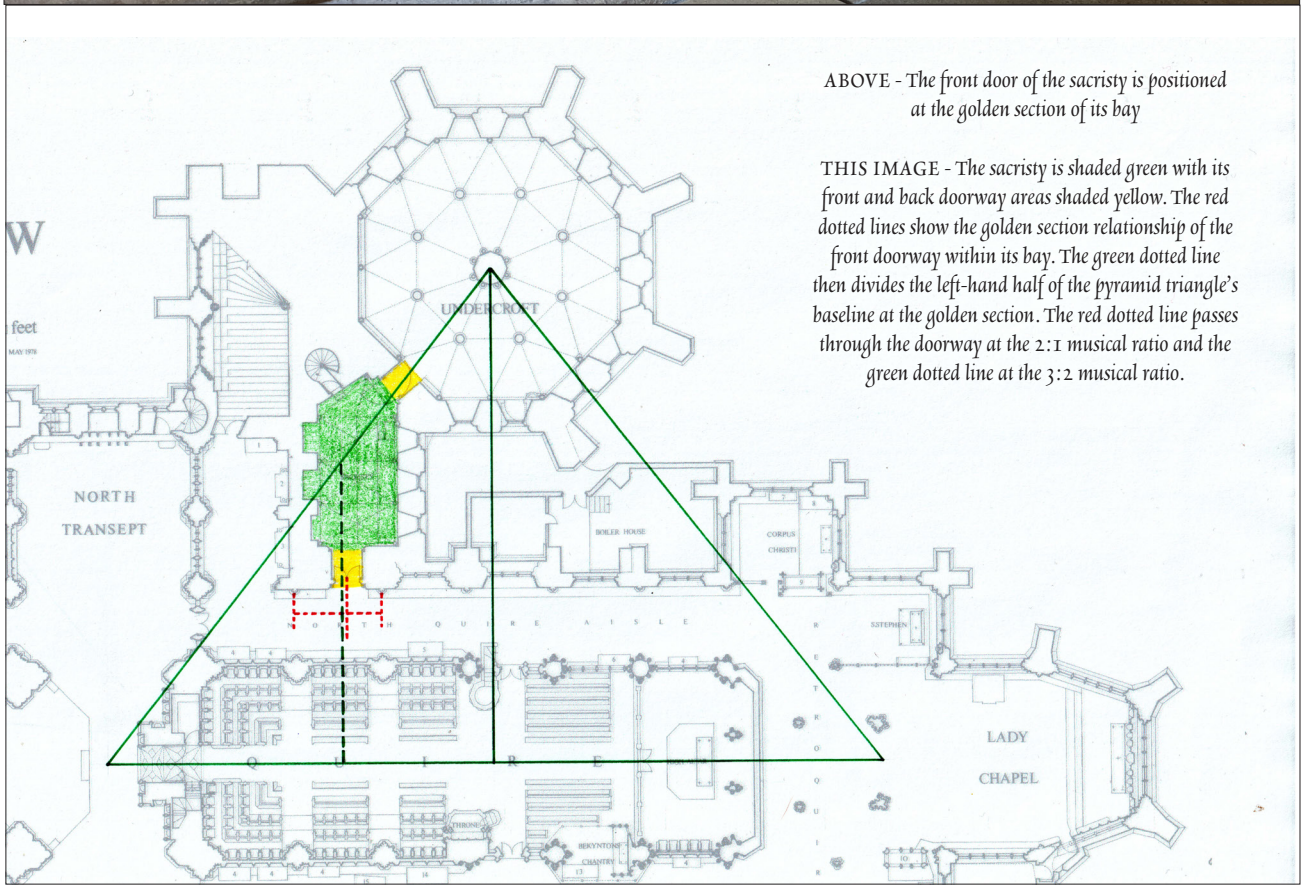
But if the greater segment of the line measures 1, then the lesser segment measures 0.618033 - which means that the whole line then measures 1.618033...



The way in which this unequal division shows itself in Wells Cathedral is in the positioning of the two doorways that lead into the sacristy – one at the front and one at the back.

In relation to the front door, it was mentioned in 9.4 that this door is positioned at the golden section of the bay in which it is situated, and that it also appears to correspond in a symbolically interesting way to the underlying geometry of the octagonal undercroft.

But there is another very interesting relationship that the position of this doorway has with the pyramid triangle that governs the whole diagram in this area of the cathedral.



ABOVE - *The front door of the sacristy is positioned at the golden section of its bay*

THIS IMAGE - *The sacristy is shaded green with its front and back doorway areas shaded yellow. The red dotted lines show the golden section relationship of the front doorway within its bay. The green dotted line then divides the left-hand half of the pyramid triangle's baseline at the golden section. The red dotted line passes through the doorway at the 2:1 musical ratio and the green dotted line at the 3:2 musical ratio.*

As the images to the left demonstrate, one of the golden section divisions of the left-hand half of the pyramid triangle's baseline happens to go through this golden section doorway.

In both instances of this use of the golden section - i.e. both the doorway within its bay and the division of the left-hand half of the pyramid triangle's baseline - the 'greater' part of the divided line is situated to the left with the 'lesser' part to the right.

The green dotted golden section line also passes through the doorway with an off-centre trajectory, although this off-centre position is not at the golden section of the doorway. But it does produce another significant division of the doorway - a musical one - that is very precisely definable. To demonstrate this precision we will first need to look at the micro-unit measurements of the quire rectangles and how they relate to this golden section line, shown in the image.

Before doing this, a small but important detail is required to properly define the following design theory. It was shown in the last chapter that the cubit used in the actual bay measurement of the building's fabric has a mean measurement of 89.8 micro-units. This is due to the micro-varying of the cubit. The usual cubit is 90 micro-units, but a necessary musical micro-variation of 225:224 changes the cubit into 89.6 micro-units, and the way in which this is expressed within the building's measurements is to have a bay measurement that uses a mean cubit of 89.8 micro-units, which is the arithmetic mean between 90 and 89.6. But in the following descriptions, rather than using this mean cubit the descriptions will use either the 90 micro-unit cubit or the 89.6 cubit depending on the particular measurement schema that is being described.

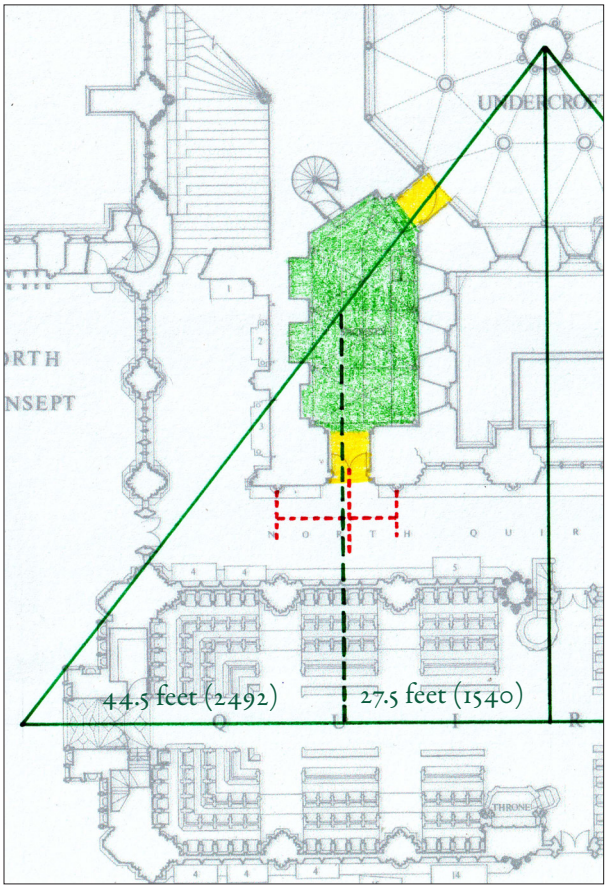
This is yet another example of the way in which both cubits are used at the same time in theoretical terms, although the actual physical measurement used in the fabric of the building is the mean cubit of 89.8.

Bearing in mind that the baseline of the enlarged pyramid triangle resolves into 144 greater feet (8640 micro-units), each half of the baseline has a measure of 72 greater feet (4032 micro-units). If this is then divided at the golden section – or rather by the Fibonacci approximation 144/89 – it divides the 72-foot distance into 44.5 feet and 27.5 feet.

$$72 \text{ feet} \div 1.617987 = 44.5 \text{ feet}$$

As shown in the image below, 44.5 greater feet contain 2492 micro-units and the remaining 27.5 feet contain 1540 micro-units.

But as the image also demonstrates, the pyramid triangle's green dotted golden section line doesn't pass through the middle of the sacristy doorway but rather a little to the left-hand side of the doorway's central axis. The central axis itself is marked by the small red dotted golden section line, which lies a little to the right of the green dotted line.

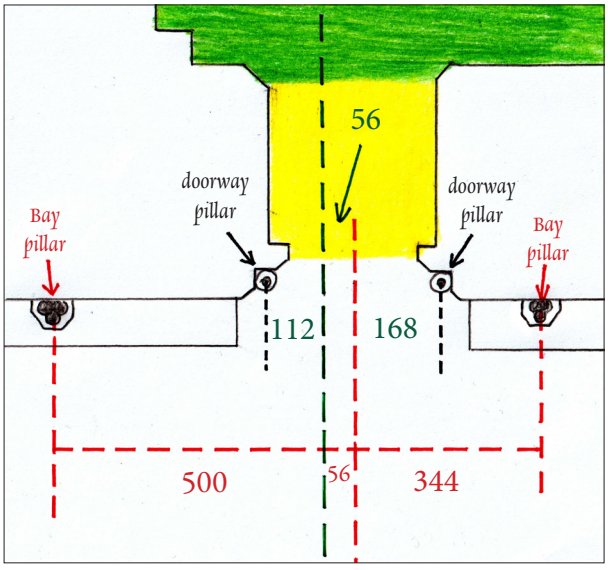


The left-hand half of the pyramid triangle's baseline is divided at the golden section - or rather at the 144/89 division. This divides the line into 44.5 greater-feet (2492 micro-units) and 27.5 greater-feet (1540).

The number of greater feet that correspond to each significant measurement of the pyramid triangle's baseline is then marked in the diagram on the next page, and each of these greater-foot measurements has its number of micro-units written in parentheses.

As the diagram demonstrates, the pyramid triangle's green dotted line starts from within the second bay of the quire. Indeed, it is 500 micro-units into the bay, which is itself 900 micro-units in total. But if we now focus on this line's interaction with the sacristy's doorway, some very precise and significant measurements become apparent.

The doorway needs to be seen as having a particular range within which the significant measurements take place. This horizontal range of distance consists of six greater feet, and the measurement is defined by the distance between the two pillars that stand one on either side of the doorway. To be precise the measurement actually runs between the 8/5 divisions of the pillars. In the following images of the ground plan the positions of these pillars are marked by the two small vertical black dotted lines that flank the red and green golden section lines.



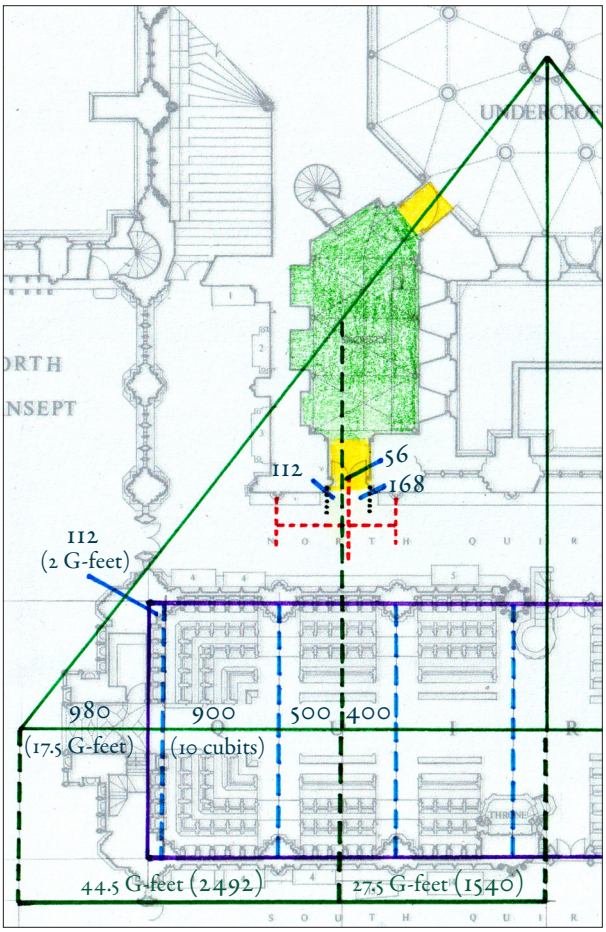
A close-up of the front door area of the sacristy. The red and green dotted lines are the golden section lines shown in the previous image. The new lines in this image are the short vertical black dotted lines. The top of these black dotted lines mark the position of the pillars that are positioned one on either side of the doorway. These pillars mark the six-foot range of distance within which the significant measurements take place. The red golden section line divides this six-foot range in half (i.e. 2:1) and the green golden section line into 1/3 and 2/3 (i.e. 3:2).

The pillars on either side of the doorway together mark the six foot range

Each pillar is 16 micro-units wide, and so their 8/5 division causes the 16 to be divided up into 10 and 6.

The six foot range stretches between the 8/5 divisions of the pillar's widths

It can be seen that the pyramid triangle's green dotted golden section line passes through the doorway at precisely one-third in from the left-hand side of the six-foot range of measure – so in other words, two greater feet. The short red dotted line which is to the right of the green golden section line marks the middle axis of the doorway, and it can be seen that it is one greater foot to the right of the green golden section line. This means that it is 500 + 56 micro-units into the 900 micro-unit bay. This then defines the golden section position of the doorway within the bay, because 900 ÷ 556 = 1.6187, which is a very close approximation of the golden number. So both phi-ness and the musical ratios 2:1 and 3:2 are present within these very precisely definable measurements.



The metrological measurements of the quire and sacristy area. 980 + 112 + 900 + 500 = 2492. This leads up to the green golden section line. Another 56 more marks the red golden section of the bay.

These descriptions have all looked upon the design of this sacristy doorway area according to a cubit that measures 90 micro-units. But if the cubit that measures 89.6 is used, the same geometry applies and works in the same way, with one key difference. The red dotted golden section line that marks the middle axis of the doorway falls at the 1.6 (i.e. 8/5) division of the bay rather than the 1.6187 division.

Imagining that the first bay of the quire now measures 896 micro-units rather than 900, the second bay would then need to contain 504 micro-units rather than 500, for it to reach the green golden section line. When this 504 is added to the 56 extra micro-units which need to be added on to reach the central axis of the doorway the total figure of 560 is reached. Finally, the whole bay of 896 micro-units needs to be divided by 560:

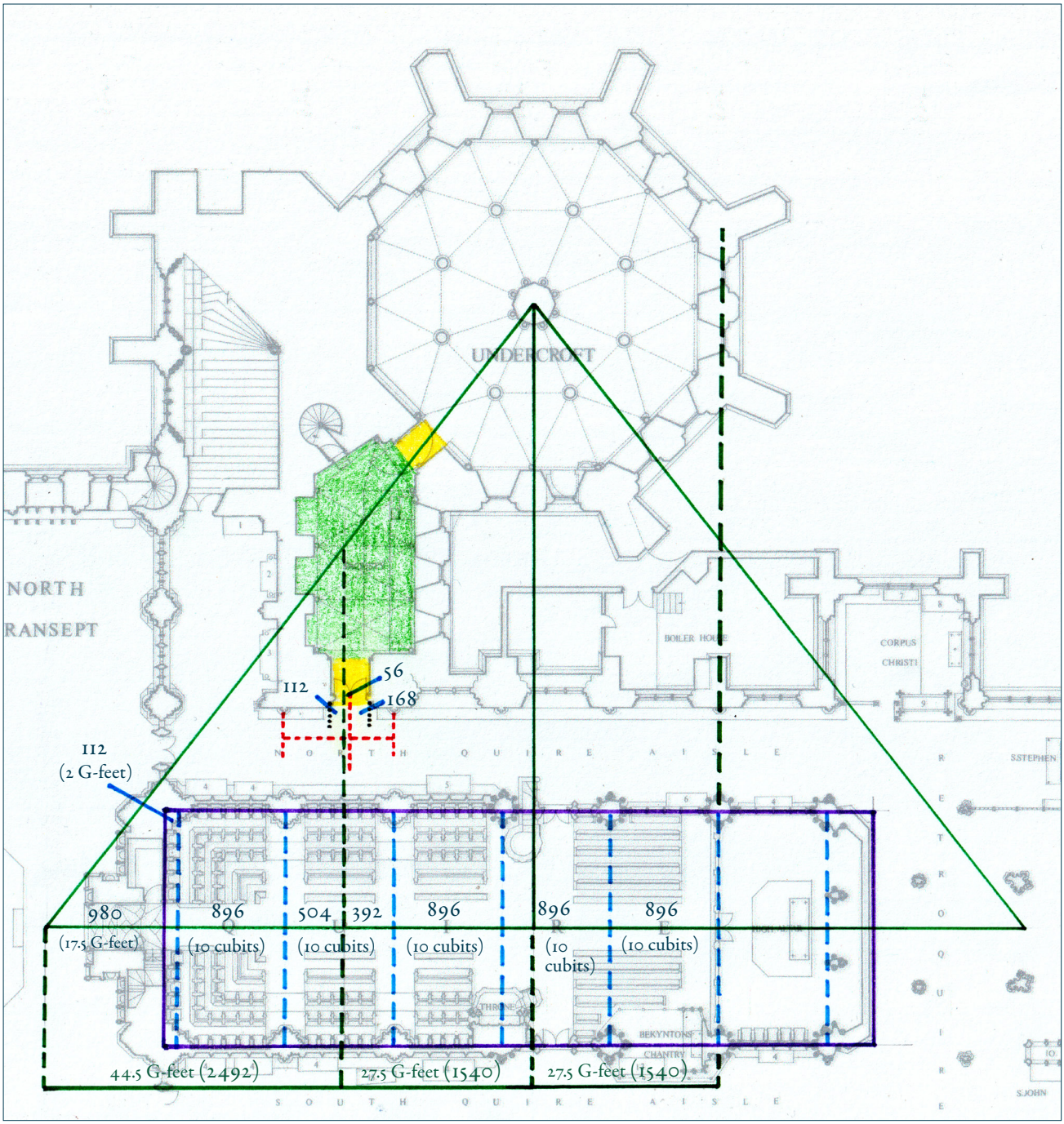
$$896 \div 560 = 1.6$$

So both versions of the cubit bring about harmonious resolutions, which inter-relate the golden section division of the pyramid triangle with the sacristy doorway, which is itself at the golden section division of its bay.

The other significant measurement in this area that corresponds to a cubit of 89.6 is one of the golden section lines on the right-hand side of the pyramid triangle. This line precisely defines the beginning of the sixth bay of the quire, which is effectively the beginning of the high altar. As the diagram on the following page shows, this line then appears to also define the eastern window line of the undercroft. If the various golden section measurements of the pyramid triangle that lead up to the sixth bay are counted up, they equal the divisions of the baseline that are brought about by bays that measure 896 micro-units: (see diagram on next page)

$$2492 + 1540 + 1540 = 5572$$

$$980 + 112 + 896 + 896 + 896 + 896 + 896 = 5572$$



When the cubit is understood to contain 89.6 micro-units the sacristy doorway is at the 8/5 division of the bay. The equivalent golden section line on the other side of the pyramid triangle then also aligns precisely with the division between the quire's fifth and sixth bays - which also aligns with the undercroft's window line.

As if all this were not enough, there is yet another quite remarkable detail within the measurements of the sacristy doorway, and it relates to the design feature shown in section 9.4 in which a stellation of the octagram star, which defines the octagonal shape of the undercroft, interacts with the sacristy doorway.

