

## MATHEMATICS AS COMPLEMENT TO THE ARTISTIC AND THEOLOGICAL EXPRESSIONS OF OUR WORLD

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At a conference on matters theological and artistic, it might seem an anomaly to have a mathematician here, whose express purpose is to engage you in considering the complementarity of mathematics to theological and artistic expressions in the overall descriptors about our world.

Let me begin with apologetics about where mathematics fits into the scheme of explanatory ideas, and perhaps an appropriate start might be with the very theological events the Church has us reflecting on at this time of the year - the Incarnation. Theology and our arts put before us important aspects of the Nativity scene, and just recently we have seen in our churches the final act played out by the Wise Men being moved across the sanctuary gradually until they eventually reached the stable last week. Just as the magi complement our Nativity scene, and the magi were the mathematicians of that day, I would like to draw your attention to the parallel between their mathematical complementarity to the Nativity accounts, and the role of the mathematicians in complementing our theological and artistic depictions of our reality.

Our traditional Nativity scene usually has statues or pictures representing Jesus, Mary and Joseph, possibly an ox and a donkey, as well as angels, shepherds and three magi. Now we know the shepherds were told about the event by the angels, so they were informed by direct revelation. The magi, on the other hand, had no such announcing and had to rely on their own intuitions and learning. It was no simple matter to hypothesise on some happening in Judea and then undertake such a long journey on just this hypothesis.

Speculation on what these mathematicians saw 2000 years ago in Media (Iran) involve astronomical calculations on our current mathematical model of the universe and propose that in 7 BC there were three separate conjunctions of Jupiter and Saturn within the background of the constellation of Pisces in May, September and

December. A conjunction happens when the two planets seem to an observer on Earth to come close together, so their combined light makes a spectacular sight.

This fact would have been of great interest, since at that time belief in the stars as important signs, was highly cultivated. In Hellenist culture, Jupiter was considered to be the sovereign king of the universe, Saturn was designated the star of the Jews and the constellation of Pisces was related to the end of the world. The wise men of the Orient, the magi who interpreted the messages of the stars, could have given something like this as meaning to the conjunction of these stars: in Judea (Saturn), a king is born (Jupiter) whose significance relates to the end-times (Pisces). Their journey was made and thus the prophecy concerning the Messiah was fulfilled for Matthew, who proclaimed the church's faith in an eschatological saviour.

Matthew tells us that the mathematicians had seen the star, but then lost it, and later they saw it again when on their way to Bethlehem, so this appearing and disappearing behaviour calls for an explanation. A documentary called 'Christmas Star' (SBS 19.12.93), fancied the date of 15th September 7 BC, the second Jupiter - Saturn's conjunction, as possibly the date of Jesus' birth, and that the Magi could have set out on their journey after seeing the first conjunction in May, and arrived at Bethlehem about the time of the third conjunction in December. This, of course, conflicts with our traditional date for the Nativity, and in pursuing this point we would have to decide whether our concern is to know the real day, or whether we are more concerned about the symbols of our belief and their meanings in the Roman culture that Christianity was replacing, as December 25 was the day of the Sol-Invictus festival and also Constantine's birthday. Returning to the symbol of stars, and in particular, let's look at the meanings the star and the mathematicians hold in the gospel narration of the birth of the Messiah. For Matthew, Jesus is the Messiah who arrived at the proper time and fulfilled all the prophecies. One of these referred to the prediction that at the end of time, kings would come to Jerusalem to adore God and the Messiah and offer him gifts (Isa. 60:6, Ps. 71:10). The Magi go to Jerusalem (Matt. 2:1) before arriving in Bethlehem by following a star from the Orient (Matt. 2:3) thereby fulfilling this prophecy.

The star is a sign that was well known at the time of the New Testament. All people had their own star, especially the great, such as Alexander, Augustus and philosophers like Plato. Judaic tradition also

had a star appearing before the births of Abraham, Isaac, Jacob, and Moses, and thus the Jewish culture at the time of the New Testament was conversant about the star of the messiah in the prophecy of Balaam (Num. 24:17).

