EVOLUTION
GRAVITATION
SURVIVAL
OF THE FITTEST?
LIFI INTERNET:
100 TIMES FASTER
THAN WI-FI
A BRIEF HISTORY
OF YOUTUBE
Hi Friends,

Happy New Year! Hope you welcomed this year with a lot of freshness and positivity.

Towards the end of last year, we thought of giving you something fresh, something new that helps you in your quest for knowledge. And it’s time to introduce Byju’s Tweenz – a monthly magazine inspiring you to think and learn.

The mission was ambitious and time a leisure. But, the passion and dedication of our team, as well as the open-mindedness of our advisors and administrators, made sure that we bring it out in time. We have such a strong and special community, and Byju’s Tweenz is reflective of that.

The highlights of the inaugural issue include a new perspective to evolution, a few questions on whether evolution has made us perfect, the journey of numbers, how Pluto led us to exciting discoveries and a lot more. We are very proud of this first magazine, and hope you find it entertaining, interesting and all the more, a tool in your pursuit of learning.

I wish our young readers all success, and through training and hard work, achieve what you aspire to. As the academic year is coming to a close, I wish you all the best for the upcoming assessments.

Keep reading and questioning.

Byju Raveendran
Let’s start with the basics, what makes you human? The breath you take in? This constant art of making love to the universe, breathing in and out, involuntarily, forever, from the first moment you ever gulped in air to your last sigh. But we aren’t the only ones that breathe and hence, that’s ruled out. So, maybe it’s our unique ability to wax poetry in one breath, and switch to solve mathematics in the next? Do you think this is a quality all living beings share? Definitely not, we, the human race did not claw our way to the top of the food chain merely with the help of luck. We obeyed and understood the laws of evolution. We evolved.

It’s time you were introduced to the renowned laws of evolution. But before, I’m going to teach you a game. How many of us are familiar with hide-and-seek? Most, I hope. It’s simple really, you are either the prey or the predator, the prey hides and the predator seeks. Now, we tweak this game. We play in the shadows of the night, call it the dark room. The rules remain the same; the prey hides in the safety of the dark shadows in the night and the predator seeks.

Consider this: a group of seven decides to play. One takes the role of the predator, he’s blindfolded and the rest hide. Now let’s draw the parallels. Who would you assume of the six to have the advantage? Would it be the one who finds the best hiding spot? Wrong. See, this right here is the biggest misconception about evolution. Most believe that evolution points to the survival of the fittest. That’s not always true. In this game, one of the six might be in the best hiding spot, but if the predator finds you, then you’re out of the game. Alternatively, you might be in the weakest spot, but when you see the predator approaching, if you quietly shift to another spot, you survive. Evolution is a lot similar. You see one could be among the strongest species, but if you’re unable to adapt to change, you won’t last.

Let’s discuss another aspect in the game. The fatter you are, the more difficult it is to squeeze yourself into a better hiding spot during the game. Hence, the thinner one generally has an advantage. This is the evolutionary advantage. When you look up, you notice that different birds have different features. This very observation is what took Charles Darwin on the road to understand evolution. He observed the different shapes and sizes of beaks sported by finches. It was an important clue to Darwin that species were able to change their traits over time. Darwin, in the beginning of his journey, wondered unlike most of us would - why are the beaks of different birds different? This helped him unravel the drama of evolution. Descent with modification is what Darwin sells as the theory of evolution.
That's not always true. In this game, points to the survival of the fittest. Who would you assume of the six to rest hide. Now let’s draw the parallels. The predator, he’s blindfolded and the night and the predator seeks. In the safety of the dark shadows in the rules remain the same: the prey hides. Now, we tweak this simple really, you are either the prey or the predator. How many of us are familiar with the theory of evolution. But evolved. With the help of luck. We obeyed and to the top of the food chain merely living beings share? Definitely not, we, next? Do you think this is a quality all could be among the strongest species, shift to another spot, you survive. Evolution is a lot similar. You see one of the six might be in the best hiding spot, but if the predator finds one of the six to be in the best hiding spot, but if the predator finds. Let’s start with the basics, what makes a species - the ability to ponder and hence, that’s ruled involuntary, forever, from the first last sigh. But we aren’t the only ones in the universe likes us better than our ancestors and let us reside in this beautiful planet longer? No, none of these seem plausible. Therefore, we bring in the concept of evolution that states that we have evolved enough to adapt to our surroundings and hence secure a longer lifetime. But can you see how we’ve interfered? Evolution would have been a natural aid to population control. But times have changed, not only have we evolved from an ape but also understood the power in science and technology. The grand victories against infectious and parasitic diseases are a triumph of the 20th century, which immunized millions of people against smallpox, polio, and major childhood killers like measles. Even earlier, better living standards, especially more nutritious diets and cleaner drinking water, began to reduce serious infections and prevent deaths among children. Deaths, that would have taken place if we hadn’t interfered. Cancer, the very word sends a chill down the spine. The cancer patients we save, transfer what evolution would consider a weak gene down the hereditary ladder. Now think upon that, do you consider that a good idea? That gene will travel across generations and increase the possibility of getting cancer. Evolution would have taken care of that issue. Nevertheless, we are an emotionally attached race. Hence, they will live and they will reproduce and we, the beautifully intelligent species that we are, will always find ways to keep us all alive.