It is possible to very precisely define that the stellation runs along the right hand wall of the doorway and actually ends up terminating within the front wall of the doorway area just beyond base of a pillar that is on the inside of the sacristy doorway. The pillar is immediately on the right-hand side as one walks into the sacristy and

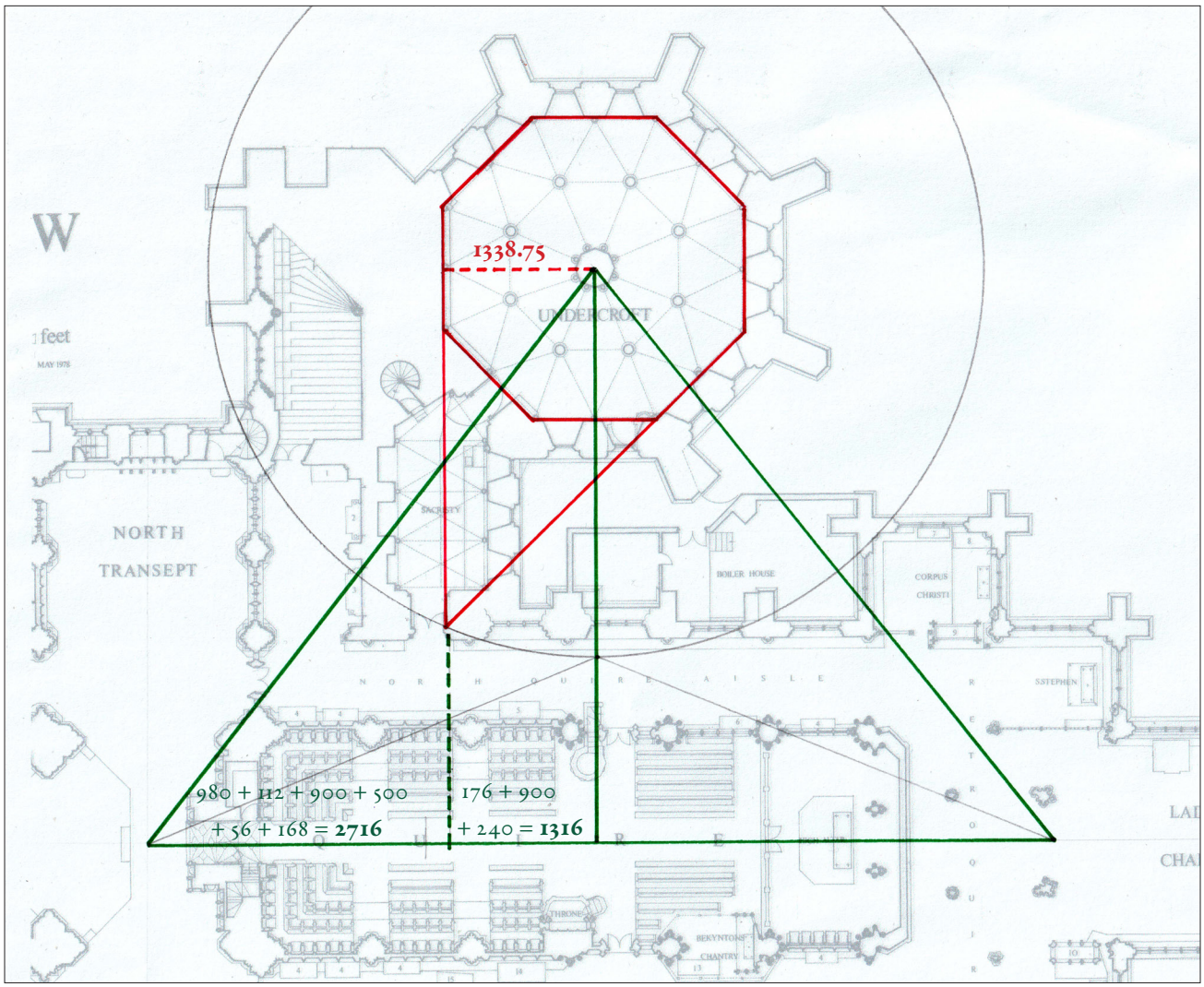
it has a rather imaginal carving at the top of it of a double ouroboros making a figure-of-eight around some foliage that is spewing from the mouth of an upside-down human head.

With the cubit of 90 micro-units, the measurement that this pillar brings to the doorway's range of six feet is quite remarkable. The diagram shows the micro-unit calculation that can be used to define the position of the pillar and its relationship with the six-foot range, and what becomes clear is that the stellation's point falls precisely 22.75 micro-units into the range from the doorway's right-hand pillar.

If the 336 micro-units of this six-foot range are then divided by 22.75, a seemingly obscure but nonetheless significant answer become apparent:

$$336 \div 22.75 = 14.76923$$

This number happens to be the precise number of days between a new Moon and a full Moon, because when it is doubled it becomes 29.53. But more significantly, this is the particular synodic measure found in the lunation triangle as shown in section 7.4, within which the number 7.3846 can be defined. This measurement is precisely half of 14.76923.



With reference to the diagram two pages back…. if the cubit is understood to contain 900 micro-units the distance from the bottom left-hand corner of the pyramid triangle to the green dotted line shown in the diagram above (which essentially marks the position of the doorway's right-hand pillar) is 2716 micro-units. The remaining number of micro-units required to reach the halfway point of the pyramid triangle's baseline is 1316 because 2716 + 1316 = 4032. But the red number - shown in the undercroft area - (1338.75 - i.e. 25.5 feet) is 22.75 more than 1316. This means that the red stellation is positioned 22.75 micro-units into the six-foot range (336) marked by the distance between the doorway's two pillars. 336 ÷ 22.75 then brings about the number of days leading up to a full moon.

To cap it all off, the relationship that the numbers 336 and 22.75 have with the lunation triangle are themselves significant lunar numbers – namely 14 and 28.

$$336 \div 28 = 12$$

This gives the lunation triangle's baseline of 12.

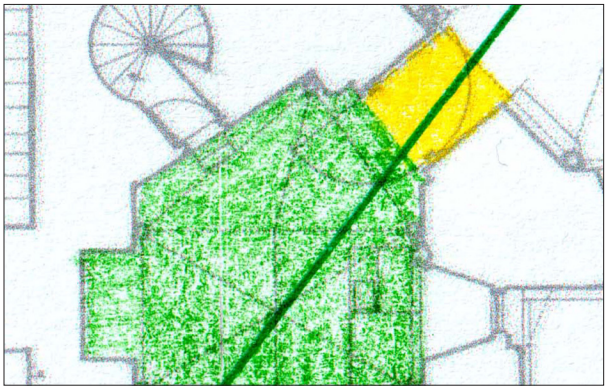
$$22.75 \div 14 = 1.625$$

This is the Fibonacci approximation used within the lunation triangle to obtain the synodic week of 7.3846.

$$12 \div 1.625 = 7.3846$$

The fact that this very detailed lunar measure derives from the stellation of the undercroft's octagram star resonates with the lunar association of these octagonal buildings within the Earth-Moon pyramid diagram, which is used in this area of the design.

Moving now to the back door of the sacristy, the first thing to point out is that the left-hand slanting edge of the pyramid triangle goes straight through this doorway into the octagonal undercroft.



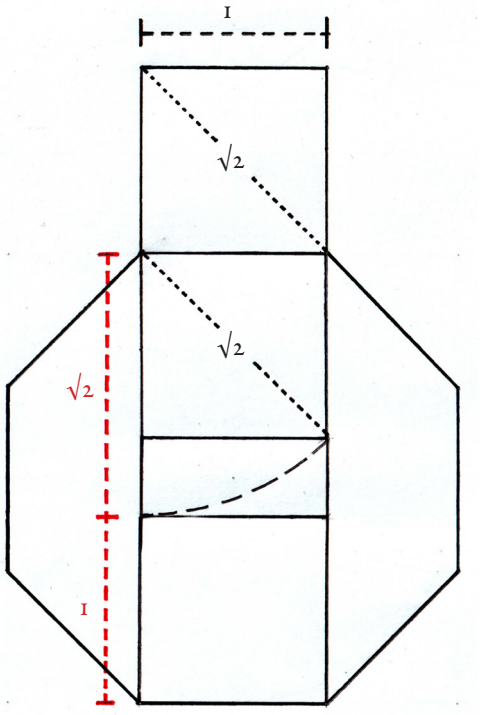
Left-hand slanting edge of the pyramid triangle (green line) passes directly through the back door of the sacristy (shaded yellow) into the undercroft

It was mentioned a little earlier that this doorway is also at the golden section of the undercroft's wall. So both the front door and the back door of the sacristy are positioned at the golden sections of their own particular stretches of wall. But on top of this, if the whole pyramid triangle is looked upon as being a Golden Pyramid Triangle then its two slanting edges would measure the golden number of 1.618 if the triangle's baseline was said to measure 2. So it is a 1.618 line passing through a 1.618 doorway, rather like the golden section line that passes through the sacristy's front door.

If this doorway is looked upon as leading into the back of the sacristy from the undercroft, then the doorway can be described as being at the golden section of the undercroft's wall. But the doorway is actually off-centre in relation to this golden section of the wall. This off-centre position actually divides the doorway by 11/7.

This forms yet another example of the interaction between phi and pi, although the Fibonacci approximation that is used here needs to be 13/8 rather than the usual 8/5 - as it produces a more ideal result. But having said this the lunation triangle relationships just mentioned above do arise from 1.625 which is actually the decimal form of 13/8.

The ideal arithmetic that governs all of this will be described after a brief interlude concerning the measurements of an octagon – which is the shape of the undercroft.

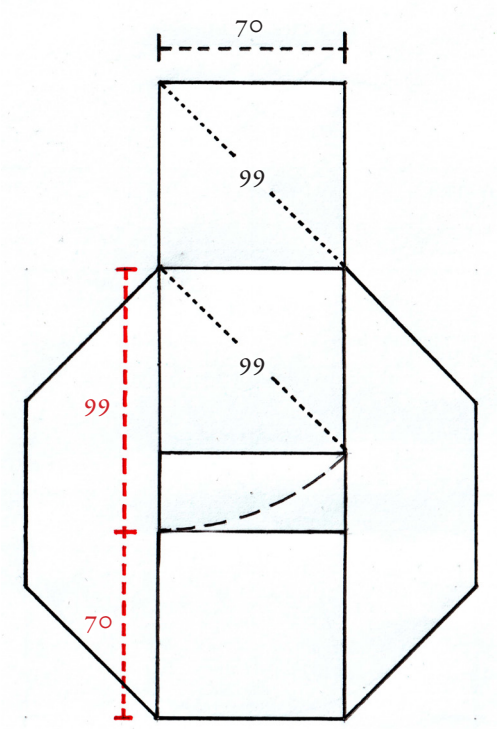


The square-root of 2 (√2 or 1.4142) in the square and the octagon

In geometric terms, the square contains the ratio known as 'the square root of 2' (√2). If the edge of a square is 1, its diagonal is √2. But in an octagon, if its edge measures 1 then its edge-to-edge height is √2 + 1.

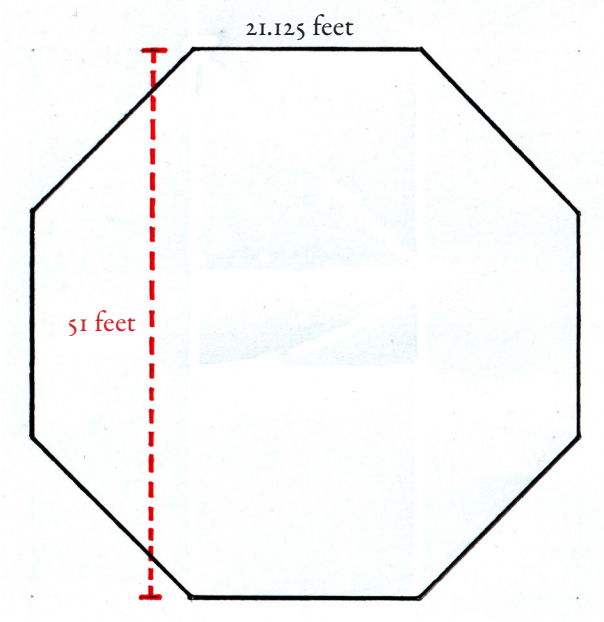
A very good rational approximation of √2 / 1 is 99/70. If √2 = 1.41421... then 99 ÷ 70 = 1.41428.

If 99/70 is extended so as to approximate the √2 + 1 measurement found in an octagon, it increases to 169/70 (i.e. 99 + 70 = 169). A sequence then begins from here, whereby the number 169 will now become the smaller number in an even closer approximation of √2 + 1. This is 408/169. The sequence then carries on with the ratio 985/408 followed by 2378/985, and so on.



The same diagram using the approximate √2 relationship of 99 to 70

Returning to 408/169, if these two numbers are both divided by 8 the ratio reduces to 51/21.125. This accordingly becomes the ratio that governs the dimensions of the undercroft in the sense that its very accurate wall-to-wall measurement of 51 feet will result in each of the walls having a length of 21 1/8 feet (i.e. decimally expressed as 21.125).



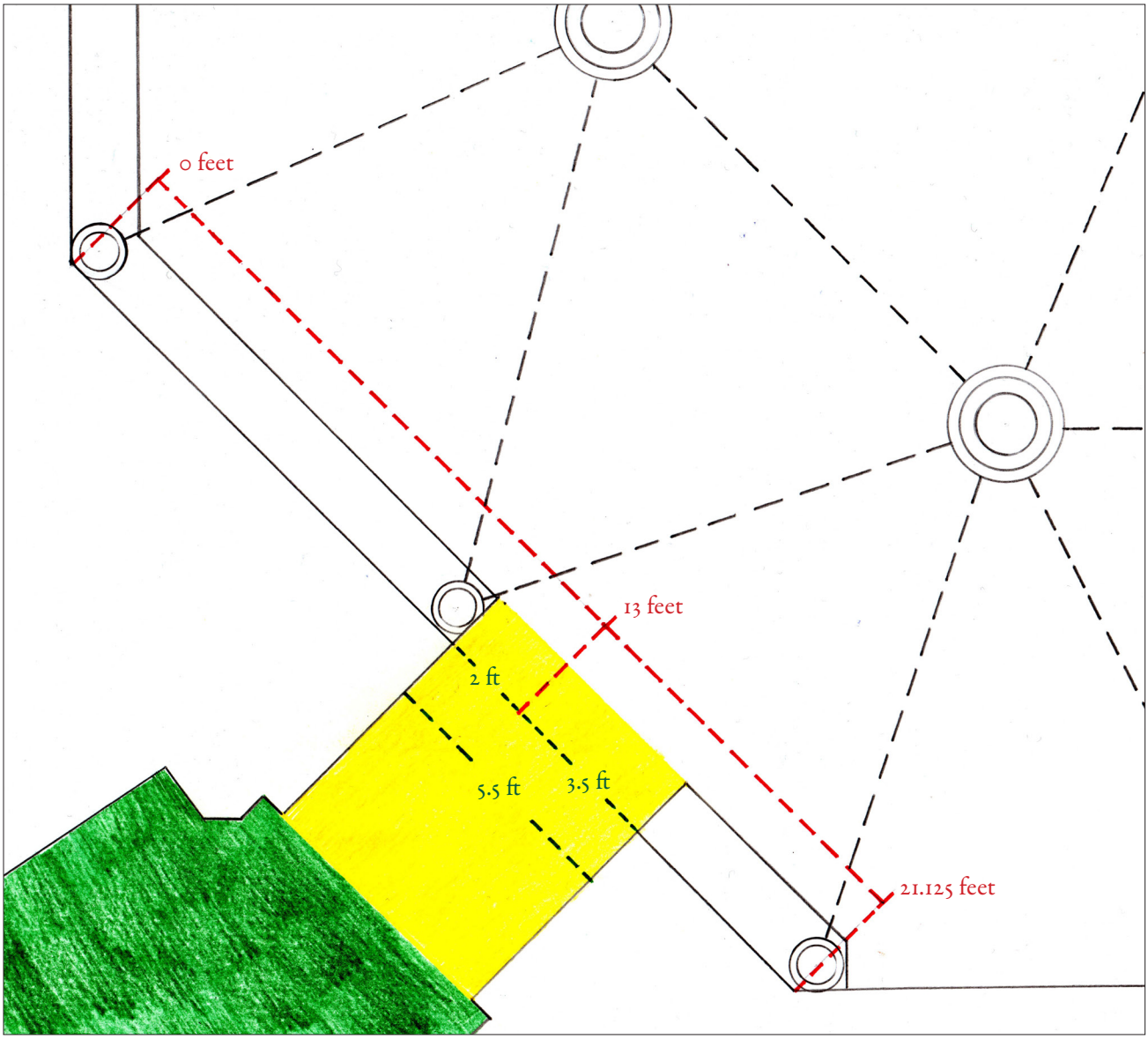
The octagon with an edge of 21.125 has an approximate height of 51

This measurement of 21.125 feet sounds obscure, as it is not a whole number of feet. However, when it is divided by the Fibonacci approximation 13/8 (1.625), there is an ideal resolution:

21.125 ÷ 1.625 = 13

So the golden section of each wall in the undercroft can be understood to be 13 feet along the wall.

This particular measurement falls within the doorway that leads from the undercroft into the sacristy, although not at the doorway's central vertical axis. The doorway is very accurately 5½ feet wide, and it begins from 11 feet along the wall. So the 13-foot golden section measurement has 2 feet of doorway on one side of it and 3½ on the other. By doubling these numbers - 2 and 3½ - the numbers 4 and 7 become apparent, which together make 11. So in other words, the 5½-foot width of the doorway can be described as being made up of 11 'half-feet'. So it can be said that the golden section of the wall divides these 11 'half-feet into 4 and 7 and herein again lies the 11:7 ratio.



The measurements of the undercroft wall and the position of the sacristy's back door. The golden section of the undercroft wall coincides with the door's 11:7 division.

All of this harmonious mathematical detail, emphasising the golden ratio to such a degree, makes the sacristy appear to be a very significant place. Another feature not yet mentioned about the sacristy is a series of seven bosses that run northwards along the ceiling. When walking from the sacristy's front door to its back door, the walker passes directly underneath these seven bosses. More shall be said of them in Part 4 (p.384 - 390).

Chapter 16.

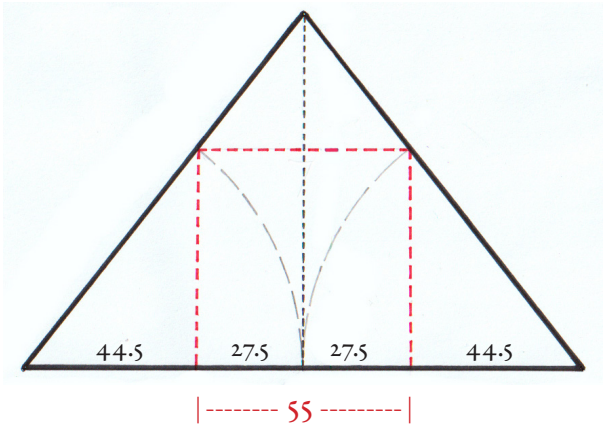
The Octagonal Chapter House and Treasury

16.1 THE CHAPTER HOUSE

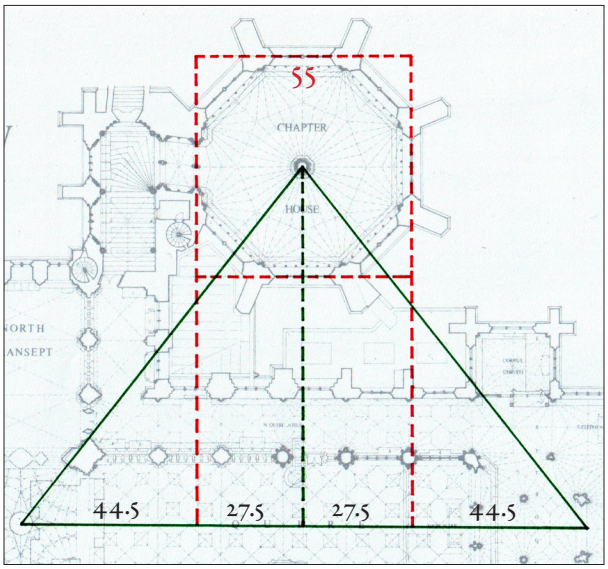
It was shown in chapter 8 (p.150-1) how the chapter house accords with the golden section lines that are produced from within a pyramid triangle. But as ever, we need to look at these golden sections as rationalised versions of the golden ratio. In this particular case, Fibonacci numbers are used. This becomes possible through the fact that the baseline of the pyramid triangle can be understood to consist of 144 greater feet, because the micro-unit measurement of its baseline is 8064 and a simple calculation tells us that 144 × 56 = 8064.

The number 144 is the twelfth Fibonacci number, so the golden section divisions can all apply to Fibbonacci numbers that are smaller than 144. However, these Fibonacci divisions work on either side of the triangle in such a way that the Fibonacci numbers are halved. So for instance the middle vertical axis of the pyramid triangle divides its baseline of 144 in half, which creates two measurements of 72 greater feet. Within each of these ranges of 72 feet Fibonacci divisions are then produced. But the fact that 72 is half of 144 continues to reflect itself in the sense that all the Fibonacci divisions consist of Fibonacci numbers that have been halved. For example 44.5 is half of 89, and so on.

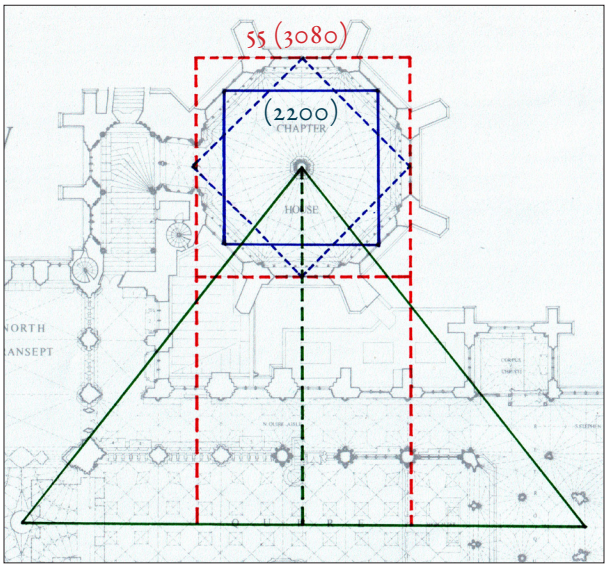
The two measurements of 27.5 feet are each half of 55 – which is the tenth Fibonacci number. However, because these two measurements are next to one another they together create a 55-foot measurement, which appears to govern the window-to-window width of the chapter house. As the diagram shows, it can therefore be suggested that a square with an edge that measures 55 feet contains the octagonal form of the building along the vertical plane of its windows.



The pyramid triangle with a baseline of 144. The triangle's golden sections are rationalised into half-Fibonacci numbers. 44.5 is half of 89 and 27.5 is half of 55. So, two 27.5 unit measurements next to one another make 55 units.



