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Gottfried W. Leibnez

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Abstract:

Gottfried W. Leibniz was a philosopher and mathematician who lived in Germany from 1646 to 1716. He first gained a bachelor's degree in philosophy, then later earned one in law. As his life went on, he made many contributions to the mathematical world. From discovering differential and integral calculus to creating the binary system of arithmetic, Leibniz changed today's world. He worked also with physics, dynamics, and attempted to create a calculating machine. While making these discoveries, he had the privilege of working with many different scholars and mathematicians, namely Weigel, Boineburg, and Huygens. With the help and guidance of these professionals, Leibniz was able to soar in his career. Leibniz was also a very religious man, as seen from his Lutheran faith. He was passionate about re-unifying the Christian churches and used his degree in philosophy to share about his faith. Leibniz enjoyed studying logic and reasoning, which directly affected both his beliefs and his mathematical discoveries. He spoke on the problem of evil in this world and still claimed that God is good regardless of the circumstances. The mathematical career of Leibniz and his profession of faith to the world make him a very well-known and influential figure. He changed the way that mathematics was performed and spoke to the beauty of our Creator.

"Everything that is possible demands to exist," proclaimed Gottfried W. Leibniz. Mathematicians make discoveries that shape the next generation. They find new techniques, create more efficient routes to the correct answer, and prove that their ideas work. This epitomizes what Leibniz accomplished in his lifetime. However his life not only increased the mathematical world, it was also dedicated to God. Leibniz gave his entire life to proclaiming the name of Jesus and to creating new mathematics. Taking a deeper look into this man's life, one can see a true genius at work.

Leibniz was born July 1, 1646 in Leipzig, Saxony, which is present day Germany. His parents are Friedrich Leibniz and Catherina Schmuck (1). Leibniz's father died when he was only six years old, so he was primarily raised by his mother. As a religious woman, Leibniz learned his core "moral and religious values" from her, and he was raised Lutheran (1). He began attending Nicolai School when he was seven, and it was here that he began to learn Latin. For the next five years he pushed even further than his assigned curriculum, and taught himself "far more advanced Latin and some Greek" (1). Even though he was very young he was interested in his father's books and reading about philosophy. At just twelve years old, he began to delve into Aristotle's works Leibniz explored the idea of logic and was not completely pleased with Aristotle's findings so he decided to spend time digging deeper (1). Thus, his start on mathematical proof and reasoning began.

At fourteen, Leibniz entered his first university, the University of Leipzig. Interestingly, he studied philosophy and had very little to do with mathematics. In 1663, he graduated with a philosophy degree and headed to Jena to spend the summer term (1). It was here that he met philosopher Erhard Weigel, a professor of mathematics at Jena, and through his influence, Leibniz began to appreciate mathematical proof (1). Leibniz's interest in logic and philosophy

led to earning a second bachelor's degree in law at Jena. Then Leibniz met a man named Baron Johann Christian von Boineburg who employed him to do many different works related to science, literacy, and politics (1). While he was working under Boineburg, a small glimpse of his religious life was revealed. One of his lifelong goals was the "reunification of the Christian Churches" (1). He gave much thought to this idea, especially as to how he could improve division within the Christian faith.

Under Boineburg, Leibniz was able to help improve Roman civil law code and he studied motion, and then he had one of his first encounters with true mathematics. He worked on creating a calculating machine for many years while employed under Boineburg.. All of this work led him to Paris, where he finally began studying mathematics and physics under a man named Christiaan Huygens (1). Very quickly after this happened, Leibniz began studying "the geometry of infinitesimals" which lead him to his first version of calculus (1). Suddenly, Leibniz's mathematical career launched.

Leibniz's first attempt at outlining calculus is described as "clumsy;" it was hard for him to find a good way to present his findings. Eventually, "on November 21, 1675, he used the integral notation for the first time" and along with this came "the product rule for differentiation" (1). While Leibniz was struggling through calculus, Isaac Newton was doing the same. In fact, the two wrote letters back and forth about each other's findings through a man named Oldenburg. The letters took a long time to be received once they were sent which later caused some issues between the two of them. These said issues do not come to the surface until Leibniz publishes his first version of calculus 11 years later.

