***DANCING*** *WITH GOD* ***THROUGH THE ARTS***

**Part Three – MATH, A Beautiful Theorem**

I hope the above title didn’t scare you off since there is more to it than just math. Hang in there and you will see.

But first, as a review, we started from the outside with nature when considering beauty and then we moved to birds and their natural habitat. Our ancestors tried to replicate nature by drawing pictures on cave walls of things they saw in world that miraculously survived even today. Not only did they try to replicate what they saw but maybe also the sounds they heard, like birds make, maybe to better hunt them. And the successful ones would wear their feathers on their heads and on their clothes.

Today we have the ability to reproduce what we see and hear in nature using our modern digital devices, like our cameras, recorders and cell phones. I am hopeful that art will never dies out and will continue to change in form, especially in our electronic age. But there is something to creating or replicating what we see and hear, as an art that is not only satisfying but prayerful.

And what does that have to do with Math? Simply this, beauty is in the eye or mind of the beholder, or is it? I would like to remind us how people not only define beauty, but what is it about something beautiful that attracts us? That is where we need to move beyond nature to get a better understanding of the nature of beauty itself. And that is why I have chosen math.

Most mathematicians would agree that Albert Einstein’s equation, E=mc2, is ***beautiful***. In fact, they would also agree that an equation needs to be simple and ***beautiful*** for it to be true. This seems strange at first, and “…most physicists still find it somewhat staggering” as quoted from Richard Feynman in Jim Holt’s book, *When Einstein Walked with Godel*. Feynman’s remark was about the intimate connection between symmetry and conservation proven by Emmy Noether as “a most profound and ***beautiful*** thing.”

Jim Holtz writes that Emmy Noether was among the greatest pure mathematicians of the twentieth century! That is surprising considering the times, 1907, when she was one of only a handful of women to obtain a Ph.D.

“She was born in Bavaria in 1882. Though the equal of such illustrious colleagues…she was, as a woman, barred from holding a full professorship, but she was allowed to give unpaid lectures as a Privatodozent. When the Nazis came to power in 1933, Noether, a Jew, was stripped of her semiofficial position at Gottingen. She fled to the United Stated, where she taught at Bryn Mawr and gave lectures at the Institute for Advanced Study in Princeton. In 1935, she died suddenly from an infection after an operation.”

Noerther’s Equation connects symmetries of the abstract mathematical theories of matter to quantities that experimenters can measure. What that means is *that mathematical descriptions of nature can be tested in the real world* – a crucial relationship between the abstract and the concrete. Otherwise, the mathematicians can dream up all sorts of formulas that may or may not necessarily have any meaning in the real world, and especially if they cannot be tested.

Another scientist, James Clerk Maxwell, in response to Questionnaire by Francis Galton, 1870, stated, “I always regarded mathematics as the method of obtaining the best shapes and dimensions of things; and this meant not only the most useful and economical, but chiefly the most harmonious and the most ***beautiful***.” Eventually his theory of electromagnetism was used to describe the real world. He was even an inspiration to Albert Einstein who developed the Theory of Relativity.

However, it wasn’t until Dirac’s lecture in 1939 in Edinburgh that the word ***beauty*** was specifically used in mathematics. He proposed a new principle of *mathematical**beauty*, “…that researchers should always strive to maximize the ***beauty*** of the mathematical structures that underpin their theories of the natural world.” He even declared that *mathematical beauty* – in common with *beauty in art* – cannot be defined, asserting that people who study mathematics usually have no difficulty in appreciating it.”

Now we are ready to define what beauty is, and in this case, mathematical beauty is not in the eye of the beholder nor the mathematician. According to Dirac, it is an integral part of determining a good mathematical formula or equation as mentioned above, E=mc2!

In the next part we will let the philosophers define beauty more precisely for us. After that, we can then move on to the beauty of music and art.