The Moon-square that derives from the Earth-Moon diagram is also nested within this octagon (see blue squares below) in such a way that its diagonal measurement appears also to have this 55-foot measurement.



The interesting thing about this apparent concordance is that the two squares in question are using the pyramid triangle in a different way to one another. This is because the Earth-Moon diagram that produces the Moon-square is based on the 11 – 7 measurements of the Pi Pyramid Triangle whereas the 55-foot square that contains the chapter house's octagonal form is derived from a rationalised version of the pyramid triangle in its golden ratio form. But another intriguing point is that the size relationship between the 55-foot square and the Moon-square is also effectively the same as the size relationship of the planet Mercury to the Moon. On top of this, the diameter of Mercury in miles is virtually the same as the square of 55:

55 × 55 = 3025 (Mercury's diameter is 3032 miles)

There are 3080 micro-units in 55 greater feet, and this also expresses a relationship between 55 and 56 as it is their product:

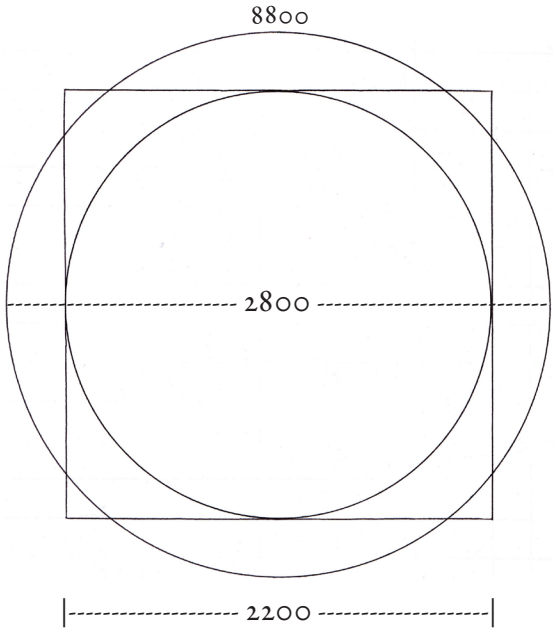
55 × 56 = 3080

As for the Moon-square, it needs to be remembered that the pyramid diagram from which it is generated has been increased in size by 55:56, and so the Moon-square with its lunar mileage number of 2160 increases to 2199.272727. Such a number is so very close indeed to the useful pi number 2200 that the designer must surely have intentionally micro-variated it upwards by the necessary micro-variation of 3024:3025. By doing this it can now be said that the Moon-square has an edge of 2200 micro-units, which is also 44 lesser feet (see the third diagram on the previous page).

If 2200 is the edge-length of the Moon-square, then its diagonal must be some kind of √2 measurement more than this. Sure enough, the ratio that accords with the design theory here is the very basic and fundamental rational version of √2, which is the relationship of 7:5. If the numbers 7 and 5 are both multiplied by 440, the ratio of 7:5 becomes 3080:2200. So herein lies the relationship between the 55-foot square and the smaller Moon-square. If the Moon-square's edge is 2200 then its diagonal measurement is the same as the edge-length of the 55-foot square, i.e. 3080 micro-units. So the resulting outcome of increasing the Moon-square by the ratio 55:56 is to rationalise its diagonal measurement into the product of 55 × 56.

As for the wall-to-wall measurement of the chapter house, this contains an interesting possibility in that it veers between two different measurements that differ by six micro-units. This is a relatively large apparent discrepancy in comparison to other parts of the cathedral, although it is perhaps not large enough for one to be absolutely sure that it isn't a result of some movement in the building over the years. But having said this, the undercroft below the chapter house is still very accurately 51 feet wide. However, the fact remains that some of the wall-to-wall measurements in the chapter house are around 2850 micro-units, whereas others are around 2856 micro-units. Interestingly, 2850 is 57 lesser feet, whereas 2856 is 51 greater feet.

If the 2200 edge-length of the Moon-square were to go through a 'squaring-of-the-circle' process, a possible design reason for having these two different measurements at the same time becomes apparent. The periphery measurement of the Moon-square is 8800 (2200 x 4). With the use of 22/7 it can then be said that an equivalent circle with a perimeter of 8800 has a diameter of 2800.

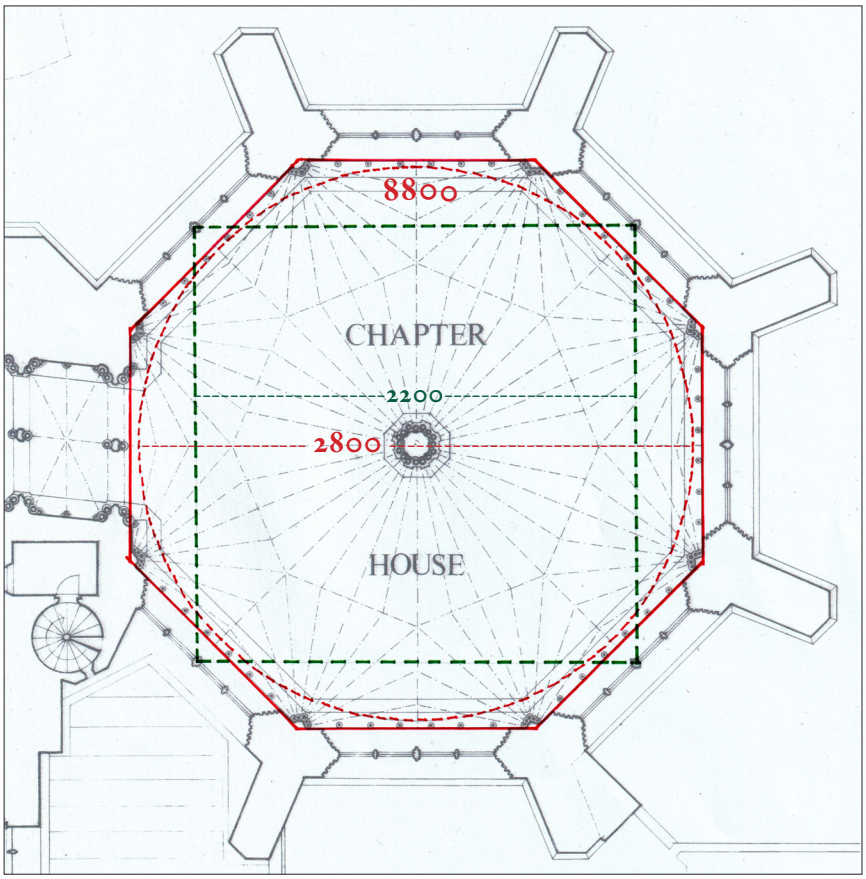


Such a number is entirely appropriate for the Moon, which has an archetypal association with the number 28 due to its sidereal and synodic cycles being a little less and a little more than 28 days. An interesting thing about 2800 within the Wells design is that this number is the product of the two different foot-units in question, i.e. the lesser foot of 50 and the greater foot of 56.

$$50 \times 56 = 2800$$

So this 2800 measurement could be described as being either 50 greater feet or 56 lesser feet. However, as mentioned above, the actual wall-to-wall measurement is a little wider than this. The two slightly different measurements mentioned above are 2850 and 2856. These two slightly different measurements are what you get if 2800 has a lesser foot added to it (i.e. 2850) or a greater foot added to it (2856). Herein lie the two differing wall-to-wall measurements, which are possibly both 'intentionally' used in the chapter house.

The circle with a diameter of 2800 can be described as the heavenly counterpart of the Moon-square because they have the same peripheral measurement (i.e. 8800). The size of this theoretical circle in-situ falls a little short of the walls all the way around, but this means that such a circle would, as it were, 'metaphysically' pass through the bodies of all the people sitting on the 51 seats that the chapter house contains. In this sense there is a circular association with the chapter house within which everyone is sitting 'in the round', rather like the Round Table that was so prominent in the



The Moon-square is marked in green dotted line. The edge-length of the square is 2200 micro-units. Its peripheral measurement is therefore 8800.

The circle that is marked in red dotted line has the same 8800 measurement in its circumference which accordingly means that its diameter measures 2800.

This diamater measurement falls just slightly short of the chapter house's inside walls which are between 2850 and 2856 micro-units apart from one another - i.e. and therefore 1 lesser foot (50) and 1 greater foot (56) more than 2800.

So this circle - which is seemingly not materially marked by anything - can be looked upon as existing 'theoretically' as a kind of symbolic 'round table' that passes through the body of everyone who is present - sitting in-the-round - "all with one accord in one place".

This inevitably confers a 'heavenly' status onto this octagonal hall as well as onto those who sit within it as part of a 'heavenly council'.

It therefore makes symbolic sense that, in cosmological terms, it seems to have a symbolic association with the Moon as well as the eighth heaven of the fixed stars in which the 12 'zodiacal' knights are seated at the round table of the circulating stars.

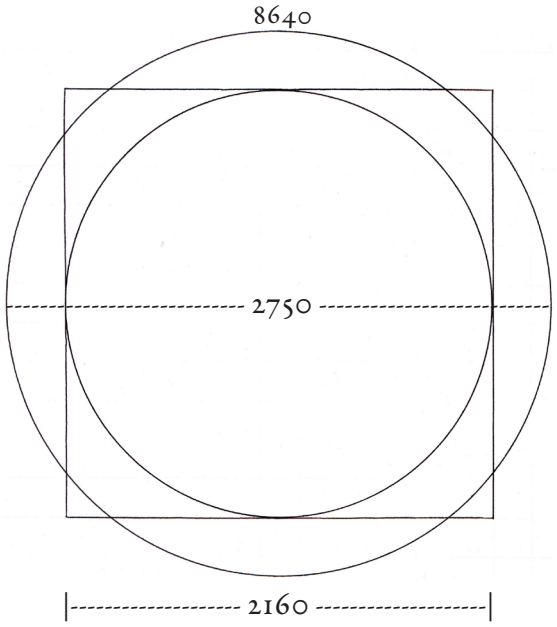
Arthurian literature of the 12th century.[1] The apparent symbolism here is unity and equality, although the bishop, the dean and the precentor do together sit at the eastern head of the table. It would also appear to suggest that the influence of the Moon is in some way being called upon within the decision-making processes associated with this octagonal hall. Such an influence must surely have an association with Wisdom and therefore the Holy Spirit.

With this association of the Moon and Wisdom in mind it was pointed out in section 9.6 that the two destinations of Pythagoras' mythical travels had Moon deities that were associated with Wisdom.

The lunar basis of the design theory outlined above becomes even more pronounced when the mileage of the Moon itself is looked at in relation to the squaring of the lunar circle. In the design theory the measurement of the Moon in the chapter house is micro-variated up by 3024:3025 from 2199.272727 to 2200 and then the use of 22:7 brings about a larger circle with a diameter of 2800. The relationship of 3025:3024 is actually a pi relationship in the sense that it is the difference between two different rational versions of pi – namely 22/7 and 864/275 (an approximation of pi associated with Leonardo of Pisa – aka 'Fibonacci'). The pi ratio 864/275 is very clearly present in the actual lunar mileage because if the diameter of the Moon-circle is 2160 miles, then the square that contains the Moon-circle has a peripheral measurement of 8640 (4 × 2160).

This can then be looked upon as producing the larger lunar circle with a circumference of 8640, which has a diameter of 2750. So the pi ratio 864/275 clearly shows itself in mileage form as 8640/2750.

What can be understood from this is that the Moon-square in the chapter house design, with its initial measurement of 2199.272727, can itself actually bring about the larger 2800 circle if the lunar pi ratio



864/275 is the particular one that is used. If four such edges of a Moon-square are added together (2199.272727 × 4) the result is 8797.090909 rather than the much neater number 8800. But if this more obscure number is then then divided by 864/275 it still brings about a diameter measurement in the larger lunar circle of 2800:

$$8800 \div (22/7) = 2800$$

$$8797.090909 \div (864/275) = 2800$$

So in one sense the micro-variation of 3024:3025 which changes 2199.272727 into 2200 isn't actually necessary. But having said that, 2200 is a much clearer number to use in terms of feet because it is 44 lesser feet whereas 2199.272727 doesn't easily resolve into any foot-unit.

But ultimately the key point here is that the chapter house appears to use the pi approximation 864/275 within its lunar architectural design much like the Moon itself, which cosmologically embodies such a ratio in its mileage.

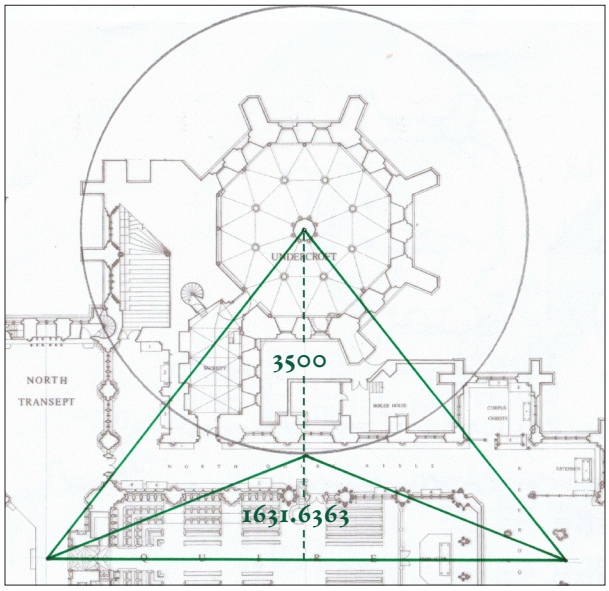
1. The circular association with the polygonal chapter houses also shows itself within the 'Pi' numbers of seats in the chapter houses at York and Lincoln. A 'circumference' of 44 seats is present at York whereas Lincoln has a very interesting seating arrangement in which 20 of the 63 seats are outside of the decagonal shape of the building which accordingly suggests the two numbers that form the pi relationship of 63/20.

16.2 THE TREASURY/UNDERCROFT

Below the chapter house is another octagonal room, which was historically referred to as a treasury. But nowadays it is referred to as an undercroft.

Its octagonal ground plan is derived from the pyramid triangle when it is understood to be a Golden Pyramid Triangle rather than a Pi Pyramid Triangle. As was shown in chapter 8 (p.147), the Golden Pediment Triangle is included within the Golden Pyramid Triangle in this particular area of the design, whereby they share the same baseline. The distance between the apexes of the two triangles then forms the radius of the container circle that effectively produces the undercroft's octagonal ground plan via an octagram star. It was also mentioned in chapter 8 (p.148) that a Golden Pyramid Triangle naturally produces a five-fold division of the circle, because it consists of golden ratio measurements that when used in a circle produce five-fold symmetry. However, in this particular instance the designer appears to have swapped a pentagram star for an octagram star, and it is then the octagon at the centre of this star that is used to define the octagonal ground plan of the undercroft.

The measurements of the Golden Pediment Triangle as it is used in this design are such that it is virtually identical to a 'pure' Golden Pediment Triangle. The rationalisation of the triangle only very slightly increases its height from the incommensurable micro-unit measurement of 1630.69683... to a rationalised measurement of 1631.636363 micro-units. This tiny change of around 1/5 inch then causes the container circle to have a radius of 3500 micro-units, because the overall height of the pyramid triangle is 5131.636363 micro-units. So in a certain sense the pyramid triangle can be looked upon as having been reduced from 5131.636363 to 3500:



The pediment triangle's height creates a circle with a radius of 3500

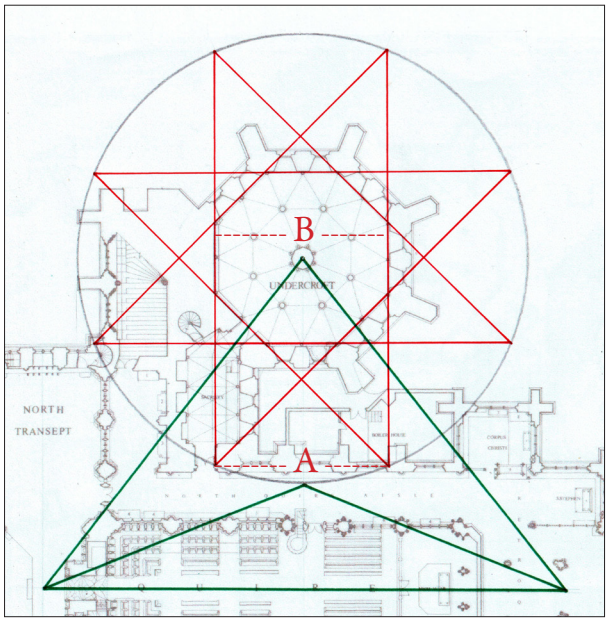
5131.636363 – 1631.636363 = 3500

A pyramid triangle with a height of 3500 micro-units also features significantly at the east end of the cathedral. Interestingly, this particular measurement is also significant in the measurements of the octagonal Dome of the Rock in Jerusalem.[2]

A container circle with a radius of 3500 corresponds to 22/7 by a ratio of 1000:1, because in the 22/7 division of the circle the radius measures 3.5. So, a circle with a radius of 3500 will have a diameter of 7000 and a circumference measuring 22,000.

This container circle then has an octagram star placed within it. As can be clearly observed, the distance between the tips of the star's neighbouring stellation points (marked 'A') is the same as the edge-to-edge

2. 3500 micro-units measure 66 feet and 8 inches, which is very similar indeed to Cresswell's description of both the diameter and the height of the dome on the Dome of the Rock. He describes it as having a diameter of 66 feet and 3 inches, and a height of 67 feet and 2 inches. This is inevitably of interest in relation to the apparent design connection between this octagonal part of Wells Cathedral and the octagonal Dome of the Rock (see section 4.2).



The distance marked 'A' & 'B' measures 2677.5 micro-units or 51 English feet

measurement of the octagon at the centre of the star (marked 'B'). So bearing in mind that the circumference of the container circle is divided into eight equal parts by the octagram star, it becomes possible to use the radius-to-edge relationship of an eight-fold circle to calculate the edge-to-edge measurement of the octagon at the centre of the octagram star.

If an octagon has a radius of 1, its edge-length has the incommensurable measurement of 0.765367... The designer appears to have used a rationalised version of this edge/radius relationship that can be expressed as 153/200. In simpler terms:

$$153 \div 200 = 0.765000$$

If the container circle has a radius of 3500 micro-units, this measurement can be multiplied by 0.765 and the result then gives the number of micro-units contained within the distances marked 'A' and 'B':

$$3500 \times 0.765 = 2677.5$$

So the edge-to-edge measurement of the octagon at the centre of the octagram star is 2677.5 micro-units. However, when this seemingly obscure number is divided into the English foot there are found to be precisely 51 of them:

$$2677.5 \div 52.5 = 51 \text{ English feet}$$

This theoretical measurement of 51 English feet can then be verified through empirical measurement analysis inside the undercroft itself. Sure enough, the wall-to-wall measurement in this octagonal room is almost exactly 51 feet, only veering off now and then by around half an inch on average.

Herein lies one of several examples that suggest the prevalence of the number 3 within the design of this area of the cathedral. When the ratio 200:153 is used to define the radius:edge measurement of the eight-fold division of the container circle it causes its radius of 3500 micro-units to be divided by 200, which yields an interesting result:

$$3500 \div 200 = 17.5$$

17.5 micro-units is one-third of an English foot and so this is why the number 153 defines the number of 'one-third-feet' in the octagon's measurement. 51 feet is the same as 153 one-third-feet (or 153 4-inch 'hands'). Indeed the 51 feet could even be defined as 17 yards, and this would then fully reflect the numerical description given by St Gregory the Great in relation to the 153 fishes of John's Gospel, in which he first multiplies 17 by the number of the Trinity to get 51, and then multiplies 51, again by the number of the Trinity, to get 153.[3]

This association of the number three with the north-side octagonal buildings at Wells Cathedral will now be looked at in more detail.

3. See chapter 3 of *Gregory the Great* by John Moorhead, 'Homitiae xl in Evangelia', Routledge, 2005, page 72.

16.3 THE PREVALENCE OF THE NUMBER 3 ON THE NORTH SIDE OF WELLS CATHEDRAL

Having just mentioned the use of 153 'hands' in the measurement of the undercroft, it can also be pointed out that there are enough instances of the number 3 within the design of the octagonal north-side buildings at Wells that there would appear to be an intentional use of numerical symbolism on the part of the designer.

The most obvious threeness within Christian theology and symbolism is of course the Trinity, but there appears to be a more wide-ranging list of threenesses used within the design, which means threeness itself is emphasised with all its multi-faceted symbolism. But having said this, the Trinity is so infused with the threeness of the number 3 that the very use of any three-fold symbolism in a Christian setting inevitably embodies some degree of remembrance of the Trinity – which, for a Christian, is of course ultimately a remembrance of God.

To begin with there is the division of the sacristy doorway into three, as was shown in the previous chapter. This is the doorway that leads through to the octagonal undercroft via the sacristy. This octagonal architectural zone actually consists of three levels, even though seemingly only two of them have ever been used. The undercroft is the first level, which is on the ground floor, and then the chapter house is the second level, in the middle. Above the chapter house there is yet another room, albeit an unfinished one, and very little is known about it. Indeed it is only even described as a 'room' because the carving on the inside of the stone window holes has clearly been finished, suggesting that this place was intended to be made into a third room at some point. Interestingly, the central pillar that runs through the undercroft and chapter house carries on upwards into this third octagonal level, and so any symbolism it may have would appear to relate to the idea of three levels that are united by a singular 'spine' or 'ontological axis'. This brings to mind what could be described as the 'ontological ladder' climbed by St Paul to the third heaven.

