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Build Me a Model: The Power of Imagination

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The Question: The Beginning of the Journey

I was first introduced to the concept of gravity in secondary school. I was told that gravity is the natural force that attracts any two objects with mass toward each other—the greater the mass, the stronger the gravitational force. I accepted this as fact. However, I was puzzled that gravity's measurement unit was expressed as acceleration. Earth's gravitational force, for example, was given as 9.81 m/s^2. But if gravity was a force, shouldn't it be expressed as 9.8 $kg{\cdot}m/s^2$? I wondered: Is gravity a force or an acceleration? And if so, what does it mean?

Humanity's Quest to Understand Nature

Since the dawn of humanity, we have tried to understand the world around us, constantly seeking to explain our observations. Why does an apple fall? How do birds fly? How does the universe work? Our first attempts at understanding nature took the form of stories. Australian Aboriginal people spoke of "Dreamtime"—a period when the universe was formed. Christianity and Islam say that the Universe began with a divine “Word”. Every civilization has its own creation story, some simple, others complex.

Human nature compels us to continually improve our understanding of the natural world. We are rarely satisfied with previous explanations, and this evolution of thought is crucial to human progress. It distinguishes us from other animals. Our understanding also evolves with new tools and methods. Mathematics, for instance, allowed humans to describe natural phenomena with precision and elegance.

The ancient Buddhist text called the Avataṃsaka Sūtra mentions "the net of Indra," likely one of the oldest written works using metaphysics to explain the universe. I view metaphysics as the precursor of physics. Indra's net extends in three dimensions, stretching in all directions. No part of the universe exists outside this net. Like any net, strings meet at junction points that hold the structure together. At each junction sits a beautiful jewel, shining like a mirror, reflecting all other jewels in the net—so that one jewel reflects in all, and all jewels reflect in one.

No part of the net can exist independently; all sections are held together by these jewels. A single movement in one place affects even the most distant parts. Therefore, the universe resembles one body, interconnected through an unimaginable array of relationships where nothing happens without affecting everything else. This became the central tenet of early Eastern sciences: all matter across the universe, though appearing separate and independent, forms part of a greater whole—one in everything, and everything in one.

Regardless of this model's accuracy, it demonstrates the imaginative power of early thinkers and their attempts to explain the universe through observation and experience. Their explanations drew not only from observation but also from their value systems, helping guide their life decisions, to lead a virtuous life.

Newton's Revolutionary Model

The concept of gravity has always accompanied humanity. Sir Isaac Newton was able to explain gravity in mathematical detail, making his model useful for predicting gravitational behavior in different scenarios—a key differentiating factor from models of the past. Legend says that Newton wondered why the moon orbits Earth instead of flying away into deep space. One day, observing an apple fall from a tree, he realized that the same force that made the apple fall, keeps the moon in orbit. He called this force gravity and later developed the Universal Laws of Gravity, stating that gravity attracts two objects toward each other.

This raises the question: why is gravity expressed as acceleration in modern textbooks? Force requires a mass to which force is applied—both the moon and Earth have mass. However, acceleration needs no object (it's merely a measurement). How can gravity, a force, be just "acceleration"? How can gravity exist without mass? Enter Albert Einstein.

Einstein's Paradigm Shift

Einstein developed another model to explain gravity: the Laws of General Relativity. He claimed that gravity is not a force—there is no natural attractive force between objects, directly contradicting Newton's model.

Einstein also claimed that the observable universe comprises four dimensions, not three: the normal three perpendicular axes of space, plus a fourth dimension—time. He called this "space-time." He proposed that space-time bends when mass is placed within it. The moon doesn't fall toward Earth due to attraction but "appears" to fall because space bends, bringing the moon closer to Earth. Imagine two balls fixed on opposite sides of a straw: when the straw bends, the balls move toward each other—not because they're moving, but because the straw holding them is bending.

When first proposed, this model to explain gravity seemed ludicrous. Einstein needed proof. He could demonstrate his hypothesis by showing that light bends when passing close to large objects. Since light has no mass, if light bends, this cannot be the result of an attractive force but from space-time curvature. The sun, our solar system's largest object, provided an ideal test case.