In 1676, Leibniz moved to Hanover, present day Germany, where he would spend the rest of his life. He took on many different projects during these last years, beginning with his

work as a librarian. One project he worked on was "draining water from the mines in the Harz mountains" and he trained to use "wind power and water power to operate pumps" (1). This worked allowed him to keep using the physics that he learned under Huygens. Even though the Harz mountain project eventually failed, Leibniz made some important discoveries. He was one of the first to study geology, and he claimed that "the Earth was first molten" (1). In 1679, Leibniz perfected his binary system of arithmetic, and in 1701 he published it (1). What is interesting about this discovery is that Leibniz related it to the creation of the universe. He saw that whole numbers can be written in this binary system using two digits, "with the story of the universe was created out of a void (0) by God (1)" (4, p.232). In modern day mathematics, it is unknown what Leibniz intended this binary system to be used for, but it is now used in computers (4, p. 232). No one can deny that Leibniz was creating a legacy.

He continued to shape today's mathematics by discovering determinants, which "arose from his developing methods to solve systems of linear equations" (1). He also worked with his metaphysical system through the 1680s, published his ideas of differential calculus in 1684, and integral calculus in 1686 (5, p.38). His version of differential calculus from 1684 was titled, "A New Method for Maxima and Minima, as well as Tangents, which is impeded neither by Fractional nor Irrational Quantities, and a Remarkable Type of Calculus for Them" (5, p.37). The two versions of calculus presented by Leibniz were monumental in the world of mathematics. His discovery of differential calculus went on to help Descartes in his mathematical career (5, p.68). When working with Huygens, Leibniz discovered concepts behind infinite series, which helped eventually lead him into his discovery of calculus. While working with the ideas of calculus, Leibniz defined all of the following terms, derivative, differentiation, subintervals, integral, and integration. Leibniz created a way to link derivatives to integrals, which eventually

became known as the Fundamental Theorem of Calculus (5, p.152). It is very important to note that during this entire period of the founding of calculus, both Newton and Leibniz were coming to the same conclusions. They worked completely independently of one another, other than a few notes written back and forth, and they discovered the same things. This is encouraging when considering the strength of the findings, but not so encouraging when the two began to dispute. Newton didn't publish his work until 1704, and then began to claim the Leibniz was stealing his work on the subject of calculus. The two never worked out their argument, and Newton gains most of the credit for the discovery of calculus, but that does not lessen the work found and given by Leibniz.

Leibniz didn't stop here though. He used Venn diagrams before they were technically defined in the 17th century (5, p.262). Leibniz did a technique, but would not actually define what that technique was because he was more focused on discovering something deeper. This shows that his mathematical intelligence was very high. He worked with dynamics, both abstract and concrete, towards the end of his mathematical career. In his later years, Leibniz's main focus was to create academies in various countries to help continue the growth of mathematics and physics concepts, and he did this until he died on November 14, 1716 (1).

The contributions Leibniz made to the fields of mathematics and physics helped pave the way for others to come along as discover more involved techniques. Leibniz was more than just another mathematician. He had much to say about the world outside of his academic studies. As noted earlier, Leibniz was Lutheran and had many ideas about reunifying the church. In fact, he actually spoke on the "Problem of Evil" and has a book written about his thoughts called *Leibniz on God and Religion*. Diving into this subject, one can better see how Leibniz's faith drove his mathematical career.

Logic and philosophy were two things that Leibniz enjoyed. He expected things to have both reason and merit. This is important to note when looking at his view on the Christian faith. He did not just believe anything on a whim, but rather had good reason behind his beliefs. Lloyd Strickland wrote a book about Leibniz's ideas about God and religion, and it is called *Leibniz on God and Religion* (3). Strickland "returned to Leibniz's original manuscripts" when writing this book (3). In his attempt to sum up Leibniz's ideas on faith, Strickland separated the book into eleven sections. These chapters show how Leibniz expressed his faith in God over his career. The book starts with a discussion about Catholic beliefs, moves onto the existence and nature of God, and then into reason and faith (3). Chapter three is where one can start to see very clearly that Leibniz's views on the world influenced his mathematical work. He saw reason behind God's creation and this directly translated into his work in his professional career, one example being the binary system of arithmetic. After this chapter, the book gets into ethics, the Bible, miracles, churches, grace, predestination, sin, evil, afterlife, and non-Christian religions (3). Leibniz covered all grounds when he talked about and discussed his beliefs. In fact, when asked about the problem of evil in the world, he gave the answer that there are two types of problems that fuel it, the underachiever problem and the holiness problem (2). His discussion on this topic can open one's eyes to his perspective on the goodness of God.