Matthew's gospel (1:1-17) also shows there is a further mathematical prophecy of the messiah by substituting the consonants of the name DaViD by their respective numbers we get the number 14 ( D=4, V=6; the vowels did not count in Hebrew). Matthew constructs the genealogy of Jesus so that the result, as he points out (1:17), is three times fourteen generations. The number 14 is the double of 7, a number that for the Bible symbolizes the fullness of God's plan. The fourteen generations from Abraham to David show the first high point of Jewish history; the fourteen generations from David up to the Babylonian exile reveal the lowest point in sacred history; and the fourteen generations of the Babylonian captivity up to Christ demonstrate the fulfilling of the salvation promise given in Genesis. Jesus completes the three times fourteen generations, and thus is the promised Messiah, having arrived at the appointed time. Jesus occupies this prophetic place in Davidic genealogy, and being the son of a virgin, also fulfills the prophecy of Isaiah (7:14). Thus Matthew shows that Jesus is both the promised Son of David and the awaited Messiah.

Luke (3:23-38) also gives a mathematical explanation to Jesus' status by recalling for his audience that in 4 Esdras 14:11-12 (Boff 1980, p.163), the Messiah was expected when the eleventh week of the world was completed, and eleven weeks make seventy-seven days. For Luke, each day represents the life of an ancestor, and he then constructs the genealogy from Adam, showing how Jesus came when the seventy-seven days of the world had been completed. Thus the genealogy of Jesus from Adam to Joseph, Jesus' adoptive father, has the necessary seventy-seven antecedents.

When we compare these genealogies we see they differ and have artificial constructions. The mathematical messages, to Luke, Greek-educated, and Matthew, an accountant, appear more important than the historical details that we would demand.

There is another interesting piece of our literary heritage I would like to put before you, that has a common thread about mathematical intuitions and creative exploratons. The Roman poet Virgil wrote:

Now the Virgin returns...

now a new generation descends from heaven on high...

Only do thou, pure Lucina, smile on the birth of the child under whom a golden race will spring up throughout the world!" (Tucker 1981, p.128).

We are astonished, not only by the words of prophecy from a pagan, but that they were written about thirty years before the event of Jesus' birth, and by a writer who could not be expected to be acquainted with Hebrew traditions.

However this Virgin that Virgil refers to, was well-known in the Babylonian, Egyptian and Greek mythology as Virgo, the zodiacal constellation in the sky. The return of the Virgin to Earth meant that the constellation of Virgo would rise just before the Sun on one of the cardinal days of the year; that is, on one of the equinoxes or solstices. Virgil was anticipating the heliacal rising of Virgo at the autumn equinox.

A heliacal rising was a special astronomical event that described the rising of a star just before sunrise, and heliacal rising stars were important generally in that they marked the passage of the seasons. As the Earth moves around the Sun, the Sun's apparent position against the backdrop of stars shifts through a band of constellations - the Zodiac. In the northern hemisphere, on the first day of spring, the Sun rises in the constellation of Pisces; in April and May it shifts into Aries and Taurus until, on the first day of summer, the Sun rises in the constellation of Gemini. And so it goes throughout the year, until the next springtime arrives and Pisces is seen to rise in the first rays of dawn once again. The next constellation soon to have its heliacal rising is Aquarius, hence the new-age interest in the coming of the age of Aquarius.

This slippage of the zodiacal clock is due to the slow wobbling of the poles of the Earth; each wobble taking about 26,000 years to complete the precession, and thus the positions of the constellations slowly shift through the ages. The magi, aware of this precession, calculated in astronomical ages of 2150 years, corresponding to the time it took for the heliacal rising of the Sun on the spring equinox to shift from, say, Pisces to Aquarius.

On the day of a heliacal rising, a bright star in the particular constellation, glimmers near the horizon for just a few minutes before the sunrise brightens the sky and the star becomes invisible. Each day the star rises about four minutes earlier, can be seen a little longer, and is a little higher in the sky before it disappears. By making observations of the heliacal rising of certain stars or groups of stars,

astronomers made fairly accurate calendars. Perhaps the best known example is the Egyptians' use of the heliacal rising of the bright star Sirius to announce the coming of the flooding of the Nile.