The opportunity arose during a total solar eclipse. An eclipse was necessary to darken the sky, allowing observers to see stars normally invisible during daylight. Astronomer Arthur Eddington observed a star shifted its position, i.e. it did not appear where it should have—possible if that star's light bent near the sun to reach Earth. The pursuing calculations proved Einstein’s model for gravity to be correct, and this more accurate explanation of gravity was adopted.

Does this mean Newton's model is obsolete? Not at all. Many scientists still use Newton's model for space exploration because its predictive ability remains excellent and it is easier to apply. However, it fails when extremely accurate predictions are needed—for instance, with extremely distant objects. However, Einstein's model also has limitations: it doesn't work in places of extreme gravity like black holes, or with subatomic particles, which require other models such as the quantum theory.

The Power of Models in Understanding

Building models and using them as frameworks to understand nature is vital to humanity's quest for deeper understanding. These models help us predict how things work. For example, Einstein's model connects space and time, allowing us to deduce that gravity would not only bend space, but also time. Therefore, we can hypothesize that gravity slows time—a concept called time dilation, already proven through experimentation. Conversely, since time and space are connected, we can predict that time also slows when we move through space. The faster we move, the more time slows for us compared to stationary observers (the Theory of Special Relativity).

Now I can finally answer my teenage question: Is gravity a force or an acceleration? The answer is both—it depends on which model we use. How is this “acceleration” useful? One usage is in space travel. If a spaceship constantly accelerates at 9.81 m/s^2, the passengers in the ship will experience gravitational force similar to that of the Earth. There are many other usages, both known and not yet known, which would one day be unlocked by the imagination of future imaginative minds.

The Educational Connection: Imagination as the Key

How does this relate to education? It highlights a crucial element in learning and understanding: imagination. Can any of us think about the Universe the way Newton or Einstein did? Or like the ancient thinkers who wrote the Avataṃsaka Sūtra? These were visionaries with vivid imaginations.

Children are naturally born with vivid imagination. As we grow older, we often lose this ability to conformity. Imagination is driven by curiosity—the need to ask questions and understand the world around us. A child's ability to question and explore is integral to growth and the journey toward fulfilling their full potential.

Writers like Agatha Christie or Rumi possessed amazing imagination. My late brother and mentor used to say that Tolkien, author of "The Lord of the Rings" trilogy, described Middle-earth so lucidly that readers felt like observers within the story. Ibn Arabi, a Muslim philosopher said that all of creation began as an imagination in God's mind.

Imagination helps us understand both ourselves and the Universe. Education should recognize each child's level and type of imagination, developing it in whatever form it takes. The next time you notice a child "daydreaming"—discuss the content of their day-dream or just leave them alone! Let them imagine without fear but with respect. Let them imagine to understand and create whosoever good they may imagine. Einstein once said, "Imagination is greater than Knowledge". Knowledge has bounds but imagination is boundless. In these times of immense uncertainty, imagination shall take us home. Imagination determines where we begin and will determine where we choose to end.

References

"Be! And it is" (كن فيكون) Surah Ya-Sin (36:82), The Quran.

Chittick, W. C. (1994). *Imaginal Worlds: Ibn al-ʿArabī and the Problem of Religious Diversity*. State University of New York Press. https://doi.org/10.2307/jj.18255420

In the beginning was the Word, and the Word was with God, and the Word was God... John 1:1-5 The Bible, King James Version (KJV).

Indra's net. In *Wikipedia*. Retrieved August 2025 from, https://en.wikipedia.org/wiki/Indra%27s_net

Matthew Stanley. 2019. *The man who made Einstein world-famous*. BBC News. Retrieved August 2025 from, https://www.bbc.com/news/science-environment-48369980

Special relativity. In *Wikipedia*. Retrieved August 2025 from, https://en.wikipedia.org/wiki/Special_relativity

The Editors of Encyclopaedia Britannica. (n.d.). *The Dreaming*. In *Encyclopædia Britannica*. Retrieved August 2025 from, https://www.britannica.com/topic/the-Dreaming-Australian-Aboriginal-mythology

The Physics Classroom. (n.d.). *The apple, the moon, and the inverse square law*. In *Physics Tutorial: Circular motion and satellite motion*. Retrieved August 2025 from, https://www.physicsclassroom.com/class/circles/Lesson-3/The-Apple,-the-Moon,-and-the-Inverse-Square-Law