Other threenesses that have already been mentioned in relation to this north side of the cathedral are the fact that the chapter house appears to be an image of the Moon, which is symbolically understood to be three-fold owing to its three 'faces' – waxing crescent, full circle and waning crescent. Another threeness shows itself in the form of the Moon-square within the Earth-Moon diagram, which is a 3 × 3 square. As mentioned in section 9.2, this might have influenced the use of the numbers derived from the 3 × 3 magic square within the stair-count of the chapter house staircase. There is also the three-fold symbolism of the all-seeing Eye of Providence via the three seats in the chapter house that have an uninterrupted view of all the other seats.

With Pentecost in mind, and its symbolic association with chapter houses, we can return to the three-fold symbolism of the number 153 as described by Gregory the Great, and in fact also similarly described by St Augustine, because both of them begin in their mathematical journey to 153 from a beginning point of the number 17. They both concoct the number 17 by adding the Ten Commandments to the Seven Gifts of the Holy Spirit. This allegorical interconnection of Old and New Testament number symbolism naturally speaks of allegorically equivalent Old and New Testament events – namely the Jewish feast of Shavuot, and the equivalent Christian feast of Pentecost. Shavuot takes place fifty days after Passover, while Pentecost takes place fifty days after Easter Sunday. Whereas Shavuot commemorates the 'descent' of the Torah, and particularly the Ten Commandments, from Mount Sinai, Pentecost commemorates the descent of the Seven Gifts of the Holy Spirit to the Apostles in the Upper Room.

One of the apparent symbolisms of the octagonal north side of Wells Cathedral is that of Pentecost – as mentioned in section 9.5. The interior layout of the chapter house resembles the scene in the Upper Room at Pentecost in which The twelve 'zodiacal' apostles encircle the 'polar' Virgin Mary – who, as the Stella Maris, is the pivot of the starry eighth heaven.

Returning to the association of the number 17 with Pentecost, the biblical account of Pentecost describes the presence of 17 different people and nations.[4] But it was also described back in section 9.2, that the number 17 is one of the significant 'Jabirian' magic square numbers that features within the stair-count of the chapter house staircase.

As an octagonal image of the eighth heaven the chapter house can also be seen symbolically as the 'Ogdaodic' origin from which the Seven Gifts descend – symbolically speaking – down the seven-unit height of the pyramid triangle into the heart of the quire. But the pyramid triangle diagram as it is used in this area of the design can also comfortably be seen as symbolising Shavuot, whereby the pyramid triangle is Mount Sinai. The 1 × 3 rectangle of the 'Solomonic' quire at the foot of the mountain is then the desert Tabernacle, which is precisely half the measurements of Solomon's Temple. As shown in chapter 8 (p.152-4), this 1 × 3 rectangle is also derived from a ten-pointed star that is made up of two five-pointed pentagram stars, which then numerically reflect the Ten Commandments with five of the commandments written on each of the two stone tablets. These stone tablets were kept in the Ark of the Covenant in the Tabernacle's Holy of Holies. It was shown in the previous chapter how the golden pyramid rhomb diagram even looks as if it might in some way underlie the design layout of the Tabernacle itself, due to the numerical and geometrical correspondences that it has in relation to the biblical description of the Tabernacle's measurements.

Returning to the descriptions of 153 by St Gregory and St Augustine, it is Augustine who first derives the number 17 from the joining of the The Commandments with the Seven Gifts of the Holy Spirit, and he then points out that the sum of the first 17 numbers is 153:

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 +$$
$$10 + 11 + 12 + 13 + 14 + 15 + 16 + 17 = 153$$

So with threeness or 'triangularity' in mind, Augustine is effectively pointing out that the number 153 is the 17th 'triangular' number.

But the measurements of the Wells undercroft, as described above, actually reflect Gregory's numerical reasoning more. He begins with 17 via the same biblical rationale as Augustine, but as mentioned above he uses the number of the Trinity as a multiplier to first get from 17 to 51 and then onwards from 51 to 153.

So the number 3 is clearly a prominent number in relation to 153, but it is also a significant number within the story of the 153 fish in John's Gospel, because this particular meeting between Christ and his disciples is specifically described as the third one after the Resurrection (21:14). Immediately after mentioning this the Gospel then goes on to describe Christ asking Peter three times in a row whether he loves him (21:15–17).

The association between the numbers 3, 17, 51 and 153 has led to this research discovering an interesting number sequence which jointly expresses these two different number patterns, described by Augustine and Gregory, in one and the same sequence. So within the sequence there is a bringing together of the addition of the numbers from 1 onwards, as used by Augustine. But there is also a coinciding of these results with the multiplication pattern used by Gregory. As can be seen within the table on the following page, the third line – which corresponds to the number 3

4. These 17 are described as 1) Galilean. 2) Parthian. 3) Medes. 4) Elamites. 5) Peoples from Mesopotamia. 6) Judaea. 7) Cappadocia. 8) Pontus. 9) Asia. 10) Phrygia. 11) Pamphylia. 12) Egypt. 13) The parts of Libya round to Cyrene. 14) Residents of Rome. 15) Jews and Jewish converts. 16) Cretans. 17) Arabs.

(shaded in green) – directly involves the numbers 17, 51 and 153. Augustine and Gregory's addition of 10 to 7 is also present within the way that the sequence generates the number 17.

As described above, the number 17 gets to 153 either through adding together the first 17 numbers or alternatively by using 3 as a multiplier to hop from 17 to 51 and then on to 153. This is effectively the basis of the sequence in the table below. The second line in the table, for instance – which uses 2 as a multiplier – begins from the number 7. If the number 7 is multiplied by 2 it produces 14, and then if 14 is also multiplied by 2 it produces 28. But at the same time as this, if the first 7 numbers are added together they also become 28:

$$1 + 2 + 3 + 4 + 5 + 6 + 7 = 28$$

... and so the sequence continues.

The table's top row contains initials that describe various mathematical procedures as listed here below. The first column shows the 'multiplier' (M). This plays the part that the number 3 plays in relation to Gregory's description of 17, 51 and 153 ... i.e. 17 × '3' = 51; 51 × '3' = 153.

The second and third column show the 'base number' (BN). This plays the part that the number 17 plays in relation to Gregory's description of 17, 51 and 153.

The third and fourth column show the 'intermediate number' (IN). This plays the part that the number 51 plays in relation to Gregory's description.

The fourth and fifth column show the 'sum of consecutive integers' (SCI) beginning from 1. These triangular numbers play the part that the number 153 plays in relation to Augustine's description.

M	BN and QCI	BN × M = IN	IN × M = SCI	QCI leading to SCI	SCI ÷ QCI = Sq-N	Sq-N
1	1	1 × 1 = 1	1 × 1 = 1	1 leads to 1	1 ÷ 1 = 1	$1 = 1^2$
2	1 + **6** = 7	7 × 2 = 14	14 × 2 = 28	7 leads to 28	28 ÷ 7 = 4	$4 = 2^2$
3	7 + **10** = 17	17 × 3 = 51	51 × 3 = 153	17 leads to 153	153 ÷ 17 = 9	$9 = 3^2$
4	17 + **14** = 31	31 × 4 = 124	124 × 4 = 496	31 leads to 496	496 ÷ 31 = 16	$16 = 4^2$
5	31 + **18** = 49	49 × 5 = 245	245 × 5 = 1225	49 leads to 1225	1225 ÷ 49 = 25	$25 = 5^2$
6	49 + **22** = 71	71 × 6 = 426	426 × 6 = 2556	71 leads to 2556	2556 ÷ 71 = 36	$36 = 6^2$
7	71 + **26** = 97	97 × 7 = 679	679 × 7 = 4753	97 leads to 4753	4753 ÷ 97 = 49	$49 = 7^2$

The fifth column also shows the 'quantity of consecutive integers' (QCI) beginning from 1. This particular number is the same as the base number, but as used in relation to Augustine's description rather than Gregory's, in which he adds a particular quantity of consecutive integers together beginning from 1 (e.g. all the integers from 1 to 17, which total 153).

The fifth and sixth columns show the 'square numbers' that are produced by dividing each 'sum of consecutive integers' (e.g. 153) by the quantity of consecutive integers (e.g. 17).

Finally the **bold black** numbers in the second column show the way in which each new base number is produced and how it occurs according to an increase of 4 each time. They also denote the amount of triangular numbers between each new result i.e. there are six triangular numbers between 1 and 28. There are ten of them between 28 and 153. There are fourteen of them between 153 and 496 etc...

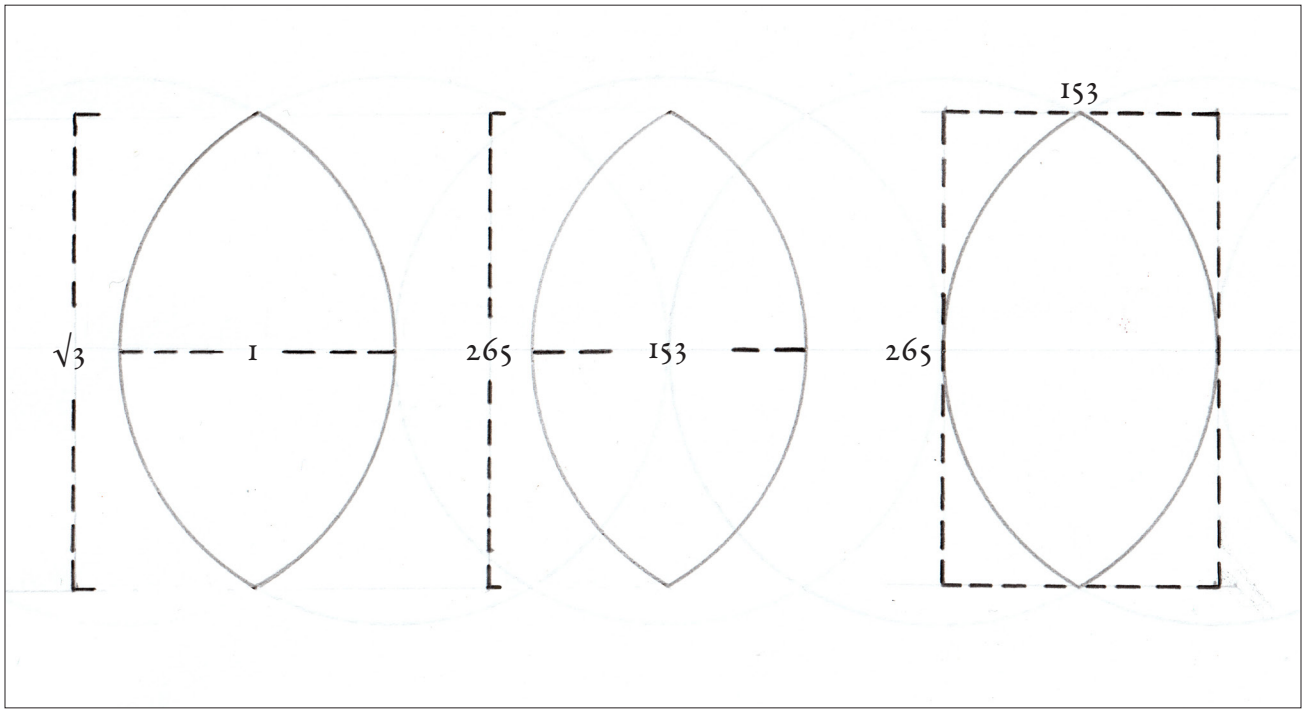
Another significant example of 3 and 153 can be seen within the commensurated measurements of a Vesica Pisces, – which, as the name suggests, has an association with the fish. This is reminiscent of the Gospel story with its description of 153 fish.[5] The length-to-width ratio of the Vesica Pisces is $\sqrt{3}$ to 1, and this is very closely approximated by the commensurable relationship of 265 to 153: See diagrams below.

$$\sqrt{3} = 1.732050$$

$$265 \div 153 = 1.732026$$

This commensurable version of $\sqrt{3}$ is associated with Archimedes because he used it, along with another approximation of $\sqrt{3}$ (1351/780), in his written description of the measurement of a circle.

Bearing in the mind the fact that the $\sqrt{3}$ rectangle can be divided up into three smaller $\sqrt{3}$ rectangles, we begin to see another lunar dimension to this threeness via the



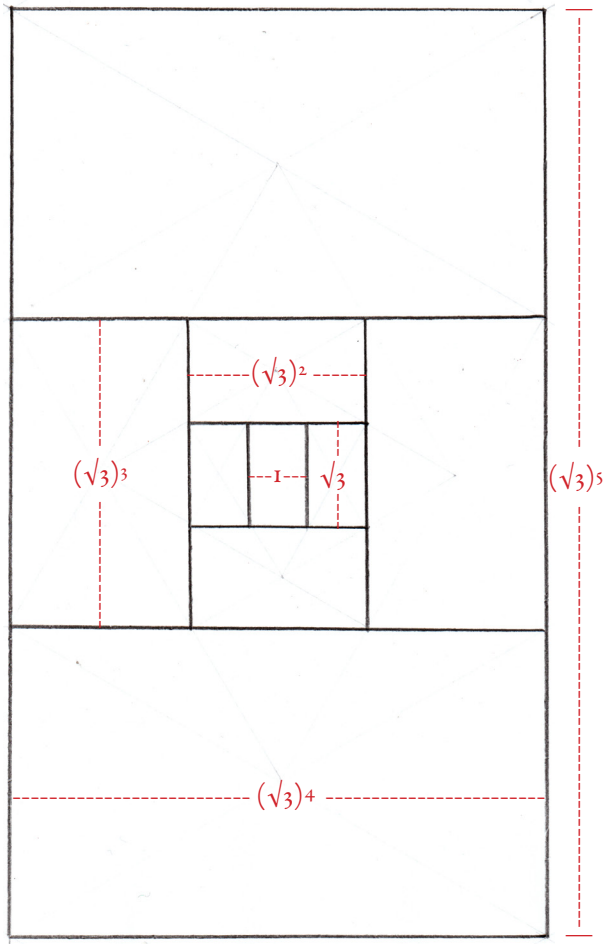
The Vesica Pisces with a width of 1 and a height of $\sqrt{3}$ is closely approximated by the ratio 153:265

5. John Michell has an interesting take on the number symbolism in this story. See p.97 - 101 of John Michell's book *How the World is Made*. Published by Thames and Hudson.

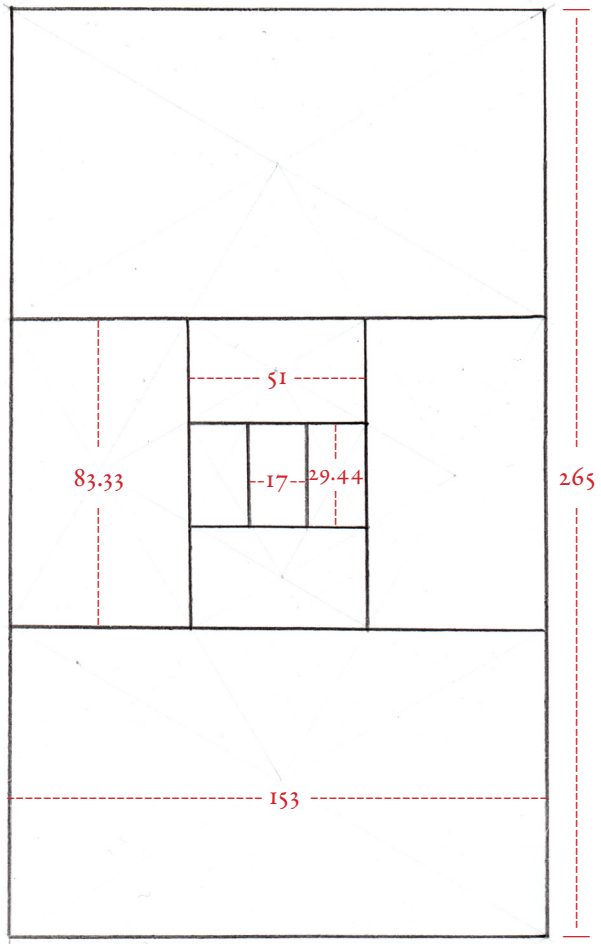
production of diminishing √3 rectangles. This is shown in the two diagrams below

As can be seen, a close approximation of the synodic lunar cycle becomes apparent as the intermediate number between 17 and 51. By multiplying the number 17 by √3 or alternatively by dividing the number 51 by √3 the resulting outcome is 29.44, which closely resembles the lunar synodic cycle of 29.53 days during which time the Moon shows three different faces.

The 88.333 shown as the intermediate number between 51 and 153 is accordingly three of these approximate synodic lunar cycles. The further multiplication of 88.333 by 3 is what then leads up to the number 265, which is an approximation of 3 × 3 synodic months.

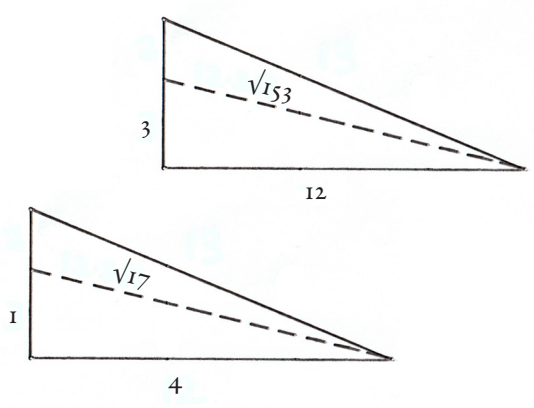


Diminishing √3 rectangles - each one formed of 3 smaller √3 rectangles. This sequence begins from 1 i.e. the shorter edge of the smallest rectangle.



The same diagram in a 265×153 rectangle has rational approximations and lunar numbers when the sequence begins from 17 rather than from 1.

The other association of 3, 17 and 153 with the Moon's synodic cycle can be seen in the lunation triangle mentioned in section 7.4. The lunation triangle has edges of 3, 12 and 12.369, and the latter number – the number of synodic cycles in a solar year – is √153. But if all these measurements are reduced by 3, it brings the diagram down to its most basic numerics – essentially a quadruple square with its diagonal – and then the measurements become 1, 4 and 4.123, and the latter number is √17.



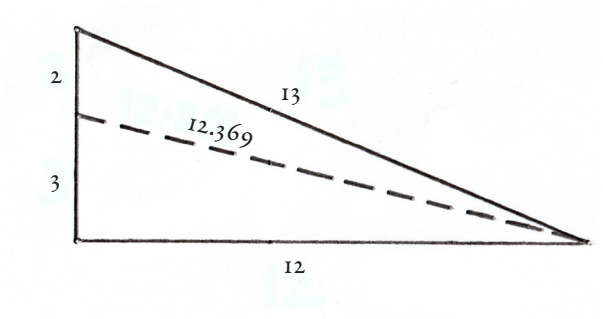
Another intriguing association of 17 with 153 - via the number 3 - is present within the storyline of the Fátima apparitions of the Virgin Mary in Portugal. These visions took place on a monthly basis over the course of 153 days in the 17th year of the last century. The apparitions were of Our Lady of the Rosary, and within a full threefold cycle of the Rosary there are 17 Pater Nosters and 153 Ave Marias.

After all of these numerical digressions, we can briefly return our focus to the octagonal north-side buildings at Wells, and have some sense of the significance of the number 3 in this region of the cathedral. As will become clear, the symbolic 'ascent' northwards to these north-side buildings from the quire also appears to symbolically resemble something quite similar to the third stage of Dante's journey in his *Commedia* – 'Paradiso' – which culminates in his direct meeting and union with the 'three-fold Unity' that is the Christian deity. Dante's description of the Trinity involves a geometric interaction between three circles.

16.4 THE LUNATION TRIANGLE NUMBERS IN THE CHAPTER HOUSE STAIRCASE

In chapter 9 (sec 9.2) it was shown how the various stair-counts of the chapter house staircase present numbers that are of lunar significance. But now that the units of measurement are being dealt with, there are yet more numerical examples of lunar significance that can be highlighted in relation to this staircase.

To begin with, the numbers of the lunation triangle are present. These were shown in section 7.4 in relation to how they occur from within the 5 – 12 – 13 right-angled triangle.



The Lunation Triangle (3 - 12 - 12.369) appearing in a 5 - 12 - 13 triangle

The numbers involved are 3, 12 and 12.369. The number 12.369 is the square root of 153 as well as also being the number of synodic lunar cycles in one solar year:

$$29.53 \times 12.369 = 365.27$$

However, it will shortly become clear that the number 12.369 is presented in the staircase measurements in the form of the very slightly different number 12.3666... as this produces a neater outcome.

In the magic-square-count of the staircase that was described in section 9.2, the first five steps form a particular architectural zone and then the following twelve steps form the next architectural zone. However, the first one of the five steps is actually situated within the doorway leading on to the staircase, and so it is outside of the quadrilateral zone of the staircase that we are about to consider. It therefore doesn't feature in the particular system that is about to be described. So it is actually the four steps beyond that first step that will be described first, followed by these first four steps plus the following twelve steps considered all as one measurement.

The first four steps very accurately measure 3 cubits, because each step has a tread measurement of ¾ cubit. Henceforth $4 \times 0.75 = 3$ cubits.

The fact that these first four steps have this measurement might lead one to extrapolate and suggest that the following twelve steps should be three times more than this. The next measurement that is actually required is the first four steps plus the following twelve steps all as one measurement. So one might assume that because the first four steps measure 3 cubits then all sixteen steps together should measure 12 cubits, because $16 \times 0.75 = 12$.

