

Math in the Byzantine Context

Thesis/Hypothesis

Math

ematics as a way of thinking and a way of life, although founded before Byzantium, had numerous Byzantine contributors who played crucial roles in preserving and developing the discipline.

Sources/ Limitations of study

According to most resources I found, there were great contributions made to the field of mathematics during Byzantium era yet it was very rarely documented. This is an obvious limitation of study as mostly everything found is then only 3rd, 4th, or 5th hand accounts of what was actually discovered/worked on during these times.

Secondary Sources

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Arguments

In the modern day field of Mathematics, scholars are always referring either through discussion or through practice to works and discoveries of ancient Mathematicians and Philosophers. Most of these ancient works are said to be of Egyptian, Babylonian and Greek origin. The original purpose of this paper was to highlight the contributions made by the Byzantines, however the research is so limited in this field that it is only possible to concentrate on the predecessors of Byzantine math as most research indicates that Byzantines played a greater role in passing on earlier works to future generations rather than developing their own original concepts (Struik 1987). The Byzantine Empire remained a safe haven for the collected works of ancient Greece and maintained its civilization from the time of Constantinople until the late Middle Ages. It's only achievement of worth in the field of mathematics was preservation of knowledge: no major discoveries or advances were made by Byzantine mathematicians according to sources. However it's application of Greek mathematical techniques in architecture and the arts were some of the finest in the ancient world (Dickson, 1996).

One of the most influential of these was Pythagoras of Samos. Pythagoras was an original thinker in that his Philosophy and teachings were a combination of Religion, Spirituality, Geometry or Mathematics and Astronomy. To gain knowledge, many great Philosophers and Scientists "undertook journeys despite poverty and exposed themselves to grave dangers. Yet they ventured to travel the length and breadth of the Greek world in order to acquire information and new ideas and to meet with other scientists and learn from them" (Burckhardt, History of Greek Culture, 1963). Pythagoras did just this, gathering most of his knowledge in the Near East (Egypt) (Riedweg, Pythagoras: his Life, Teachings and Influence, 2002). Despite being called "fundamentally different from the Greek way of life", Pythagoras eagerly observed all of the Egyptian rulers possible. With him, he brought back to Greece "many

of the ritual rules that until then would seem alien to Greek ears.”
(Riedweg, 2002).

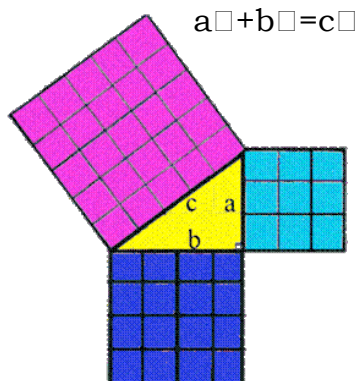
Among many things, it is said that Pythagoras gained his geometry understanding from these Egyptians, while knowledge in arithmetic came from the Phoenicians and Astronomy from Chaldeans.(Reidweg, 2002) . Many sources say that before returning to Samos, Pythagoras retreated to a cave outside of his home city where he brought his mathematical learning together with astronomy and spirituality. “It is here that the great minds of Greece came to take part in his instruction.”



Pythagoras' Cave

<<http://www.samosguide.com>>

Eventually, Pythagoras would run an entire school with his gathered knowledge. One of many famous discoveries of the school was the fact that the earth is a globe on the abstract principle that a sphere is the most perfect shape and that hence the earth has to have this form. A second discovery by Pythagoreans is a principle that we are taught today in our schools the Pythagorean Theorem. The theorem states when a square is made out of each side of a right angle triangle, the square of the horizontal line from the triangle and the square of the vertical line add up to the square of the diagonal line and we are then given the equation:



This however is where limitations of study come into play. Upon researching, multiple sources stated differing stories of who exactly created the Pythagorean Theorem. Was it Pythagoras himself, one or more of his disciples who then put it under his name, or Babylonians from long before Pythagoras' time? In the end, it is not important who exactly came up with the theory, as it is a lesson of caution to stories of history. It is well established in most literature found, that not much proper documentation was made that survived from his actual time. Therefore most of what we read is hearsay that comes from different points of view. Despite not knowing details of Pythagorean history, we do know that Pythagoras and his disciples have contributed to a major part of the mathematics that was preserved and passed on through the Byzantines. If it were not for the Byzantines, much of Pythagoras' work would not have been carried along through time to our very textbooks and theories today!

Another more general topic that the Byzantines helped carry on through history is that of patterns. This happened probably more out of an attempt to please the eye esthetically rather than out of a sense of duty to future scholars (Struik 1987). This was the early appearance of Geometry in pre-Byzantine and in Byzantine times. Continuous patterns of basic shapes inside other shapes were carried on through pieces of art work such as dipylon vases of the earlier Greek periods as well as Byzantine mosaics (Struik).



(Speltz, 1915)

All of the mosaics pictured above are Byzantine Floor samples. In order to create such intricate designs, the Byzantines must have had to understand geometrical shapes and patterns extensively. from the planning of the final outcome to which shapes the tiles themselves would be made into in order to form the over all floor. During the Byzantine Empire, the focus of mosaics turned from geometric floor designs to Christian story telling on walls and ceilings of churches. Even looking at the latter tiles, although the overall pictures are no longer just geometric patterns, the tiles used are still geometric shapes, mainly tiny squares. It is amazing to think that such detail and skill was put into these minute shapes in order to perfect the final product.

As mentioned earlier, one of the main contributions Byzantine Mathematicians made to the history of math was through architecture, which is easy to understand now that we have seen how well they understood basic shapes and calculations. Take for example Hagia Sophia meaning Holy Wisdom, in Constantinople. From 537-542 AD, workers of the emperor Justinian built what was at the time, a “new and difficult feat of technology. They placed a vast circular dome on top of a square formed of four arches. The link between the curve of each pair of arches and the curve round the base of the dome is made by a complex triangle shape known as a pendentive.” (Gascoigne).



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(Gascoigne)

Conclusion

Although the above are only three short examples of how mathematics was applied during the Byzantine Empire, they were an overall attempt to cover the most basic and most intricate uses of pre-Byzantine mathematical discoveries during the Empire itself. The original thesis statement of this paper was that Byzantines were great contributors to the field of mathematics. In some eyes, they contributed nothing (Dickson, 1996). In others, they used earlier findings to make their own unique contributions to the world at the time and in their future. It seems more obvious in three short glimpses of the broad scope of mathematics that the latter is more likely to be true. Research however, will continue to leave the topic open for discussion.