As noted earlier, Leibniz first gained a degree in philosophy. During his philosophical career, he spent a great deal of time discussing and researching the problem of evil. The overall idea of this discussion is for Leibniz to prove that God is neither an underachiever nor does God have a deficiency in holiness. When first talking about the underachiever problem, Leibniz states that "God does not underachieve in creating the world because this world is the best of all possible worlds" (2). He then continues in explaining how he truly believes that this world is

created to maximize happiness and provide the best life a person can live. The second issue that Leibniz talks about is the holiness problem. This is where he explains that God is not responsible for the evil in this world and that the presence of this evil doesn't imply that God isn't holy. The importance of looking into Leibniz's thoughts and views on God as Creator of the world is that it reflects the way his mathematical career is shaped. Here, we see that in his philosophical career he focused on logic and proof to explain his thoughts. He carries this over into his mathematical career as he proves his findings to make complete logical sense.

Leibniz had strong beliefs that God was very real and very good. He spent his life devoting himself to the plan and will of God. He wanted to fight for unification of churches, and he wanted people to see that the world had order and was under control of God. Leibniz wrote about his thoughts on these matters and also showed through mathematics that there was, in fact, reason and patterns in the world.

As I grow into a mathematician, aspiring to work in the field in my future, I hope to implement my faith in my work. Patterns and reasoning are the areas that I really enjoy about math, and I truly think that they speak to the Lord's beauty and perfection. Mathematics has a way of all fitting together; each piece has a place that it fits. This, to me, is a testimony of how God orchestrates all things together perfectly, without flaw. As I continue to pursue mathematics, I will seek out more ways to see God's beauty in the work that I am doing. My job, as a daughter of God, is to bring His name glory. Mathematics is just one way that I can do this, and I plan to do just that. I hope that when people see the work I do in my future, or even now as a student, they see the Lord's grace and mercy at work.

When I get into my future career, whatever that may be, my only goal is to bring Christ's name glory. Whether that is teaching math in the United States or traveling to share the gospel

while teaching mathematics, I want people to see the Jesus that saved me. Regardless of what my future work may look like, I want to love the people I come in contact with and show them Jesus to the best of my ability. If that's teaching math to high school students then I will spend each day making sure that my students can see the importance of learning and working excellently for the Lord, while doing my best to live a life for Christ in their midst. On the other end of this, I will also strive to make Jesus known in my home life. The way that I live each day, I hope is a representation to those around me of the love that was poured out for me. I hope to wake up each morning and give my day to Christ, surrendering my wants and desires for His best, and I pray this will influence my family. I dream of spending quiet times with my husband, praying for our kid's lives, and looking forward to all God has in store for us. I want my home to be a safe haven and sanctuary that people feel welcomed into, and for people to come in and here the sweet name of Jesus praised. This will take work, and it will be a fight to keep the evil of the world out of the walls of my home, but the fight is worth it. I can only hope that my students, colleagues, friends, and family see Jesus when they see me. Whether I am sharing the gospel, doing mathematics work, or cooking dinner, may Christ's name be glorified over my own.

If I could just serve the world half as much as Leibniz did, I will have made it. He transformed the mathematical community of his day and shaped the mathematics I am using today. He spent his life finding patterns and reason for the way things worked and functioned. On top of all his mathematical contributions, he dedicated his life to the Lord and made sure that people knew his beliefs. He was confident and unashamed. This is what believers are called to be. We are told in 1 John 2:28 to remain in Christ so that when He appears we can be confident and unashamed before Him. From the looks of it, Leibniz lived this kind of life. My goal is to do the same, in my career, my home, and my life.

Sources:

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