However, the steps do not all have the same tread measurement, and when the measurement of the 16 steps is taken it actually comes to 12.3666 cubits rather than 12 cubits as one might expect.

In the diagram to the left, the lunation triangle shows its measurements of 3, 12 and 12.369. So it is the short edge and hypotenuse of this triangle that have seemingly been included in the staircase's tread measurements in the form of 3 cubits and 12.3666 cubits. These two measurements are formed of 270 and 1113 micro-units. But what of the triangle's long edge of 12 cubits? A measurement of 12 cubits is what one might have expected to find for the sixteen steps, although they

ended up as 12.3666 cubits. However, with 12 cubits we are again drawn towards lunar measures when its micro-unit total becomes apparent:

12 cubits × 90 micro-units = 1080 micro-units

The number 1080 is the number of miles in the radius of the Moon, and so this lunar measurement also features in the Wells Earth-Moon master diagram itself as the radius of the lunar circle that is contained within the Moon-square. So despite not actually being used directly in the measurements of the staircase, it is alluded to as part of the lunation triangle numbers that are contained within the staircase's design.

The next thing to focus upon is the average gradient of the staircase. In short, the angle in question is one that is produced by the diagonal of a particular type of Fibonacci rectangle. A rational rectangle of this sort approximates an irrational golden ratio rectangle with a short edge of 1 and a long edge of Φ + 1 (i.e. 2.618...). But the Fibonacci numbers used to approximate this are 8 and 21, which thus form the short edge and the long edge of the rectangle. The way in which this is present within the numerical design theory is with the use of an apparent mean foot of 53 micro-units. The arithmetic mean between the greater foot of 56 and the lesser foot of 50 is 53, and when this is used as a unit everything works out very harmoniously.

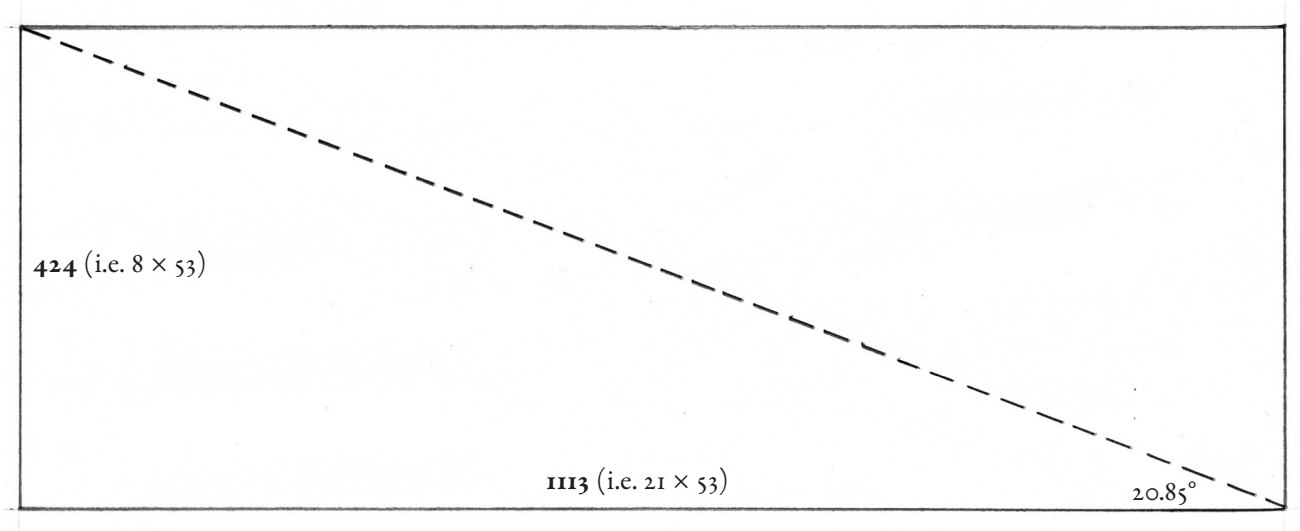
If the numbers 8 and 21 are both multiplied by 53, they produce the following results:

8 × 53 = 424

21 × 53 = 1113

So, the total (vertical) rise of the sixteen steps is 424 micro-units, whereas the total (horizontal) run of them is 1113 micro-units. The number 1113 is the number of micro-units in 12.3666 cubits, and as just described it is the total run of the sixteen steps that embodies the numbers from the lunation triangle.

The number 424 is then the total rise of the 16 steps, and this can be understood through the fact that 424 ÷ 16 = 26.5, which is half of a mean foot of 53. So each of the 16 steps has a rise of half a mean foot. This is easily verified through an in-situ measurement of the rise of each step. However, as already mentioned, it is the different tread measurements that bring about the measurement of 1113. If all 16 steps had a tread of 67.5 micro-units (¾ cubit) they would together add up to 1080 micro-units. But steps 10 to 13 are all 70 micro-units, step 15 is 77 and step 16 is 81. It is these differing tread measurements that turn the rectangle below into a Fibonacci rectangle of 21/8 as well as also including the lunation triangle numbers in the form of 3 cubits and 12.3666 cubits.



The average gradient of the first part of the chapter house staircase is the angle found in a 21/8 Fibonacci rectangle

Besides the mean foot of 53 the use of mean measurements seems to show itself elsewhere in the staircase as well, although in the form of means between particular quantities of the usual measurement units.

So the wall-to-wall width on either side of the first four steps is a mean measurement between 12 greater feet (672) and 13 English feet (682.5). The difference between these two measurements is actually 1/5 of an English foot, so the mean measurement between 672 and 682.5 involves adding 1/10 of an English foot to 672 and taking 1/10 away from 682.5. The mean measurement is accordingly 677.25 micro-units, and indeed this is very accurate in relation to the in-situ wall-to-wall measurement for this first part of the staircase. The fact that this measurement involves 12 and 13 is of interest in relation to the lunation triangle, which arises from a Pythagorean triangle with edges of 5, 12 and 13. Indeed, the number of synodic lunar cycles in one year is between 12 and 13.

Further up the staircase two more widths become apparent that occur at the same time, as it were. One is the wall-to-wall width and the other relates to an inner wall of steps that runs alongside the staircase. They both appear to embody mean measurements between the lesser foot (50) and the cubit (90).

The wall-to-wall width measurement is 710 micro-units, which is the mean between 14 lesser feet (700) and 8 cubits (720). The narrower width measurement from the inner wall of steps takes one unit off each of the above-mentioned measurements. This turns them into 13 lesser feet (650) and 7 cubits (630). Their mean is then 640 micro-units, which is then the actual in-situ measurement for this narrower width.

Looking at such lunar measures in philosophical terms, it can only be reiterated that the reason for including cosmological measures of this sort in a medieval Christian building is not for the sake of secretly incorporating crackable codes, but rather to bring the soul into alignment with the numerical thoughts of the Divine Mind via direct physical contact with planetary essences that were believed to have a heavenly influence on the soul who came into contact with them.

With such a medieval Christian belief in mind, we can finish with a few lines from the *Cosmographia* of Bernardus Silvestris.

'For anything which is brought forth to assume the mode of being proper to its kind derives the causes and nature of its substantial existence from the celestial sphere, as though from a life-giving god. For how are the stars borne about in a ceaseless journey, if not because they have imbibed ethereal nourishment? How would the creatures of the land, the waters, the air, move if they had not received enlivening impulses from the firmament?'

Chapter 4, 'Megacosmos' - *Cosmographia*

Chapter 17.

The Retroquire and Lady Chapel

17.1 THE NUMBER 55,440 IN RELATION TO THE GREAT PYRAMID

There is another set of numerical concordances that appear to be contained within the Earth-Moon diagram, and they involve the number 55,440. The reason for looking at this number is because it also appears in relation to the size of the Great Pyramid, as well as within the design of the east end of Wells Cathedral.

Bearing in mind that the numbers 7 and 11 govern the height and base of the pyramid triangle in John Michell's diagram, let these two consecutive prime numbers form the limits of a multiplication of the consecutive numbers that run between them.

$$7 \times 8 \times 9 \times 10 \times 11 = 55{,}440$$

Bearing in mind that the number 11 corresponds to the triangle's baseline and the number 7 to its height, there is an interesting numerical outcome if either 7 or 11 is excluded from this calculation.

When 7 is taken out of the calculation and 11 is kept in, the diameter mileage of the Earth associated with the pyramid triangle's baseline of 11 is produced:

$$8 \times 9 \times 10 \times 11 = 7920$$

The inverse happens when 11 is taken out of the calculation and 7 added in, whereby it produces the 5040 mileage of the radii of the Earth and Moon associated with the triangle's height of 7:

$$7 \times 8 \times 9 \times 10 = 5040$$

This mathematical concordance arises from the fact that the three numbers used within both calculations – i.e. 8, 9 and 10 – together bring about 720:

$$8 \times 9 \times 10 = 720$$

The number 720 is the amount of miles within each small square unit of the 11 × 11 square grid of the Earth, or the 3 × 3 grid of the Moon within the Earth-Moon diagram. So the fact that this calculation of 720 is either multiplied by 7 to obtain 5040 or by 11 to obtain 7920 reflects the Earth-Moon diagram in which the pyramid triangle has a baseline formed of 11 of these small squares and a height consisting of 7 of them. But when both 7 and 11 are included in the calculation, it brings about the much larger number 55,440.

Another way of looking at this is quite simply to say that the two ways of defining the measures of the pyramid triangle in the Earth-Moon diagram are either with a baseline of 11 and height of 7, or alternatively with a baseline of 7920 and a height of 5040. If the height of 5040 is then multiplied by the baseline of 11 the number 55,440 is produced. A similar thing then occurs if the baseline of 7920 is multiplied by the height of 7:

$$5040 \times 11 = 55{,}440$$
$$7920 \times 7 = 55{,}440$$

With this in mind, let the dimensions of the Great Pyramid now be assessed in relation to the diameter of Planet Earth.

The Great Pyramid uses a cubit that is 440:441 larger than the cubit used in the design of Wells Cathedral. It was also mentioned in section 12.2 that the Wells cubit has a measurement of 12 to 7 in relation to the English foot. John Neal refers to this unit within the Cosmic Canon of measures as a 'root cubit'.

It was also mentioned earlier that if this particular cubit were to be used to define the size of the Great Pyramid, it would have a baseline that measures 1/7 of a mile *precisely*. So if it could then be said that there would be

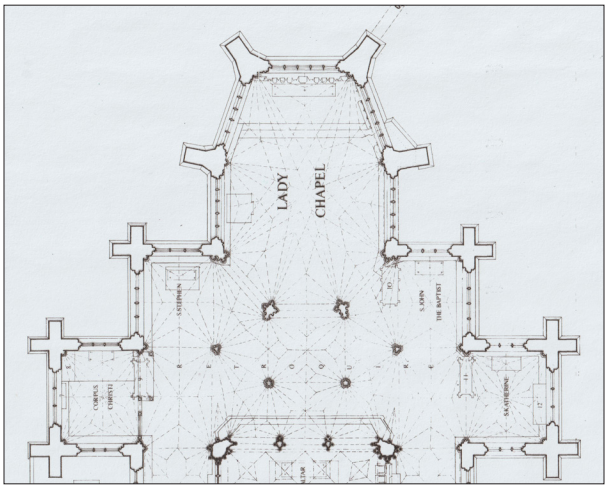
seven Great Pyramids – formed of this cubit – in one mile it would mean that there would be 55,440 Great Pyramids in the diameter of the Earth, because 7 x 7920 = 55,440. The equivalent thing could be said in relation to the height of a Great Pyramid formed of such a cubit in the sense that eleven of these heights form one mile and so there would be 55,440 of these heights in the radii of Earth and Moon, because 11 x 5040 is also equal to 55,440.

What all of this suggests is that an 'arithmetically ideal' Great Pyramid is formed of this size of cubit, but that the actual Great Pyramid has been micro-variated by 440:441. The 'ideal' arithmetic of this theoretical Great Pyramid can be seen in the fact that it is precisely 1/7 of a mile along its base and its cubit has the fundamental relationship of 12 to 7 with the English foot. But in its 'earthly' form at Giza in Egypt the pyramid is adapted so as to embody and thus express the difference between Earth's polar radius and its mean radius, which have a relationship of 440:441. So rather than being 1/7 of a mile along its base the Great Pyramid of Giza is 440:441 bigger than this, and such a micro-variation is very simple to employ as a result of the pyramid's baseline measuring 440 cubits. The baseline of the Great Pyramid in Giza can accordingly be described as measuring 441 'ideal' cubits, or 440 of the enlarged micro-variated cubit.

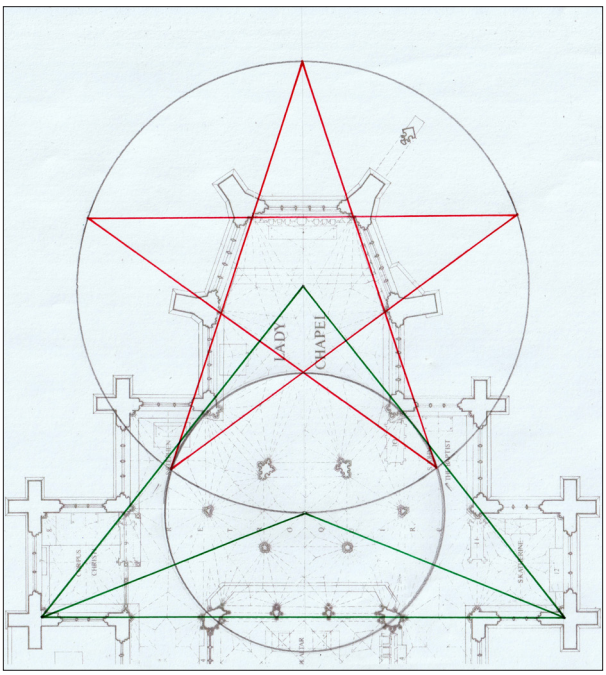
As will shortly become clear, the way in which the number 55,440 is used in the design of the east end of Wells is at 1/10 of the size. Rather than 55,440 micro-units the measurement 5544 micro-units is used, as well as the measurement of 5500 micro-units. The relationship between these numbers is the same as 126:125, as also is the relationship between 55,440 and 55,000. The reason why this ratio is of such importance in the research of John Neal will also be touched upon.

17.2 THE EASTERN END OF THE CATHEDRAL

Beyond the rectangular quire lies the east end of the cathedral. It consists of a retroquire with a small transept chapel on either side, and then beyond this is the Lady chapel.



The cathedral's east-end - a Lady chapel, retroquire and transept chapels



The Golden Pyramid triangle and pentagram as the basis of the east-end

This whole area of the cathedral's ground plan is governed by its own pyramid triangle master diagram, which was shown at the beginning of chapter 8. The diagram's principal form is a Golden Pyramid Triangle in the sense that it produces a pentagram star, which is then used to form the pentagonal eastern end of the Lady chapel.

But it is also used in the form of a Pi Pyramid Triangle, albeit one that is made up of two different rational variations. These two slightly different versions of the Pi Pyramid Triangle each use a different foot-unit. One is formed of lesser feet, and the other one of greater feet. But the pentagram geometry, which is mathematically characteristic of the pyramid triangle in its golden ratio form, is actually derived through close approximations from the rational unit measures of these Pi Pyramid Triangles. So as usual there is a very skilful fusion of the different potential geometries that the various pyramid triangles contain.

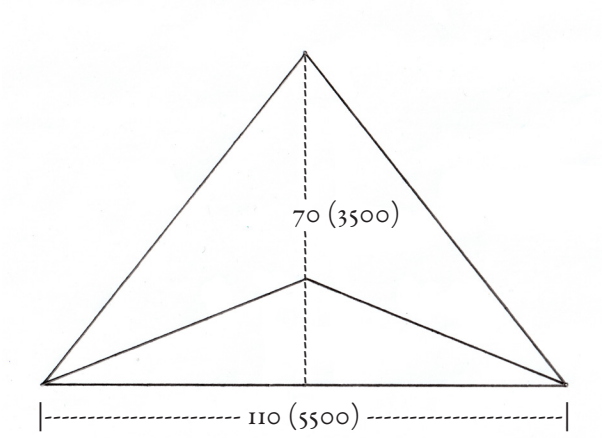
The first Pi Pyramid Triangle is formed of lesser feet. The triangle's baseline is 110 lesser feet, and its height is 70 lesser feet. This closely reflects the Pi Pyramid Triangle with its baseline of 11 and height of 7 through a multiplication of 10.

The second Pi Pyramid Triangle is formed of greater feet. Its baseline is 99 greater feet and its height is 63 greater feet. This also reflects the 11 – 7 pyramid triangle, albeit through a nine-fold increase from 11 and 7 up to 99 and 63.

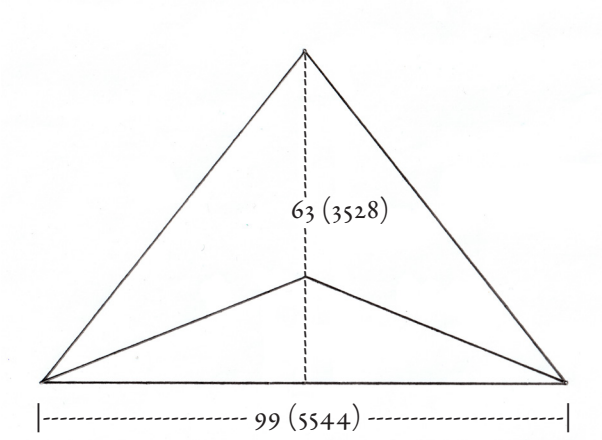
There is a third triangle used within this master diagram, although it is a rationalised Golden Pediment Triangle with a baseline formed of 105 English feet. The height of this pediment triangle is then variated in the sense that the design utilises the triangle as if it consists of various different heights which bring about a variety of different design resolutions within the ground plan. This will be expanded on in more detail shortly.

The micro-unit measurements of these three triangles are shown alongside the foot measurements.

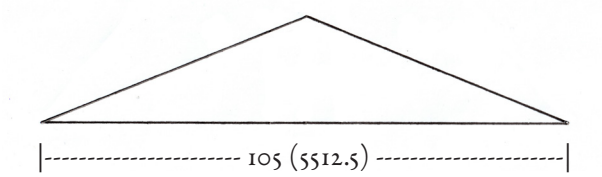
First pyramid triangle
Baseline – 110 lesser feet (5500).
Height – 70 lesser feet (3500).



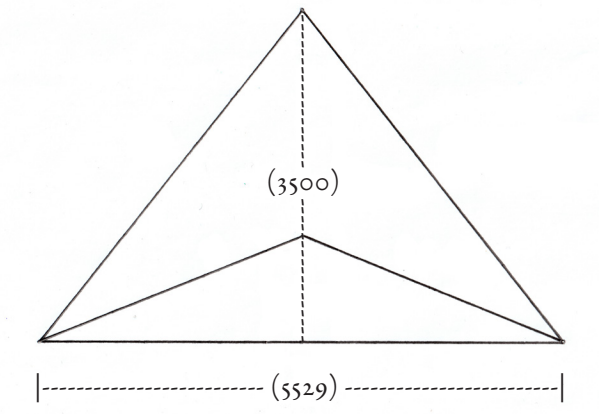
Second pyramid triangle
Baseline – 99 greater feet (5544).
Height – 63 greater feet (3528).



Pediment triangle
Baseline – 105 English feet (5512.5).
Height – see following paragraph.



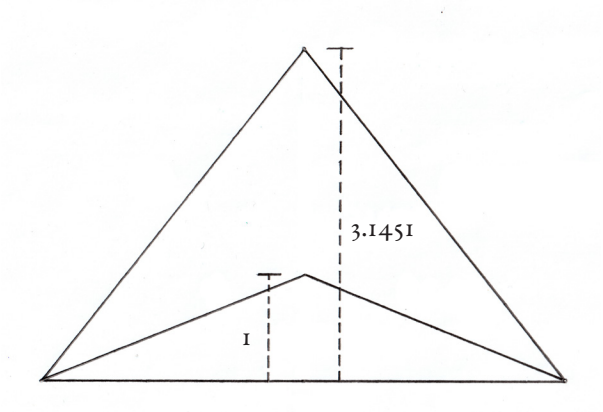
The height and baseline measurements of the pyramid triangle that are actually used within the built ground plan itself are a mix of these three triangles. The height of the pyramid triangle is taken from the 3500 micro-unit height of the first pyramid triangle (70 lesser feet). The baseline, on the other hand, appears to use a mean measurement between the baselines of the second pyramid triangle and the pediment triangle. These two baselines measure 5544 (99 greater feet) and 5512.5 (105 English feet). The actual in-situ measurement between the north wall of the north-side transept chapel and south wall of the south-side chapel – which mark the limits of the pyramid triangle's baseline – is around 5528 micro-units. This is virtually the arithmetic mean between 5544 and 5512.5 – which precisely speaking is 5528.25. But for reasons that will become apparent, this irregular measurement will be micro-variated up to 5529.[1] So the baseline of the actual pyramid triangle can be seen as having this micro-variated mean measurement of 5529 and a height of 3500. In this way, all three triangles are incorporated into what are effectively only two different measurements – i.e. a height and a baseline – which are actually then used for the in-situ measurements within the ground plan of the building itself.



However, there is one more measurement that needs to be accounted for, and that is the height of the pediment triangle. It was mentioned above that this particular triangle is used in such a way as to have various different heights all at the same time. It was mentioned in the

1. This tiny micro-variation involves an increase by the ratio 7791:7792.

second section of chapter 7 (p.118) that a Golden Pediment Triangle nested within a Golden Pyramid Triangle embodies a close approximation of Pi. If the pediment and pyramid triangles share the same baseline, and the height of the pediment triangle is 1, the height of the pyramid triangle would be 3.1451.