Virgil was anticipating the heliacal rising on the autumn equinox of the bright star Spica of the constellation of Virgo, which had not been seen for 6000 years, and astrologers took particular note of the heliacal rising of a special star. Virgo would be seen at the autumn sunrise, and later the rising of the constellation Pisces on the spring equinox would inaugurate the Piscean age.

Christians educated in this knowledge saw a likely poetic interpretation in Mary giving birth to Jesus. The piscean (fish) symbol was used in many references to fish in the Gospels, and eventually in the symbol of the "fish" being used for Jesus.

John recounts the miracle of the catch of fish, just after the Resurrection, and for some strange reason mentions the exact number of fish caught - 153 fish. We are surprised that anyone would go to all the trouble of actually counting such a large catch of fish, which leads us to look at the mathematics in the situation for the message. 153 is the sum of all the consecutive numbers from 1 to 17. ( $153 = 1+2+3+4+5+6+7+8+9+10+11+12+13+14+15+16+17$ ). 153 is called the seventeenth triangular number, since this number of, say, cans will stack neatly into a triangle shape of seventeen layers, with seventeen on the base layer, and we use the triangle in our art as a symbol of the Trinity.

Just as we saw that 14 was important in the Matthew's scheme, so to is 17, because 7, the completion, represents Jesus. We recall about Peter's asking Jesus whether 7 times was all that one was required to forgive, and Jesus' reply about 77 times 7, and also the world was created in seven days, the seven seals of the Revelation, and the seven last words of Jesus.

Returning to our stars, we see that Matthew, in 2:2, tells us that the mathematicians arrived in Jerusalem from the East. Some translations have the Magi saying they had seen "his star in the east". In Greek, "the east" is usually "anatolai", however the original text reads "anatole" which is a word of special astronomical significance, and requires a mathematical interpretation. This is the heliacal rising, that occurs at first light - the rising of a star just before sunrise, and thus better translations say the Magi had seen the 'rising of his star'.

We see then that mathematical metaphors were used by the evangelists in expressing their theology concerning the Messiah, and this has a continuing tradition throughout our heritage. We can see an

impressive co-operation of theology, the arts and mathematics in such expressions as, say, in Gothic architecture. A look at Chartres, for instance, sees a coming together of a single masterpiece from the many parts contributed by many generations of architects into its harmonious whole. Its facade is set in a web of numbers, proportions and geometric harmonies anchored at a few fixed points. Within this unity, each stone has been measured, worked, then cemented into its own appointed position by its masons. The artists working the stained-glass windows, or the sculptors fashioning their small individual masterpieces tell of both biblical and also ordinary people at their work. I saw Pythagoras, the mathematician, there in stone alongside butchers, bakers and all the rest of the guilds.

Such a construction serves as a model to show the complementarity of theology, the arts and mathematics in the creation of significant statements about our condition that can help us with meanings that we wish to communicate.

Theology in its discourse about transcendence and immanence uses symbols to communicate its ideas, and mathematics in its discourse about reality and abstraction uses symbols, and art in its communicating about beauty and ideas also makes use of symbolisation. The symbol can be a memory aid to help us fix concepts in the mind, and in our working with these symbols and manipulating the symbols we are able to work towards better representations of our world and our situation in it. Our symbols and metaphors seem to be our currency when talking about concepts, and sometimes they have to be re-worked. Mathematical metaphors on cosmology have had to change from the mechanistic Newtonian model to a quantum mechanics metaphor incorporating a "Big Bang" creation model. Discussions and disagreements about particular metaphors are inevitable and hopefully will lead to a refining of the symbols. However we must remember that a metaphor is just that, and not the reality itself, so a particular metaphor does not alter that reality. Conflicts arise over the metaphors and we need the perspective of theologians, artists and mathematicians as well to assist in the refining process of our symbolisation about our own purpose in cosmic terms. The mathematical, artistic and spiritual are just different facets of the same transcendental reality of "God's self-manifestation in nature, history and human experience" (Capra et al., 1992 p.xii).

## REFERENCES

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