When we look at our knowledge of the physical world, we see that humanity has made remarkable steps, especially in the last few thousand years. For example, according to a bronze-age scientist, the answer to how the universe started or walked was probably the work of the various gods.

Today, we have much more information. Science is not only perfect in explaining how the universe was formed; it also provides a very clear indication of how it might end. On the other hand, it allows us to take great steps in understanding how the world around us works. Scientists always provide learning more of everything from the interactions of the greatest masses that cannot be imagined, such as stars or galaxies, to the movements of small subatomic particles.

There was a transition from mythology to the science in search of our world.

Curiosity is one of the defining characteristics of human beings. As long as we're around, we're discussing big questions: Why are we here? Are we alone in the universe? Is there a creator?

These questions are thousands of years old but using scientific methods to get answers is a relatively new approach.

In the ancient times, gods were a good method to explain the world’s natural phenomena. There were many gods such as gods of rain, sun, even earthquake, and volcano gods.

This belief allowed us to turn to the appropriate gods when we needed good weather. We believed that when drought or natural disasters hurt us, we did not satisfy with the gods that cause them.

Ancient Greek philosophers such as Aristotle, Archimedes and Thales must carry us beyond this mythological thought. These Greek thinkers devoted themselves to thinking about the great questions of life and the universe and began to find ways to understand the world beyond divine intervention.

Although Archimedes is not considered as a proper scientist today, he has a really important place in the scientific world because of his experiments, careful observations, measurements, and results. This also proves how revolutionary principles like the law of the lever, which means small forces can be used to lift heavy objects, were found.

At the beginning of the modern times, such ideas continued to be studied and thus emerged with the name is known today as the scientific method. That represents a strict system including a hypothesis, tests with experiments, measurements, and observations.

Galileo, Johannes Kepler, and Rene Descartes who were scholars were an early supporter of the scientific method in the sixteenth and seventeenth centuries. The laws of gravity and motion

were formulated by Isaac Newton thanks to this system and we started to understand the movements of planets and stars.

Finally, scientists use the scientific method to explain how the whole of the physical world works.

Thus, the belief that every event in nature or even human decisions can be scientifically explained came to exist; namely, scientific determinism.

Free will or scientific determinism: A debate related to human-being for the scientists

You might be thinking, ‘’If my decisions can be explained scientifically, isn’t that against the idea of free will?’’

Indeed, many people accept the scientific determinism’s rules likewise its application of nature but there is a trickier situation for human nature.

As a result, the concept of free will and the existence of this have long been debated by scholars.

In the defense of free will, Rene Descartes refused to accept a simple explanation of the laws of nature that show us like robots following a predetermined program.

According to Descartes, there was a clear distinction between the human body and the human soul. While the human body could be explained by scientific law, it wasn’t applicable to the soul.

The source of a person’s free will was the soul as suggested by Descartes and he even found a place for the soul: The pineal gland, which resides in the center of the brain.

While there are many questions that lead to the conflict between free will and scientific determinism, Descartes reveals a challenging case.

Firstly, if humans have free will, do all mammals? If so, when did this trait appear in our evolution?

Is free will a trait of multicelled organisms, or is it also in bacteria? Where do we draw the line between living beings that are subject to scientific law and those who are apparently of magical quality?

The simple truth is, there is no line. We can comfort us by thinking that we are free to choose everything in our lives. Also, we can explain all of these thoughts and decisions by using physical and chemical laws.

Recent developments in neuroscience have clarified the scientific laws behind our actions.

Scientists nowadays know to make people speak or move certain parts of their body by stimulating their certain part of the brain. Therefore, any choice we make can be associated with biological mechanics similar to other organisms in our environment.

No reality can be independent of the observer.

What do you think a goldfish see if it lives in a fishbowl in your living room?

This was actually a concern in the city of Monza, Italy. The city council decided that the fish in the curved aquarium were forced to live in a cruel distorted reality because it distorted the vision of them, so curved fishbowls were banned.

But to make this true, we must first believe that our reality is not distorted in any way or that we have a certain reality that needs attention.

