The Language God Speaks

Calculus is the language that God talks. This quote is attributed to Richard Feynman in a conversation with Herman Wouk, the author of Winds of War and War and Remembrance, books that tell the story of WWII. Feynman, although an atheist himself, proposed to Wouk that if he did not understand calculus, he could not understand God fully.

For those who did not have the privilege of studying it in high school, calculus is the branch of mathematics that measures change. The physical world is constantly changing, and mathematicians and scientists are discovering that those changes are very orderly and follow predictable mathematical sequences.

Let me give one example: the cadets in our cadet club build cub cars that they race down a track. We know that it is gravity that pulls those cars down the track and they accelerate all the way down the track. The winning car, we all understand, is the one which is the best built and which creates the least friction when it is moving. We know from laws of motion that it doesn't matter how heavy the car is, it will accelerate down the track at a set rate, dependent entirely on the angle of the track. If all the cadets built cars that generated no friction as they ran down the track, they would all finish at exactly the same time regardless of how heavy they were. Again, it is friction that causes the cars to run at different rates, not the weight of the car.

Let's say that the cadets did build a car that generated no friction against the track and which did not succumb to wind resistance. As the car moves down the track, it will accelerate as long as the track is at an incline, for gravity will continue to pull on it. Acceleration is the rate of change of speed, as we well know if we drive a car. Speed is easy to measure because all we have to do is take the distance we travel and divide it by the time we travelled. Thus, if we drive 100 km for one hour, we would say that our speed was 100 km/h. We talk about speed all the time, and it is easy enough to measure.

Acceleration is more difficult to measure because the speed changes. So, if we return to the cub cars on the track, can we predict how far a car will go in a given period of time? It turns out that although the rate of speed varies, the distance it travels at any point in time is predictable. Let me illustrate:

- The track is angled so that the car travels exactly 1 metre in the first second.
- In the second second, it will travel 3 metres. (Those who have built tracks such as these have done the measuring for us.)
- In the third second, it will travel 5 metres.
- In the fourth second it will travel 7 metres.

Here is the amazing thing:

- After 1 second, the car has travelled 1 metre.
- After 2 seconds, the car has travelled 4 metres (1+3) which is 2^2.
- After 3 seconds, it has travelled 9 metres (1+3+5) which is 3^2.

- After 4 seconds, it has travelled 16 metres (1+3+5+7) which is 4^2.

This means that we can predict how far the car will have travelled in 10 seconds.

It will have travelled 100 metres (10^2), for if we add together the first 10 odd numbers (1+3+5+7+9+11+13+15+17+19), we also get 100. Further, without measuring, we can also say that in the 11^{th} second, the car will travel 21 metres, and it will be going at an average speed of 21 m/s for that second which is 75.6 km/h.

If you don't like math, your eyes may be crossing and your brain spinning, so let me just say this: normal, simple math enables us to measure speed, something that is constant, and something that we all use. But if we want to measure the change in speed (acceleration), something that varies, we need calculus. When we engage in this study, we begin to understand that even change is governed by laws of constancy.

So, who wants to measure the rate of change in anything? It turns out that nearly every single modern discovery depends on knowing the rate of change. Our cell phones, computers, animated Disney movies, GPS systems, rifle scopes, satellites, and just about any flying object require calculus (the measure of the rate of change) in their design. We don't have to understand calculus in order to use these inventions, but their existence depends on mathematical field of calculus.

In Psalm 19 the psalmist says that the heavens declare the glory of God, that they reveal to us what kind of God we have. The Belgic Confession says that creation is a book which reveals who God is, illustrating his majesty and power. Neither the one who wrote the psalms, nor the author of the Belgic Confession had studied calculus, and they could not have known that the whole universe follows very defined laws that govern the rate of change so that we, as human beings, can use what is in creation and develop it further to meet our needs.

So, why did Richard Feynman tell Herman Wouk that calculus is the language God speaks? In a world where everything is changing, we might feel that things are out of control. Until the last few centuries, most mathematicians and scientists were somewhat afraid of studying change because it seemed so variable or random. But calculus has taught us that even the changes in this world are governed by the laws that have been set into this universe. To put it another way, God is not only the God of that which is constant and unchanging, he is the God of that which changes. Understanding calculus and being able to use it helps us understand the book of God's creation a lot better, and when we read that book, we know God more, for we can hear him speaking. Thus, not only does God speak in the beauty of a sunset or the power of a volcano; he also speaks to us in the symbols, numbers, and geometric shapes of the field of mathematics known as calculus. The implication of all of this: we need not fear change, for God governs even that.

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