The relative heights of Golden Pyramid and Pediment triangles approximate pi

This approximate relationship to pi appears to be used in the east end master diagram via the potential height variations of the pediment triangle. But before this can be described there is a need to briefly touch upon the ancient metrology research of John Neal – a close friend and associate of John Michell.

The difference in size between the first and second pyramid triangles reflects the ratio 126:125 because if the numbers 126 and 125 are both multiplied by 44 they produce the baselines of the two pyramid triangles – 5544 and 5500:[2]

$$126 \times 44 = 5544$$

$$125 \times 44 = 5500$$

The equivalent relationship is inevitably also present in the heights of the two pyramid triangles if the numbers 126 and 125 are multiplied by 28:

$$126 \times 28 = 3528$$

$$125 \times 28 = 3500$$

This ratio of 126:125 is a significant one for Michell and Neal partly because it is made up of two smaller ratios – 441:440 and 176:175.

When expressed in decimal form, 126:125 is 1.008.

Of the two smaller ratios, 441:440 is 1.00227272 and 176:175 is 1.00571428.

By multiplying 441:440 by 176:175 ...

$1.00227272 \times 1.00571428 = 1.008$

... the product is 126:125.

The two ratios 441:440 and 176:175 produce variations of pi in relation to the 22/7 approximation of pi:

$$22/7 \times 441/440 = 63/20 \text{ (which is 3.15)}$$

$$22/7 \div 176/175 = 25/8 \text{ (which is 3.125)}$$

John Neal has demonstrated in his research how such measurements appear to relate to an ancient knowledge of the size of the Earth, along with its oblate shape. As we will see, these various pi approximations also appear to be used in the design of this pyramid diagram at the east end of Wells.

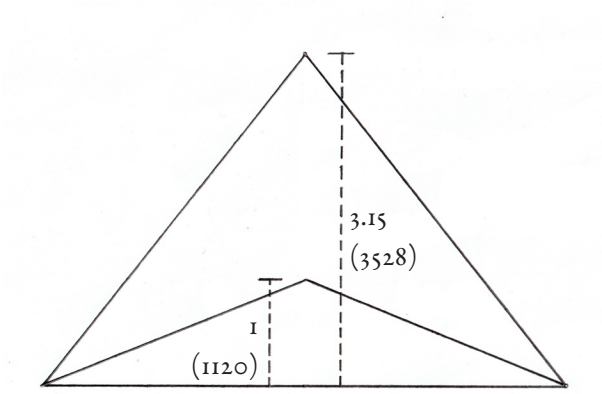
The fact that the two pyramid triangles mentioned above embody a difference of 126:125 means that it is immediately of interest that the division of this ratio into the smaller ratios of 176:175 and 441:440 is precisely what the baseline of the pediment triangle brings about in relation to the baselines of the two pyramid triangles. It was mentioned above that the baselines of the pyramid triangles are 5544 and 5500. The baseline of the pediment triangle is then 5512.5, or 105 English feet.

The relationship of 5544 to 5512.5 is the same as 176:175, and the relationship of 5512.5 to 5500 is the same as 441:440.

2. These two numbers were mentioned in the previous section in relation to the number 55,440, which appears to be used in relation to the Great Pyramid.

This would also appear to present itself within the pi relationships that exist through the varying height of the pediment triangle in relation to the pyramid triangle. The pyramid triangle with a height of 3528 is formed of 63 greater feet, and this can very easily be looked upon as relating to a pediment triangle with a height of 20 greater feet, which is 1120 micro-units:

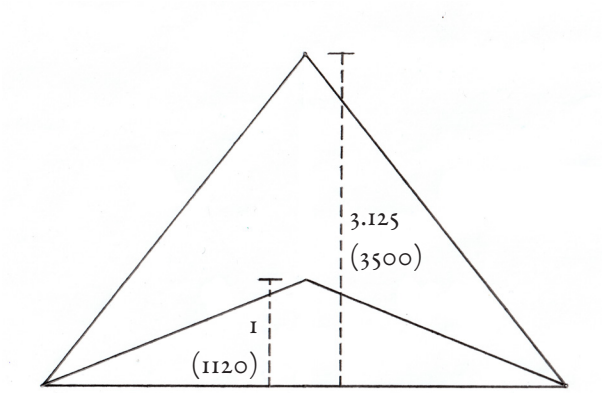
$$3528 \div 3.15 = 1120$$



The 63/20 (3.15) approximation of pi in the second pyramid triangle

This is how the 63:20 approximation of pi shows itself within the pyramid triangle of greater feet. The pyramid triangle of lesser feet has a height 3500. If this figure is divided by 25:8 (3.125) it again brings about 1120 micro-units:

$$3500 \div 3.125 = 1120$$



The 25/8 (3.125) approximation of pi in the first pyramid triangle

So at first this would appear to be the height that would be used for the pediment triangle within the design because it is the same result, albeit derived from the two different pyramid triangles which embody their own particular approximation of pi. However, for reasons that will shortly become clear, this is not the height that is measurably present within the fabric of the building.

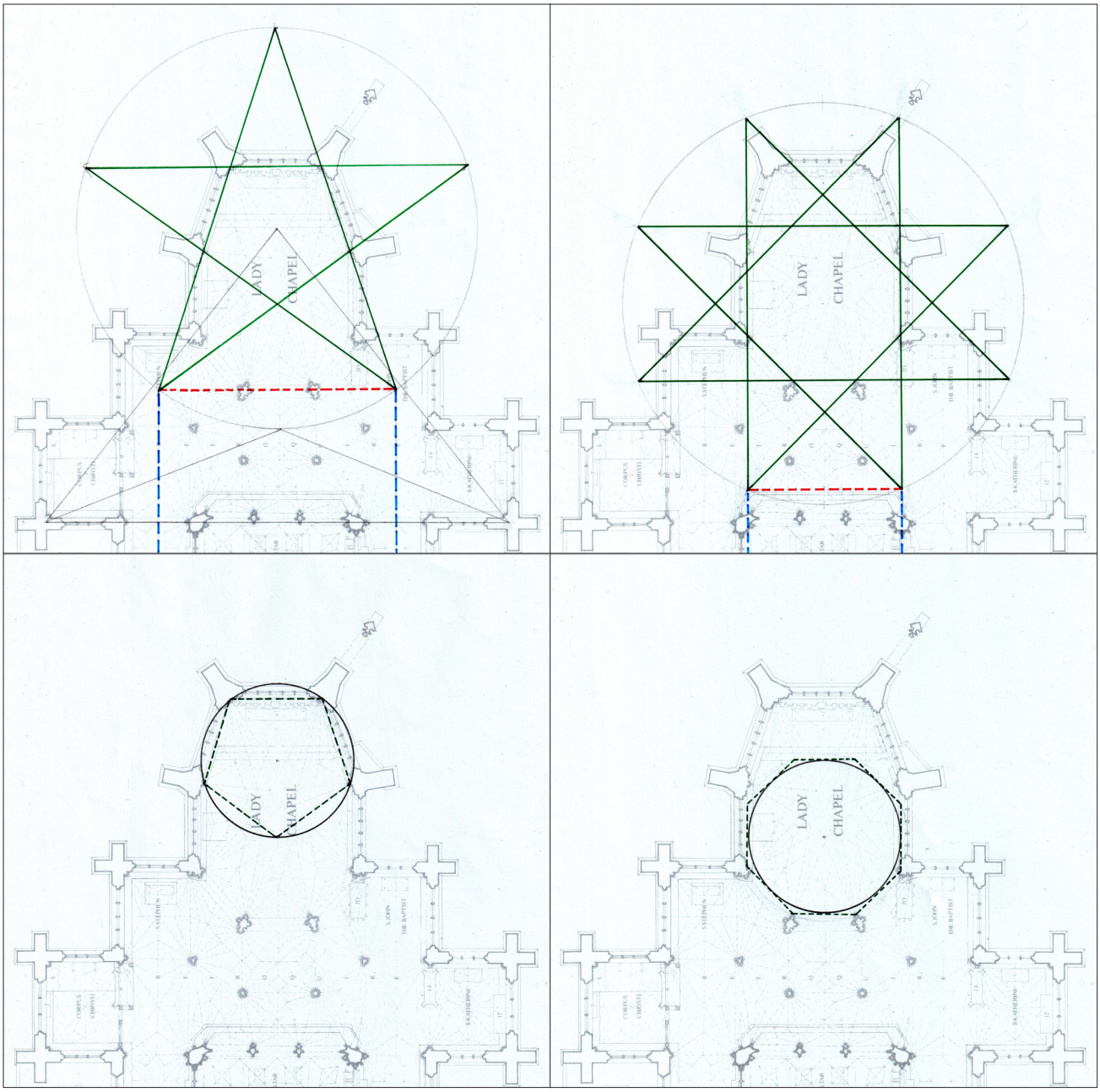
The pediment triangle is used by the designer in such a way that it has three different heights that all inform the final design in their own particular way. Having said this, all three of the heights are derived, via musical micro-variations, from a 'theoretical' pediment triangle with a height of 1120 micro-units. So in this sense an 1120 pediment triangle is fundamental to the design theory, despite not being directly present in the measures of the building.

The varying heights of this pediment triangle have a very particular effect on the circle that contains the pentagram and octagram stars, which then go on to form the shape of the east end of the building. The taller the pediment triangle is, the smaller the container circle for the stars, and the shorter the pediment triangle, the bigger the container circle. This then seems to allow some quite brilliant numerical design resolutions, which will shortly become clear. The three different design resolutions in question concern the following aspects of the design:

1) The distance between the stellations of the pentagram star (marked in red dotted line in the first image on next page). This measurement marks the distance between the central axes of the side aisles (marked in blue dotted line).

2) The distance between the stellations of the octagram star (red dotted line in second image). This measurement relates to the width of the quire.

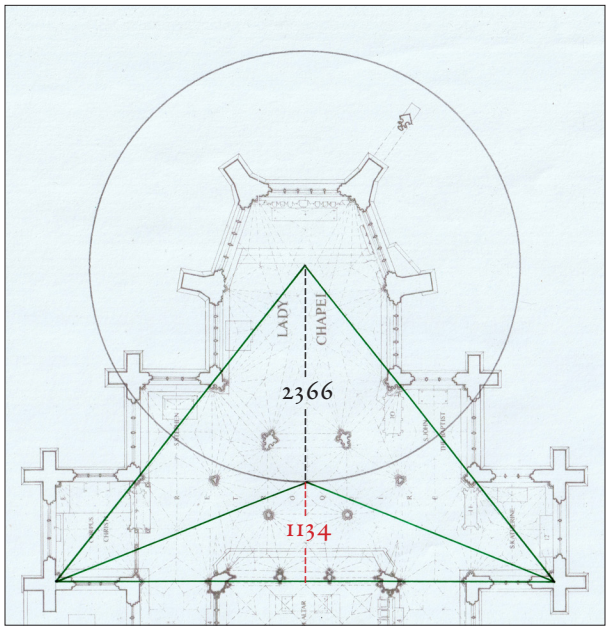
3) The size of the container circle that contains the pentagon, and is contained by the octagon, at the centres of the two stars (see the third and fouth images on the following page). These two circles are very similar, but slightly different, in size and this is due to the relationship of likeness that exists between the pentagram and octagram that was shown back in section 5.4.



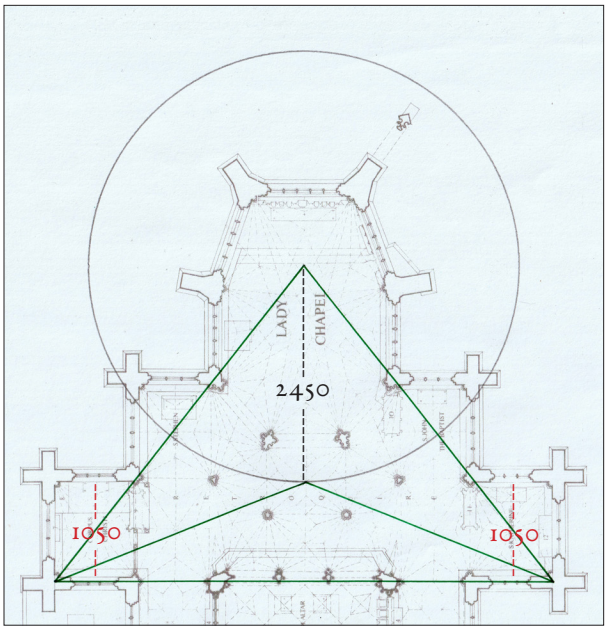
These four images show diagrams outlining the measurements that are about to be described in terms of their mathematical formulation. The first two images mark the distances between the stellations of the pentagram and octagram stars. The third and fourth images show circles whose sizes will be defined.

The distances between the stellations of both stars will first be shown, because they appear to be part of an associated measurement plan. The 'theoretical' pediment triangle with a height of 1120 micro-units is first increased by what is known in musical tuning theory as the syntonic comma, which is 81:80. The measurement of 1120 accordingly increases to 1134, and indeed this is very precisely the height of the pediment triangle as it shows itself within the fabric of the building in relation to the retroquire's ground plan. This forms the container circle for the octagram star. This container circle has a radius of 2366 micro-units i.e. 3500 - 1134 = 2366.

Returning to the 1120 height of the pediment triangle, it will now be decreased in height by the musical ratio known as the Just diatonic semitone which is 16:15.



The measurement basis for producing a circle to contain the octagram star. This octagram-star circle is actually used lower down within the pyramid diagram in comparison to the circle shown in this image (see previous page).



The measurement basis for producing a circle containing the pentagram. The pediment triangle is 'theoretically' 1050 although this measurement is actually used on each side of the pediment triangle in the transept chapels.

This decreases the height of the pediment triangle to a measurement of 1050.[3]

This 16:15 ratio is one of the semitones described earlier as being present within the cathedral's measurement units in that it is the relationship between the greater foot and the English foot. But the semitone of 21:20, which is the relationship between the English foot and the lesser foot, is also present here because the 1050 height of this new pediment triangle is both 21 lesser feet as well as also being 20 English feet at the same time.

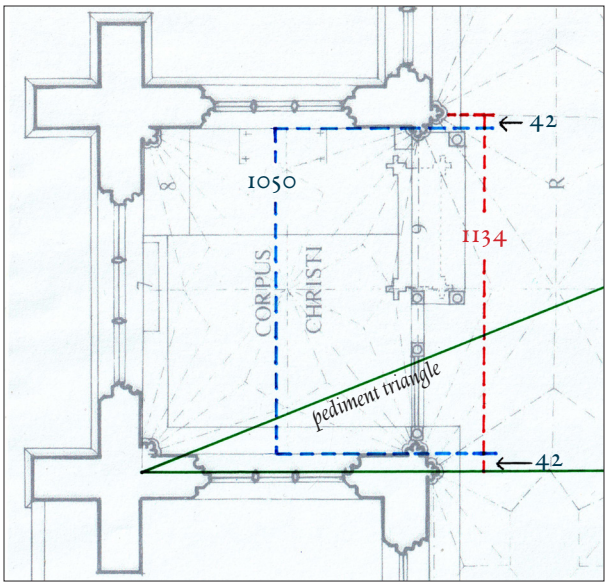
This reduced height of 1050 in the pediment triangle is present in the fabric of the building within the east–west measurements of the transept chapels, both of which are precisely 21 lesser feet/20 English feet. The fact that this measurement is in its particular position within the design naturally reflects the vertical height of this 1050 pediment triangle, even if the measurement itself is on either side of the geometric position of the pediment triangle (i.e. in the transept chapels) rather than in the middle area of the retroquire, where the apex of the pediment triangle is actually positioned in geometric terms.

As to the container circle that this shorter pediment triangle produces, the circle has a radius of 2450 and it contains the pentagram star. The fact that this version of the pediment triangle is shorter means that the container circle it produces is larger in relation to the circle mentioned above as containing the octagram star. The octagram circle has a radius of 2366, which is 84 less than the pentagram's circle's radius of 2450.

The difference in height between the two pediment triangles – of 1134 and 1050 micro-units – is also 84, which is itself actually the same as 1½ greater feet. The two pediment triangle measurements theoretically begin from immediately after the sixth and final bay of the quire, as this is where the baseline of the pyramid and pediment triangles are located.

3. In tuning theory it is the application of the syntonic comma of 81:80 to the Pythagorean semitone of 256:243 that resolves the semitone into the simpler 'Just' form of 16:15. Another point of interest with this pediment triangle, along with its height of 1050, is that it is precisely 3/10 the height of the pyramid triangle that has a height of 3500. It also forms an interesting Fibonacci relationship with half of this pyramid triangle's baseline (2750). If 1050 and 2750 are both divided by 50 they reduce to the Fibonacci numbers 21 and 55.

However, the 1050 measurement has been pushed forward by half of this 1½ foot difference, seemingly for reasons of aesthetics. This shows itself in the positions of the transept chapels, in that they begin ¾ of a greater foot after the sixth and final quire bay and terminate ¾ of a greater foot before reaching the pillars that mark the 1134 height of the larger pediment triangle. So in other words, the 1050 measurement has been centrally nested within the 1134 measurement.



The 1050 measurement nested evenly within the 1134 measurement

These two height variations of pediment triangle are architecturally embodied, as has just been described above. But the third height variation is not actually measurably present anywhere in the fabric of the building. So it might naturally then be asked how it can be suggested that this third height measurement is used at all within the design theory. The answer to this lies in the existence of the quite brilliant design resolutions that its apparent use within the design appears to bring forth, which demonstrate that it must have been knowingly used by the designer.

This third height is again derived from the 1120 pediment triangle, but this time through reducing its height by 126:125. The rationale behind this reduction takes us back to the relationship of 126:125 existing between the two pyramid triangles that embody the two different-pi variations of 63:20 and 25:8. As was already mentioned, if the pyramid triangle with a height of 3500 is divided by 25:8 it brings forth the 1120 height of the pediment triangle. Likewise, if the 3528 height of the taller pyramid triangle is divided by 63:20 it also brings forth a pediment triangle of 1120. So what the designer appears to have done is to use the height of the 3500 pyramid triangle along with the pi variation used in the other pyramid triangle, and this produces the following calculation:

$$3500 \div 3.15 = 1111.11111\ldots$$

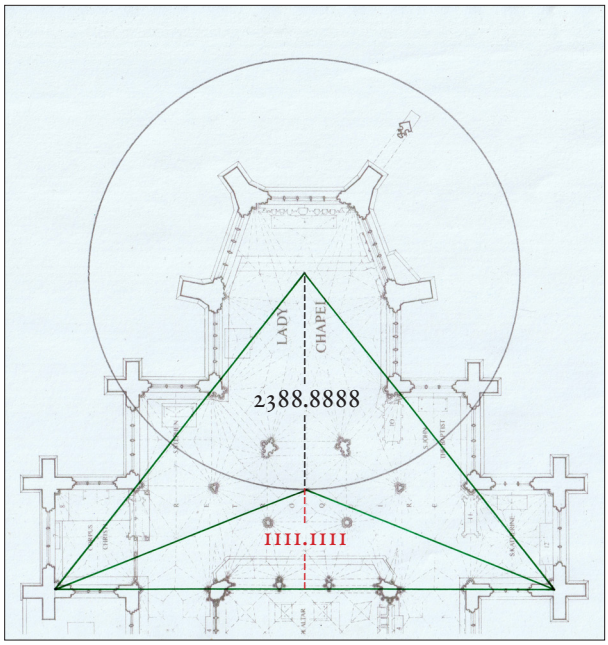
It immediately becomes clear why it would not be possible to include such a 'fractured' number within 'whole number' units of measurement. However, it is a staging post on the way to some wonderful design resolutions, which will now be described.

First of all, it can be pointed out that the difference between 1111.1111... and 1050 is 61.1111... and this seemingly obscure number is actually very significant within this master diagram. If the 3500 height of the pyramid triangle is seen as a radius of a circle, then 61.1111... is 1/360 of this circle's circumference.

This shows a clear relationship with any circle's pi measurement of 22/7. If a circle's diameter is 7 then its radius is 3.5, which is 1000 times smaller than 3500. So if a circle has a radius of 3500, its diameter will be 7000 and its circumference will accordingly be 22,000. This circumference can then be divided by 360.

$$22{,}000 \div 360 = 61.1111\ldots$$

So this is the first significant fact about the seemingly obscure pediment triangle with a height of 1111.1111 micro-units. The key point to emphasise here is that the division of the circle into 360 naturally reflects the cosmology of Planet Earth with its division into 360° of latitude. The division of a circle into 22,000 also closely reflects the latitude geometry of St Andrews Cathedral in St Andrews, Scotland, where the 360° circle of Planet Earth is divided into 44,000 micro-units of latitude.



The measurement basis for producing a circle to contain both pentagram and octagram stars. However, it is the central pentagon and octagon, derived from these stars, that actually goes on to be used in the final design.

This new pediment triangle measurement divides the 3500 height of the pyramid triangle into 1111.1111 and 2388.8888. The second of these two numbers is then the radius of the circle that contains the pentagram and octagram stars used to create the shape of the Lady chapel. As will become clear, this apparently insignificant number leads to a quite remarkable cosmic design resolution that defines the north–south wall-to-wall measurement of the Lady chapel, and which again relates specifically to the cosmology of Planet Earth.