The truth is that we are very suspicious of seeing everything in its own way.

Or, in other words, there is no reality other than an individual experience.

Shortly, our senses send information to our brain and we make a mental picture, that is ‘’reality’’ as we called.

Recognizing the image of a tree comes from the capture of the light of your eye's retina by the light emitted by the tree-like object, and your brain used it to create the mental image of a tree.

We believe what we see is reality because the same senses are used to create the scientific laws which are accepted as accurate. Your reality becomes the correct one as your vision stick to these laws.

Therefore, the reality of goldfish in a curved fishbowl could be equally accurate and correct.

Imagine that the goldfish carried out experiments on this fishbowl and created a set of laws about the principles of governance in the world. However, the curved fishbowl provided observation of objects in a curved line instead of a straight line so this world would be a functioning version of reality and the result would be different than our world, not surprisingly.

As a result, the reality you experience will be as valid as that of other living organisms.

There are potentialities that create scientific laws that accurately reflect their relative experience, despite their different perspectives on everything.

There are some necessities for a good model of reality: Elegance, consistency, authenticity, and predicting the future.

Everything is relative and it shouldn't be forgotten but this does not mean that we accept any old theory or scientific model.

There are four criteria that every good model of reality should adhere to.

Firstly, let's consider that it should be elegant.

We can admit that elegance is quite subjective. However, according to most experts, an elegant model can make an incredibly complex subject extremely simple in the world of science. For instance, the famous formula of Einstein, $E=MC^2$, represents scientific elegance.

Here is Einstein's advice for scientists while striving for a theory: ''As simple as possible, but not simpler.''

The second criterion is that a good theory shouldn't come from too many adjustable or random factors.

If a theory needs too many extra elements to work, it is a sign of misdoing.

For instance, the first astronomers believed that everything had turned into perfect circles all over the Earth. However, it did not take long for their observations to contradict this theory, so there was a need to add new factors to keep this theory alive.

Ptolemy, the Roman mathematician and astronomer, proved the fault of that original theory by suggesting that the planets should move in smaller individual circles around the Earth, which would explain by the observations.

Thirdly, a good model should be able to explain every existing observation.

Newton suggested the theory of light which means that particles or as he called as corpuscles shape the light. Thanks to his theory, movement of the light in a straight line and refraction of it in water were explained.

However, Newton's theory was not an acceptable scientific law because he could not explain one specific observation that is why the light generated a concentric ring pattern when reflected between the two surfaces.

Fourthly and finally, every good theory has to make a contribution to future observations and predictions.

Nature is defined in a subatomic scale and we gain a different understanding of the world through quantum theory.

So far, what we see and observe with the naked eye in our environment is all normal and explainable. However, if human-being is able to see everything around at the sub-atomic level, where quantum theory rules, we couldn't talk about normality here.

The uncertainty principle is one of the most important tenets of quantum physics and the German physicist Werner Heisenberg suggested it in 1926.

He believed that there was no way to measure simultaneously the position and velocity of a particle with any precision.

When a particle's speed is decreased to zero, we lose the ability to measure its position and vice versa. It is impossible to predict where a particle is and where it will be in the future with an infinite number of possibilities.

The best thing you can do is to measure the likelihood of various locations where a particle is.

According to another key principle of quantum theory, while we make an observation, we are affecting what we observe and that means observation couldn't be done passively.

For example, we're opening a refrigerator to see its inside; as a result, the temperature of the contents changes and photons come into the food and drinks.

Although it doesn't do much to light up something as big as an apple, attracting photon or light's particles greatly affect the movement and direction of other small particles.

As you can see, the distortion that can be caused by simple light makes it very difficult to experiment at the quantum level.

Einstein caused a great change in our understanding of time and space.

Albert Einstein was only 26 years old in 1905 when he turned to physics.

He proved a theory of special relativity which means we have different ways while experiencing time and that is relative.

Imagine you're in the cockpit of an airplane moving at almost the speed of light to understand how this is possible. And while flying, there's a beam of light bouncing down the plane.

The light always moves up and down from your perspective. However, the light will travel along a different path that moves at a forward angle with each bounce for a person standing on the ground and watching the plane zooming in.

Sounds logical, doesn't it? But here's where things get tricky: The speed of light is the same for everyone. That comes from the formula, speed = distance/time. I mean, you travel at 10mph or 10,000mph, the light will always travel at 186000 miles per second. In this scenario, while the

speed of light is the same for both you and observer on the ground, your perception of the distance will be different and that means time perception must be different as well.

Simply, the faster you travel, time becomes slower for you in compared to someone standing still.

On the other hand, Einstein's Theory of General Relativity also explained how gravity works.

For this reason, he put forward the theory that explained our dimension as a combination of space and time so he called it as space-time.

You can think of space-time as the surface of the billiard table; if the gravity had not been, the table would be straight and everything would move freely. Gravity, however, is like a weight in the center of the table, causing the objects to be bent towards it and travel around the center.

So, the gravity of a big star like the sun can attract enough planets in the orbit around the solar system.

Although M-theory might be a great candidate for a unified theory of everything, physicists continue arguing.

Today, there are lots of theories to explain different things' working mechanism such as gravity and quantum particles work. However, these separate theories are not always compatible. As an example, quantum theory and general relativity don't exactly play well together.

This is what physicists have been engaged in for generations is a Great Unified Theory (GUT) that connects three of the four basic forces of nature: Weak nuclear force, strong nuclear force, and electromagnetism. And finally, the fourth one is gravity.

The works of formulating a GUT did not succeed despite all efforts because experiments continue to disprove the theories.

For instance, in the 1970s, a GUT had attempted to predict the decrease of protons by an average of 10^{32} years. However, recent experiments proved that the correct ratio is more than 10^{34} years.

However, since the M-theory can be a long-sought answer to a unifying theory, not all are lost.

The M-theory is a collection of multiple theories that work together to create a larger and more complete picture so it differs from traditional attempts by not having a single theory.

M-Theory provides details of local areas with individual maps, and when they all come together, you can capture everything. In this respect, its work is a bit like Atlas.

M-Theory suggests the likelihood of multiple universes that is the most interesting aspect of it.

In fact, it reveals the existence of a number of other universes, and as we will see in the next chapter, it was a pure chance that our universe was suitable for life.

As the universe continues to expand, we are lucky to be here.

Our existence in the universe and the existence of the universe itself are always a cautious issue. Over the centuries, two ideas dominated the question of how the universe came into being: It always existed and it was the work of God.

Modern science had the tools to explain the beginning and expanding of the universe for only recent years, while it obeyed the laws of nature.

American astronomer Edwin Hubble discovered in 1929 that almost all galaxies moved away from the Earth in a single direction. He also stated that their speed increases gradually as they go away.

There was a clear result: The universe is expanding. That means it's smaller before.

In fact, according to the scientists, the situation of the universe before the explosion that set the universe in motion, the Big Bang, is similar to that scientists were able to rewind the expansion to the point when all matter and energy were intensely concentrated in a small area at extreme temperature.

As a result of the Big Bang, luckily, Earth became a form which is suitable for life.

Today, our planet is located in the habitable region. It is located at a distance from the sun and not damaged by destructive meteorites.

Thanks to the fact that we are not too far or too close to the sun, the water that forms the surface of the planet has not boiled, nor remained cold as ice. Nevertheless, many people from many different religions believe that our lucky position is not a matter of chance, but a design cleverly designed by God.

However, if we have a belief about God as a creator of the universe, this directs us more questions, including one basic, who or what created God.

According to most astronomers, physicists and those who follow the scientific method, we were not shaped by divine hand. Many factors came together and made us lucky and fortunate Earthlings.

The Grand Design by Stephen Hawking, Leonard Mlodinow Book Review

For thousands of years, people believed in the whims of the gods to explain physical formations. But it was finally understood that the universe was governed by physical laws and could be understood accordingly. While physical laws showed us how the universe behaves, it proved that people could discover these laws by developing and applying scientific methods.

https://goodbooksummary.com/the-grand-design-by-stephen-hawking-book-summary/