A geometric principle that was shown in section 5.4 demonstrated that if pentagram and octagram stars are contained in the same size of circle then the smaller circle containing the pentagram's central pentagon is virtually identical in size to the circle contained by the octagram's central octagon. This geometric relationship is used in the following calculation of the Lady chapel's dimensions, because the circle in question inevitably governs the wall-to-wall measurement between the north and south walls of the chapel, as they are derived from two opposite edges of an octagon.

Let the container circle with a radius of 2388.8888 have an octagram inscribed within it. The octagram ratio that was used in the last chapter in relation to the octagonal undercroft will again be used for this Lady chapel octagram. The ratio in question is 153:200, which is expressed in decimal form as 0.765:

$$2388.8888 \times 0.765 = 1827.5$$

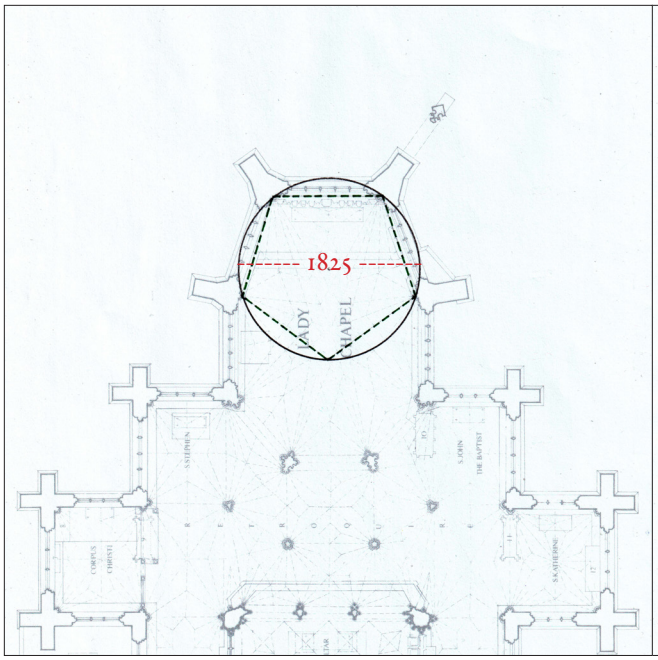
Now let the container circle with a radius of 2388.8888 have a pentagram inscribed within it. A ratio that is very similar to the one used in the quire area shall be used for this Lady chapel pentagram measurement. The ratio mentioned in relation to the design of the quire was the Fibonacci ratio 144:55, which is expressed in decimal form as 2.61818. But the ratio that will be used here is 1720:657, which is expressed in decimal form as 2.61796. However, for the sake of this particular calculation the first number in the ratio needs to be halved from 1720 to 860. The ratio is thus 860:657, which in decimal form is 1.30898:

$$2388.8888 \div 1.30898 = 1825$$

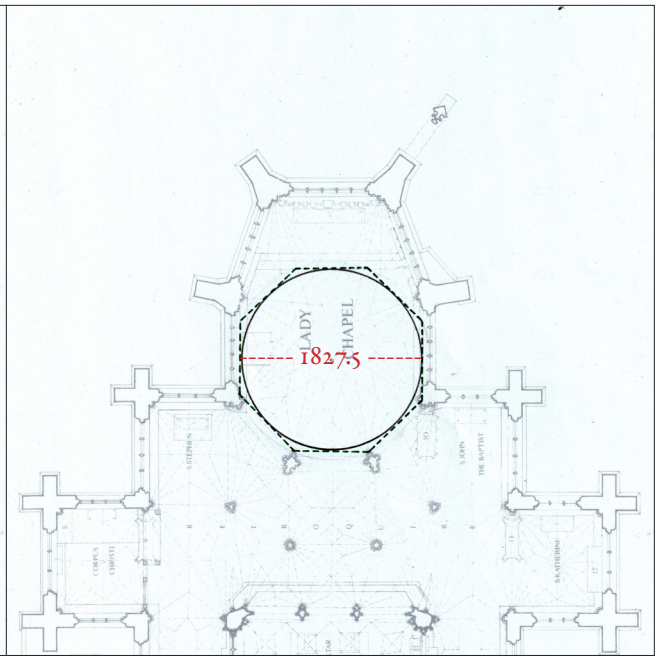
So these two calculations can now be looked on as two slightly different variations of the north–south width of the Lady chapel. But we are still left with the question of which one of these minutely different measurements is actually used for the final in-situ measurement. It would presumably be a mean measurement between the two. So first these two numbers can be added together, before being divided equally to find their mean:

$$1827.5 + 1825 = 3652.5$$

If this result is read in a similar way to the other cosmic numbers in the cathedral's design, a remarkable result becomes apparent. The micro-unit numbers in the nave, for instance, are such that 3650 and 3640 should be read as 365.0 and 364.0 whereby the decimal point is moved one column to the left. In a similar way the above result of 3652.5 should be read with the decimal point moved one column to the left.



If the radius of the pentagram star's container circle is 2388.8888 then the circle that contains the pentagon, which is at the centre of the star, has a diameter of 1825.



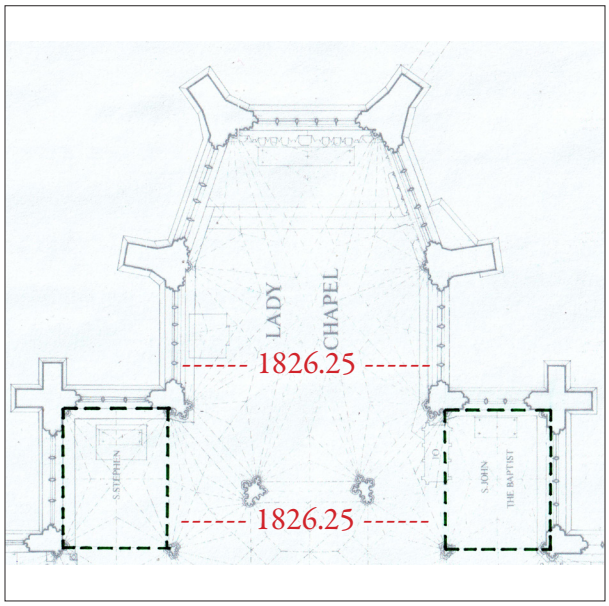
If the radius of the octagram star's container circle is 2388.8888 then the circle contained by the octagon, which is at the centre of the star, has a diameter of 1827.5.

The result is 365.25 – the precise number of days within the annual cycle.

Returning to the chapel's in-situ measurement, the halving of 3652.5 yields the arithmetic mean between the pentagram and octagram measurements, which is the final north–south wall-to-wall measurement in the Lady chapel:

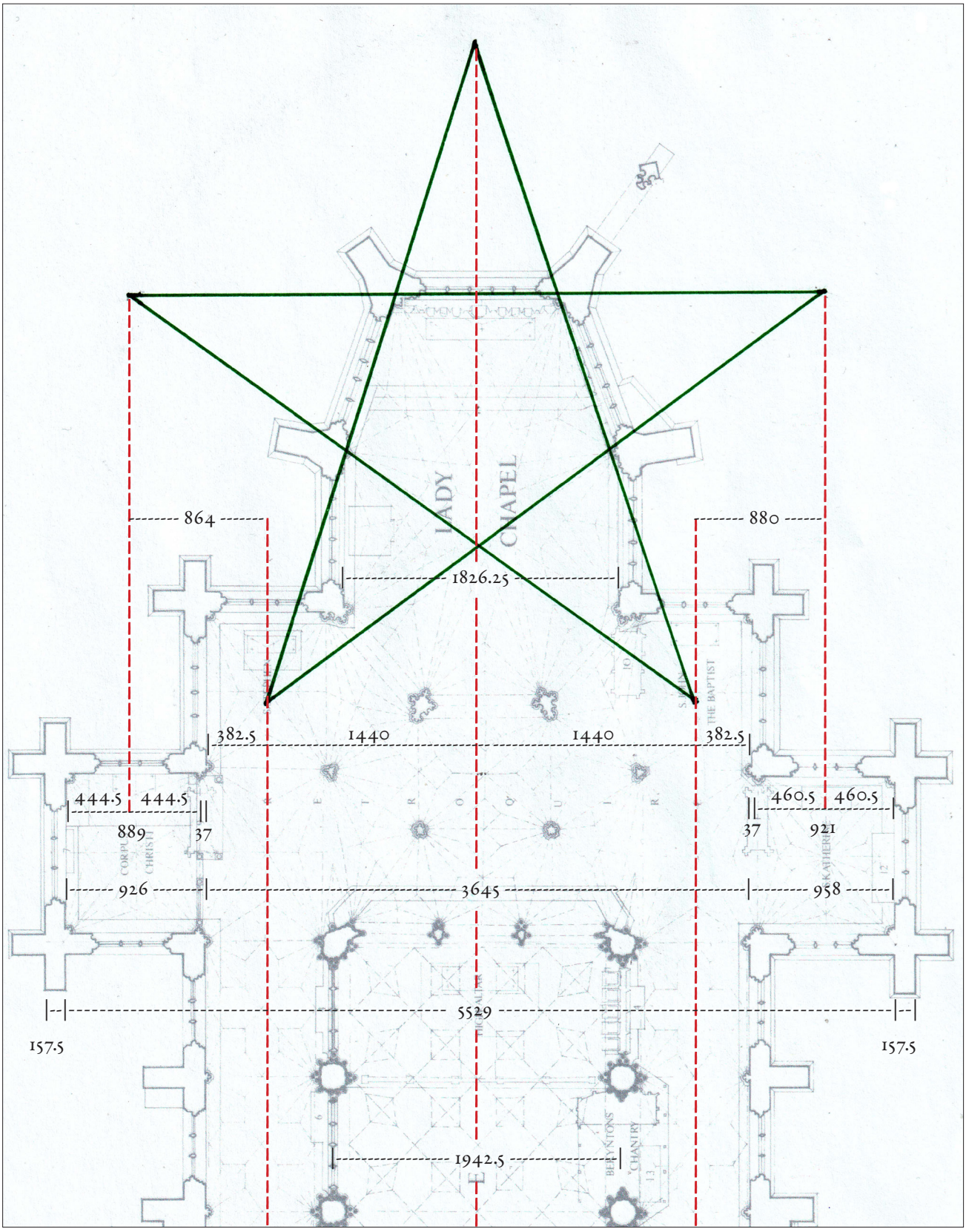
$$3652.5 \div 2 = 1826.25$$

As this calculation demonstrates, the width of the Lady chapel reflects the precise number of days in half of the annual cycle. The actual in-situ measurement of this theoretical dimension is very accurate indeed, and veers off by only half an inch on average. When it is understood in its cosmic form (i.e. as 182.625) this number – being as it is half of one annual cycle – is the number of days between the winter and summer solstices. This is also of interest in relation to the fact that the measurement is the physical distance between the 'solstitial' chapels of St Stephen and St John the Baptist.



The width of the Lady chapel - 1826.25 - can be looked upon symbolically as the period of time between the solstices - 182.625 days and so it is appropriate that this measurement falls between the solstitial chapels

One measurement that has not yet been mentioned is the internal wall-to-wall measurement of the whole chancel area. This encompasses the quire as well as the north and south quire aisles. Admittedly there are not



The various micro-unit measurements that govern the dimensions of the east-end area of the cathedral. They are all described in more detail within the main text.

many clear lines of view to test this measurement and see how consistent it is all the way along their east–west length. But in the few places where measurement is possible it appears to be 3645 micro-units, which is the arithmetic mean between the two grids used in the nave that measure 3650 and 3640.

With such an 'earthly' measurement in mind we can look at the next aspect of the design, which relates directly to the recently mentioned number 3652.5 – which symbolically reflects the 365.25 days in a year. This precise numerical description of Earth's annual cycle in days sits very close to the equivalent synodic number of Planet Venus – which, as mentioned earlier, is the planet symbolically associated with this area of the cathedral.

The ratio associated with a geocentric view of Planet Venus is 8:5. This can be seen in the relationship between the synodic cycle of Venus in relation to the orbital period of Earth. This is approximately a relationship of 584:365. However, if the actual orbital period of Earth is used it slightly changes the numbers in the ratio to 584.4 and 365.25.

If the Venus synodic number is then converted – by appropriately moving the decimal point – it becomes 5844. This number is of immediate interest because it is precisely 300 micro-units more than the baseline of the pyramid triangle formed of greater feet. As already mentioned, this particular pyramid triangle has a baseline of 99 feet, which is 5544 micro-units. If 6 lesser feet (i.e. 300 micro-units) are added on to this it brings forth the Venus synodic number of 5844.

However, it was also mentioned earlier that the baseline measurement for the pyramid triangle used in the actual fabric of the building is a micro-variated mean measurement of 5529 rather than 5544. But if the six lesser-feet are converted into six English feet the micro-unit measurement increases from 300 to 315, and then if this measurement of 315 is added to 5529 it brings about a total of 5844, which is the Venus synodic number.

In terms of the built fabric itself this Venus synodic number materialises through the inclusion of the wall thicknesses of the transept chapels. The 5529 measurement of the pyramid triangle's baseline is taken from the internal wall-to-wall measurement between the north wall of the Corpus Christi chapel and the south wall of the St Katherine chapel. But if the thickness of these two walls is added on to the measurements they produce the Venus synodic number, because each wall has a precise thickness of three English feet (157.5). So together these two walls add on the six-foot measurement that is formed of 315 micro-units.

This means that the Venus-Earth synodic relationship of 5:8 is present in the fabric of the building through the Lady chapel measurement, which is half of 3652.5 micro-units and the above-mentioned measurement of 5844.

Now that the Lady chapel's pentagon and octagon have been shown along with their cosmic 'earthly' measurement there is a need to return to the effect that the heights of the first two pediment triangles have on the pentagram and octagram stars. These measurements concern the particular size of container circle that brings about the distances between the stellations of both the pentagram and octagram stars.

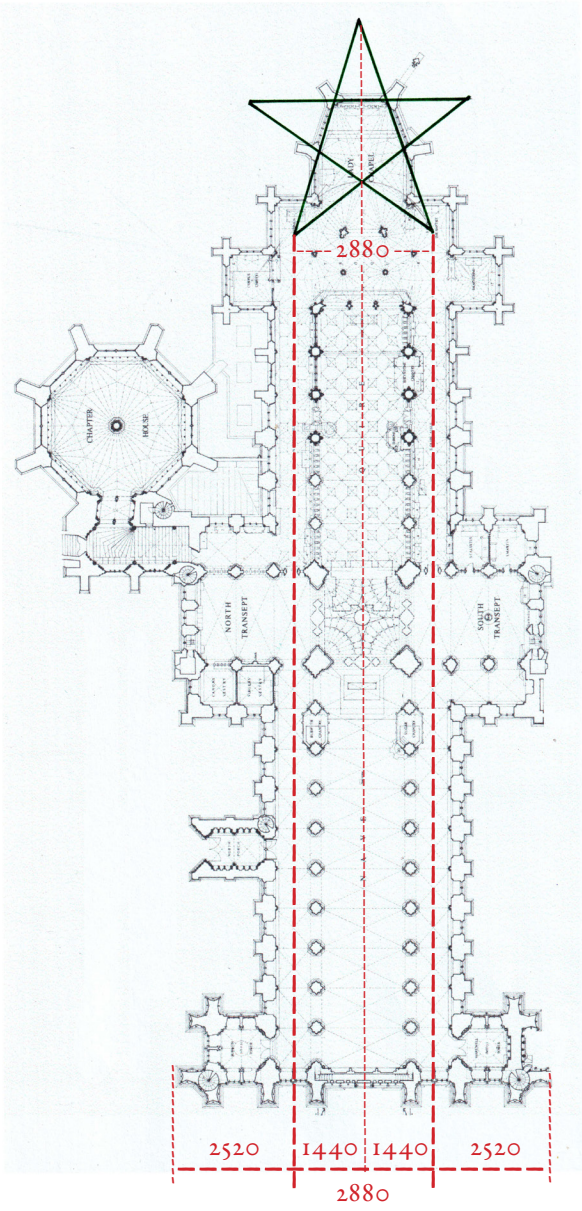
The relationship between the radius and edge-length of a pentagon is inevitably an incommensurable measurement, which therefore can't be expressed as a ratio. If expressed in decimal form it can be said that if a circle has a radius of 1, then the pentagon inside this circle would have an edge-length of 1.17557. There is a very close rational approximation of this, which the designer of the Lady chapel appears to have used in this particular instance, and that is 2880:2450. The decimal division of the larger number by the smaller number shows how accurate the approximation is:

$$2880 \div 2450 = 1.17551$$

As the calculation shows, this rational approximation is so accurate that it is not until the fifth decimal place

that the number differs from the decimal expression of the actual radius–edge relationship of a pentagon.

The number 2450 is the radius of the circle that is produced by the shorter pediment triangle which has a height of 1050, and this is the circle which could be said to contain the pentagram star – although with this particular version of the east end pentagram it is the star's stellations that are used in the design because they determine the distance between the central axes of the two side aisles. These central axes are 2880 micro-units from one another. This was also shown arithmetically to be the distance between the two side aisles down at the western end of the cathedral, as was shown in the section about the nave in chapter 14 (p.254). So the eastern and western ends of the cathedral both clearly correspond to the same system of measurement via their respective pyramid triangle diagrams. However, whereas the 2880 measurement derives from approximate golden ratio measurements in the east end pentagram, it derives from pi measurements relating to 11/7 at the west end according to the pyramid triangle used on the west front and the nave. These 11/7 measurements accord with the windows above the two side west doors that are out of alignment with the two side-west doors.



What this number 2880 brings about in the east end master diagram is a number that is related to Fibonacci numbers. If 2880 is halved it becomes 1440, and if that number is then divided by 10 it becomes the twelfth Fibonacci number – 144. The relating of a Fibonacci-friendly number to the five-fold form of the pentagon is entirely in-keeping with the golden ratio measurements of the pentagram's symmetry. But it also returns us to a diagram that was first shown in chapter 5.

As the image from two pages back makes clear, the distances between the vertical red dotted lines produce larger and smaller distances that approximate the 'lesser and greater' relationship of the golden ratio. However, there is more detail of variation to this which can now be explained.

Remaining with the image from two pages back, the vertical red dotted lines are running from the pentagram's five stellated points down the middle axis of the whole cathedral, as well as along the middle axes of the cathedral's side aisles and transept chapels. The key point here is that these two examples of 'lesser and greater' distance (i.e. between the red dotted lines), have their 'greater part' in the middle section of the ground plan so that both 'greater parts' are next to one another. So this naturally expresses 2 × 1440 = 2880. The measurement numbers in the image show the distance between the two feet of the pentagram, as being 2880 which is actually marked as being two distances of 1440. Owing to the fact that the 1440 measurement forms a 'greater

part' of a golden section, it means that it can be suggested that the middle axes of the transept chapels should be another 890, which would form the 'lesser part' in relation to 1440 as the 'greater part'. This is because the number 89 is the number preceding 144 in the Fibonacci sequence. The entire distance of 1440 and 890 would then bring about a final measurement of 2330 on each side. But as ever there are variations, which appear to be musically related, and these cause the above 'Fibonacci-ised' pentagram diagram to be only the basic underlying principle which is then actually variated within the final design.

One of the ways in which this variation becomes clear is in the fact that the north–south measurements of the two transept chapels are quite different from one another. They differ by around 2/3 foot, which is a huge 'discrepancy' in relation to the very tight accuracy that characterises the dimensions of this building. Some might suggest that such an apparent discrepancy is the result of a random unplanned practicality that got in the way of the intended building work. But the diagram of micro-unit measurements helps to explain why it can be suggested to be an intentional aspect of the design.

As will become clear, the diagram three pages back demonstrates the designer's use of musical ratios through the various micro-unit measurements that govern this area of the building.

To begin with, there is an interesting use of the Pythagorean major third (81:64) in relation to two of the measurements mentioned above. The width of the building is 3645 micro-units, which as mentioned above is the arithmetic mean between the two grids used in the design of the nave. If this 'earthly' number is paired up with the distance between the legs of the pentagram – 2880 micro-units – the ratio for the Pythagorean major third becomes apparent.

This musical ratio is 81:64, and simply multiplying both of these numbers by 45 produces the ratio 3645:2880.

But there is a particularly interesting musical relationship that shows itself within the differing north–south measurements of the transept chapels. As mentioned above, the two measurements of 1440 would naturally appear to pair up with a measurement of 890, and this would then reflect a Fibonacci expression of the pentagram's golden ratio measurements. But as the diagram shows, these measurements are different on either side and neither of them is 890. The south-side measurement is 880 and the north-side measurement is 864. These measurements mark the central axes of both transept chapels. But why are they different on either side, and why do they not produce 890 in their dimensions?

The answer appears to be musical but also arithmetical – and indeed geometrical! If 1440 is added to 864 is becomes 2304. If this total is then divided by 1440, a Fibonacci relationship becomes apparent.

$$2304 \div 1440 = 1.6$$

This relationship is the same as 8:5.

If the equivalent calculation is now made on the south side whereby, 1440 is first added to 880, this brings forth the total of 2320:

$$2320 \div 1440 = 1.61111\ldots$$

This particular relationship is the same as 29:18, which is a Lucas number relationship. So one side of the cathedral is Fibonacci and the other side is Lucas.

The difference between 29:18 and 8:5 is 145:144, and in this sense the Heavenly Jerusalem number 144 becomes associated with 8:5.[4]

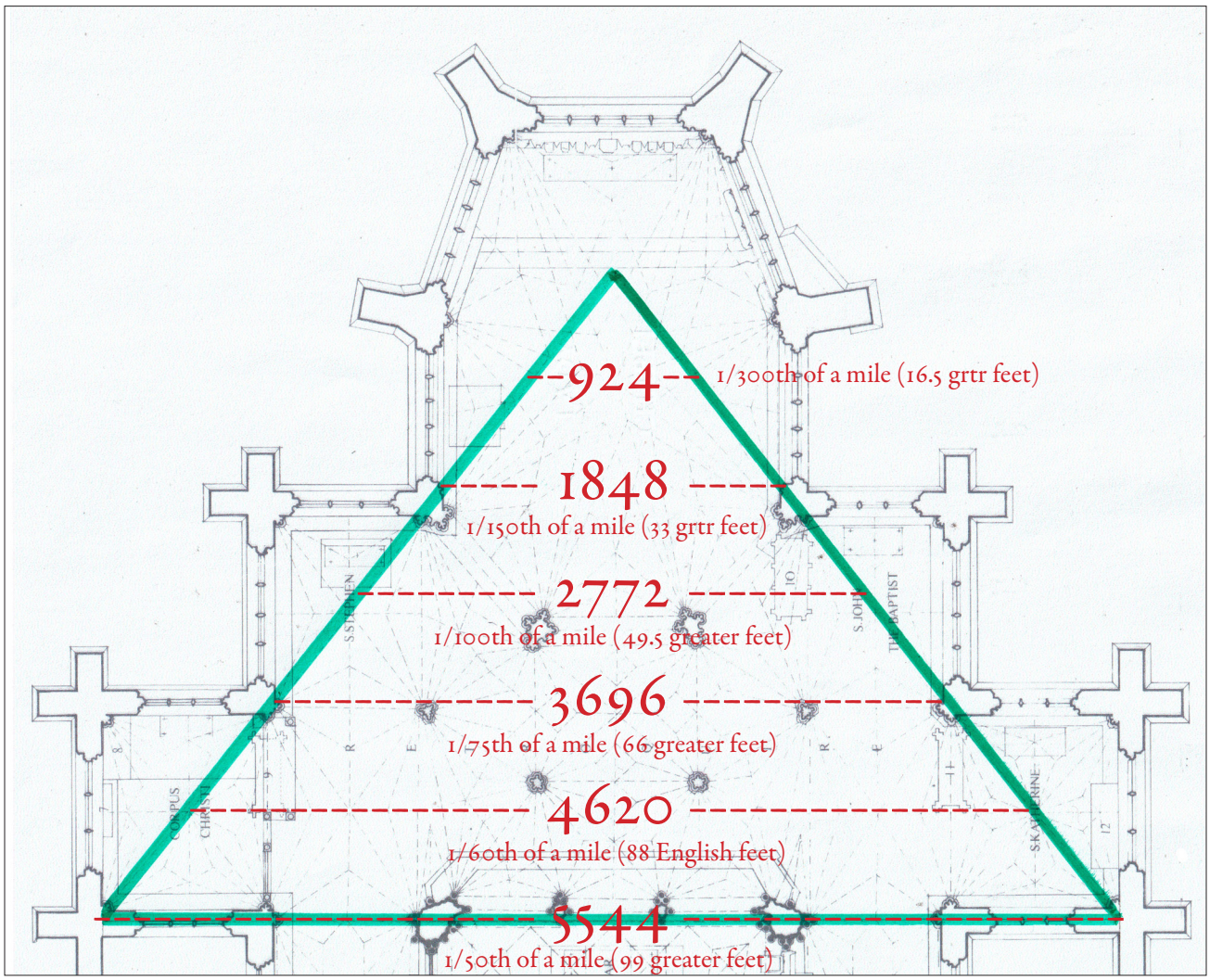
Another way of looking at these relationships is to say that 1440:864 is the same as 5:3, and 1440:880 is 18:11. These give the Fibonacci and Lucas number relationships that precede 8:5 and 29:18 in their respective sequences. But 5:3 and 18:11 are both also musical ratios

4. A relationship between 8/5 and 144 is something that also occurs within the measured latitude of the Temple Mount in Jerusalem – this will be focused on in chapter 21 (sec 21..2).

for the sixth note of the diatonic scale. The 5:3 ratio is the major sixth and the 18:11 is a 'neutral' sixth as it falls between the major and minor sixth.

There is a rather grand expression of musical ratios that looks possibly to be present, although it would involve the inclusion of various musical commas to work out. It involves the pyramid triangle with a baseline of 5544 micro-units and a height of 3528. This is the larger of two pyramid triangles included in the design of this part of the cathedral, and in greater feet it measures 99 along its baseline and 63 in its height. The baseline of 99 greater feet is precisely 1/50 of a mile. If the height of the pyramid triangle is divided up into six levels – as accords with the architectural layout – each new horizontal baseline or 'rung' progressively becomes shorter as the pyramid triangle is ascended. The next baseline up from the first one is 1/60 of a mile. The next one is then 1/75, the one after that 1/100, then 1/150, and finally the single unit itself of 924 micro-units, which is 1/300 of a mile. The relationships between these progressively shortening baselines also expresses the musical ratios of 6:5 (minor third), 5:4 (major third), 4:3 (fourth), 3:2 (fifth) and 2:1 (octave).

The two lower baselines have different lengths, of 5544 and 4620. This helps to bring about the musical tone, because if 5544 can be looked on as 99 greater feet, then 4620 can be seen as 88 English feet, and this relationship of 99:88 is the same as the musical tone 9:8. But the fact that the greater foot and the English foot have a difference of 16:15 – a semitone – means that the actual



The musical ratio triangle with red dotted lines showing lengths that are fractions of a mile. It embodies the musical ratios 6:5, 5:4, 4:3, 3:2, 2:1 as well as the 9:8 tone.

difference between 99 greater feet and 88 English feet is a minor third – a tone plus a semitone.

Further detailed study is required to fully ascertain whether this grand musical schema was used by the designer, suffice to say that its singular unit of 924 micro-units can be symbolically associated with one quarter of the days in a year if reduced by the ratio 85:84. This brings it down to 913.13 which when multiplied by 4....

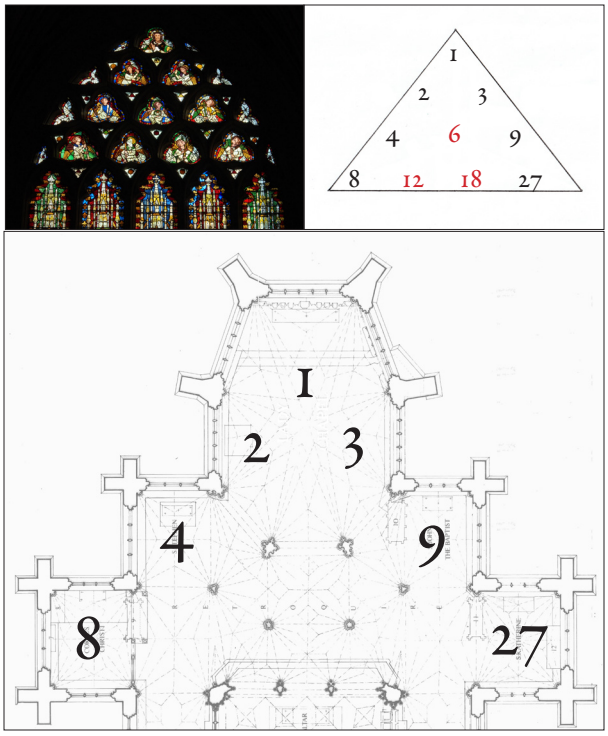
$$913.13 \times 3652.5$$

....becomes the number of days for earth's annual cycle when the decimal point is moved appropriately (i.e. 3652.5 becomes 365.25)

This grand musical ratio schema would mean that the ratios for the whole diatonic scale are present in this design. The pyramid triangle of ascending ratios contains the 9:8 tone as just described, but also the major and minor thirds as well as the fourth, the fifth and the octave. The sixth is present in the measurements of the pentagram. But what of the elusive seventh? To see something that resembles the musical seventh one can look to heart of the cathedral itself. The width of the whole chancel in relation to the width of the quire is 3645:1942.5 which, with the reduction of a tiny micro-variation (1296:1295), brings about the musical ratio of the major seventh – 15:8.

As the above description makes clear, the Lady chapel is by far the most musical part of the cathedral's design, and in fact Lady chapels are well known to have had a strong connection with music – particularly musical innovations that experimented with musical forms beyond the traditional use of chant in the quire.

The other musical form that shows itself in the cathedrel's design and indeed the Lady chapel is the tetraktys-shaped windows that call to mind the Platonic Lambda, containing the numbers that produce the most primary musical ratios. This Lambda form can also effectively be seen in the layout of the ground plan itself, with the Lady chapel holding the numbers 1, 2 and 3 and then the chapels of Stephen and John holding the 4 and the 9, and finally the transept chapels holding the 8 and the 27. Such heavenly music naturally resonates with a place that symbolises both the Risen Christ as well as the crown of the Coronated Virgin - and indeed Eden 'in the east'.



The Lady chapel's tetraktys-shaped window, Plato's tetraktys-shaped Lambda and the Lambda reflected in the east-end ground plan.

The final measurement to account for returns us to the Cosmic Canon and the measures of the Earth. This relates to the distance between the stellations of the octagram star. This is the star mentioned a little earlier that is contained in a circle with a radius of 2366.

If the ratio 200:153 is again used to define the relationship between the radius and 1/8 of the circle, the distance between the octagram star's stellations becomes 1809.99. This measurement can now be reduced by 126:125, which brings it to 1795.625 which can effectively be described as the 20-cubit width of the quire using its cubit of 89.8 micro-units. Precisely speaking this 20-cubit measurement is actually 1796 rather than 1795.625. However, with the absolutely tiny micro-variation of 14,365:14,368 the correct width measurement of 1796 can be reached.

17.3 MICRO-VARIATIONS IN THE PYRAMID GEOMETRY OF THE BISHOP'S PALACE MOAT WALLS

One small extra point that needs to be made about the pyramid geometry in the Bishop's Palace moat walls relates to the use of micro-variations.

Both bottom corners within the upturned pyramid triangle fall a little off-centre within their respective bastions. The apparent reason for this is the use of micro-variations in the sense that the 280-cubit length of the pyramid triangle's two sloping edges have been shortened so as to incorporate a couple of micro-variations. The position of the bastion to the east has been adapted by the 56:55 ratio. So, the distance has been shortened from 280 to 275 cubits, and this 5-cubit reduction reflects the reduction by 56:55. In practical terms it means that the distance between the central points of the southern and eastern bastions is 275 cubits rather than 280. This the means that both the phi and pi triangles are incorporated into the design schema because the 5 cubit variation reflects their difference. But having said this a 280 cubit measurement is actually present too because the wall on the far side of the bastion is 5 cubits beyond the bastion's central point. So the distance from the central point of the southern bastion to the far side of the eastern bastion is 280 cubits.

The position of the bastion to the west appears to have been shortened by the ratio 126:125 whereby the distance between the central points of the southern and western bastions is 277.7777 cubits rather than the original 280 cubits. But in this case the far side of the bastion doesn't produce the 280 cubit measurement that features in the eastern bastion but rather 280 increased by 175:176 - or 280 + 1.6 cubits. Interestingly this extra 1.6 cubits contains 144 micro-units. This significant Fibonacci number - also mentioned in the Biblical description of the Heavenly City - will also feature in the following section in relation to the latitude geometry of the Great Pyramid itself.

Bearing in mind the lunar nature of the Earth-Moon diagram, along with the association of the Moon with the number 99, it is interesting to note that the difference in length between the two micro-variated measurements of 275 cubits and 277.7777 cubits is the same as 99:100.

As for the 500-cubit distance between the southern bastion of the moat walls and the centre of the octagon in the Lady chapel's ground plan, this appears to be enlarged by the ratio 125:126, whereby the precise physical distance is 504 cubits. Such a variation appears to bring about a geographical unit that is much more in keeping with the 'ideal' dimensions of the Earth as it is expressed in the Earth-Moon diagram. Indeed, there are 48,400 of these geographical distances in the diameter of the Earth, whereas with the 500-cubit distance there are 48787.2 of them. But a 504-cubit distance inevitably also resonates with the radii measurements of Earth and Moon, which together measure 5040 miles. Bearing in mind that there are 3080 cubits in the mile, there are 30,800 of these 504-cubit distances within the joint radii of Earth and Moon (if based on 22/7).

So, much like the cathedral, the Bishop's Palace is also marked out in harmonious concordance with the size of the Earth and the Moon. This means that it geometrically 'incarnates' a few of the ideal mathematical relationships that are forever contemplated in the Divine Mind. In this sense the eternal realm of number takes on an earthly embodied form so as to architecturally 'dwell among us' – and of course we too in it.

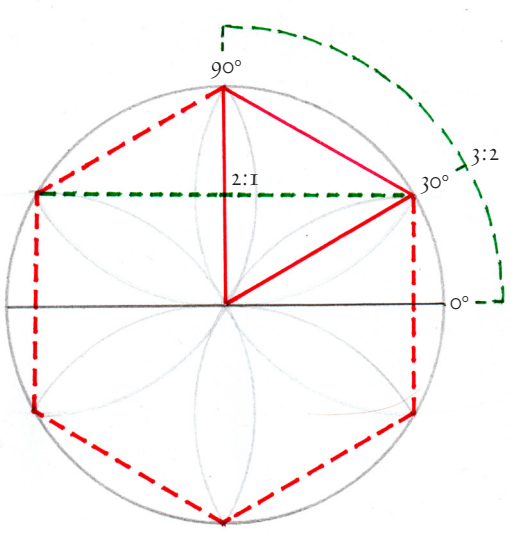
This part of the book has gone into very great detail about the measurements of Wells Cathedral. It must be repeated here that the slideshow talks on the website **www.tombreegeometry.com** would be helpful in understanding this particular part of the research if reading this section has been in any way challenging.

17.4 THE LATITUDE GEOMETRY OF THE GREAT PYRAMID

At the beginning of this chapter it was suggested that an 'arithmetically ideal' Great Pyramid is precisely one-seventh of a mile along its base. It was also shown how this measurement accords with the number 55,440, which arithmetically derives from the consecutive multiplication of all the numbers from seven to eleven. However, the actual Great Pyramid in Giza is 440:441 bigger than one-seventh of a mile, and this can be seen as reflecting the 440:441 difference between the polar and mean radii of Planet Earth.

Another thing to consider is that the Great Pyramid is geographically located very close indeed to a latitude of 30° north of the equator, albeit slightly off that. It is generally suggested that its location does geo-cosmically relate to 30° but that, for some reason, it was built a little way to the south of this latitude.

The 30° line of latitude is significant for various reasons, including the fact that – as any geometer knows – the first and most primary division of the circle is with the circle's radius, which divides the circle into six. So 30° north of the equator is 'one radius' around the planet starting from the north pole. In other words, the distance between the north pole (90°), the 30° latitude and the centre of the Earth are all the same – if one thinks of the Earth as an ideal uniform sphere.



Planet Earth and the 30° latitude of the Great Pyramid

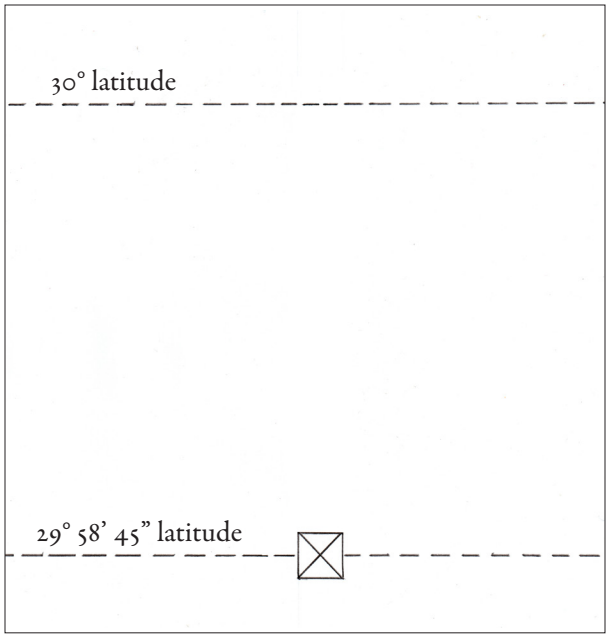
An interesting thing that this six-fold symmetry brings about is the first two musical ratios of 2:1 and 3:2, if one looks at the way in which it divides the circle's radius in relation to the distance between its 'equator' and its 'north pole'. As the diagram shows, the 30° parallel is halfway between the north pole and the centre of the circle, and so this naturally divides its radius at the 2:1 point. But it is also one-third of the way around the circumference between the circle's equator and north pole, which thus reflects a 3:2 ratio.

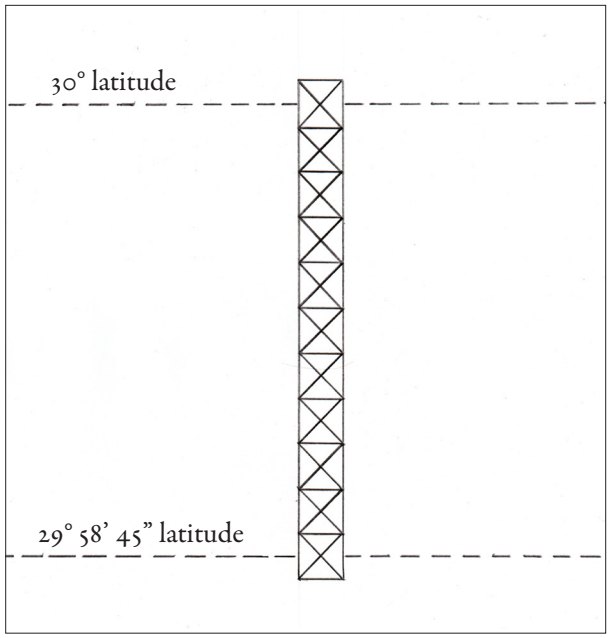
But perhaps most significantly, it is around the 30° line of latitude that the 'ideal' 3960-mile radius of Earth is present within the oblate form of the planet. The polar radius of Earth is just a little under 3950 miles, whereas the equatorial radius is a little over 3963 miles. But it is just a little way south of 30°, at around 29.5°, where the radius of Earth is the ideal measurement of 3960 in a similar way to how it presents itself in John Michell's 'arithmetically ideal' diagram.

So if 30° is of such significance, it can be asked why the Great Pyramid is so very close to this latitude but not precisely on it. The following description suggests a reason for this.

In the first diagram there is an image of two lines of latitude. They are the 30° line and then below that the actual latitude of the Great Pyramid, which can be described as 29.979173. In degrees, minutes and seconds this is defined as 29° 58' 45". As the diagram demonstrates, this is the line of latitude that passes through the middle of the pyramid's square base.

In the second diagram the square base of an 'imaginary' Great Pyramid has been placed upon the 30° line of latitude with another nine 'imaginary' Great Pyramids also added in between, which thus demonstrate that the Great Pyramid is eleven of its square bases away from the 30° line of latitude. This would appear to make sense of the fact that an 'arithmetically ideal' Great Pyramid is one-seventh of a mile because of the





joint significance of the numbers seven and eleven within John Michell's pyramid triangle diagram of the Earth and the Moon. If there are seven 'ideal' Great Pyramids in a mile, then eleven of them in a row defines its latitude, and this then incorporates both of these consecutive prime numbers that are so significant within the Earth-Moon diagram.

On top of this, if eleven 'ideal' Great Pyramids measure 1.571428 miles, then such a measurement is in itself significant because it is 1/7920 of the 'ideal' distance between Earth's north and south poles. The number 1.571428 is half of 22/7 pi (i.e. 3.142857). If looked upon as a mileage, there are forty-four of these distances in an 'ideal' degree of latitude. When 1.571428 is multiplied by forty-four it produces 69.142857, and this is the number of miles in one 'ideal' degree of latitude – (i.e. if defined by 22/7). So if these forty-four distances of 1.571428 miles are then multiplied by the 180° between the poles, the number 7920 is reached.

$$1.571428 \text{ miles} \times 44 = 69.142857 \text{ miles (i.e. } 1^\circ)$$

$$180^\circ \times 44 = 7920$$

However, there is an interesting detail that needs to be highlighted, which again points in the direction of John Neal's research relating to the ancient knowledge of the oblateness of Earth. To say that there is a row of eleven Great Pyramids first presents us with the question of whether this pertains to the 'arithmetically ideal' Great Pyramid that measures one-seventh of a mile or, alternatively, to the physical size of the actual Great Pyramid – which, as mentioned earlier, is enlarged by the ratio 440:441. The answer to this would appear to be the 'arithmetically ideal' Great Pyramid albeit enlarged by the ratio 125:126.

But more specifically, we need to focus on the distance between the two actual lines of latitude themselves, which are effectively ten Great Pyramids apart (which can be understood through referring again to the above diagram of eleven Great Pyramids in a row). This gives a distance of 1.428571 miles (i.e. 10/7), which when increased by 125:126 becomes 1.44 miles. This is then the precise distance between the two latitudes. It also naturally reflects the very significant number 144, albeit reduced by 100:1.

So again there is an indication of the ideal arithmetic of John Michell's diagram and a Great Pyramid that measures one-seventh of a mile, although the significant ratio 126:125 is also included, which leads into the rich detail of John Neal's findings relating to the various different approximations of pi that define the differing radii of an oblate Planet Earth.