Of course, there are more questions raised. Consider this, evolution talks about a genetic change from species to species. If we keep tracing back until a common ancestor, we may find the one, the father from whom we all originated. But then again, this raises another agonizing question - where did that father come from? Did a non-living thing discover the art of giving life? So you see, evolution is not something that can be defined or taught in a 700 word article. It is something that the great minds of the world are still studying. They say, the love of knowledge is kind of a madness. It’s time you enrolled into this madness.

Did You Enjoy the Stew?
Nasrudin was invited to the royal palace for dinner one night. During the meal, the King asked Nasrudin if he enjoyed the stew.
“Yes,” replied Nasrudin, “it was fantastic.”
“Really?” said the King. “I thought it was pretty bad.”
“Yes,” said Nasrudin, “you’re right—it was quite awful.”
“Wait a minute,” remarked the King. “You just said it was fantastic a few seconds ago.”
“That’s correct,” explained Nasrudin, “but I live in and serve the town of the King, not the stew.”

Walnuts and Watermelons
As Nasrudin rested under a tall walnut tree one day, he looked a few yards to his side and noticed a big watermelon growing on a thin vine near the ground.
Nasrudin looked up and said, “Great God, please permit me to ask you this: why is it that walnuts grow on big strong trees, while watermelons grow on thin weak vines. Shouldn’t it be the other way around?”
But at that very moment, a walnut fell from high on up in the tree and hit Nasrudin square on the head.
“Ahh!” remarked Nasrudin. “I suppose Nature’s ways might not be as backward as I thought. After all, if a big watermelon fell out of the tree and onto my head, it might have killed me!”

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TECHNOLOGY

PAPER THIN FLEXIBLE TELEVISION

There are a lot of reasons OLED displays are revered by video experts as the superior display technology over LEDs, and even plasmas. But one of the most intriguing design traits of OLED tech is the ability to create ultra-thin, malleable displays.

Short for organic light-emitting diode, one of the main ways OLED displays differ from LED-lit LCD displays is that they don’t need a backlight to brighten up your living room. Simply applying electrical current lights up each OLED pixel individually, which not only allows the displays to offer unparalleled black levels, rich colors, and vivid contrast, but also allows OLED displays to be remarkably thin; LG’s EC9700 4K OLED TV, for instance, is about as thick as an iPad.

The design gets even thinner when you remove the brains of the TV from the equation, as LG Display has done with its fascinating wallpaper display prototype. Dubbed a “future display” by the company, the panel is a remarkable .97mm thick, and weighs just over 4 pounds (1.9 kg) allowing it to be placed virtually anywhere with ease.

According to LG, their new organic light-emitting diode (OLED) displays are not only flexible enough to curve around the walls and corners of your home or office, they’re virtually impossible to break, and are thinner and lighter than any LCD screen currently on the market.

The thin screens has made OLED a desirable choice not only for televisions, but for a wide range of wearables and other mobile products. The South Korean company also revealed two smaller iterations - one version that’s entirely transparent, and another that can be rolled up like a newspaper to a radius of just 3 centimetres.

HOW THE TV IS MOUNTED TO WALL

• Thanks to a magnetic mat that sits behind, the TV can be stuck to a wall.
• To remove the display from the wall, you peel the screen off the mat.
• LG Display used high molecular substance-based polyimide film as the backplane of the flexible panel instead of conventional plastic to achieve the maximum curvature radius.
• The polyimide film also helps reduce the thickness of the panel to significantly improve its flexibility.
• As for the transparent OLED panel, it boasts 30 percent transmittance, which was achieved by adopting transparent pixel design technology.

WHAT DOES OLED STAND FOR?

• OLED stands for organic light-emitting diode.
• Its panels are made from organic materials that emit light when electricity is applied to them.
• As a result, OLED panels don’t use a backlight meaning they are thinner than LCD displays.
• OLEDs additionally have bright colours, brilliant contrasts and a wide-viewing angle.
• LG’s 65-inch, 4K OLED TV, for instance, costs $9,000 (£5,800).
Bacteria vs. Virus

Bacteria are single-celled, prokaryotic microorganisms that exist in abundance in both living hosts and in all areas of the planet (e.g., soil, water). By their nature, they can be either "good" (beneficial) or "bad" (harmful) for the health of plants, humans, and other animals that come into contact with them.

A virus is acellular (has no cell structure) and requires a living host to survive; it causes illness in its host, which causes an immune response. Bacteria are alive, while scientists are not yet sure if viruses are living or nonliving; in general, they are considered to be nonliving.

Infections caused by harmful bacteria can almost always be cured with antibiotics. While some viruses can be vaccinated against, most, such as HIV and the viruses which cause the common cold, are incurable, even if their symptoms can be treated, meaning the living host must have a strong enough immune system to survive the infection.

### Comparison chart

<table>
<thead>
<tr>
<th></th>
<th>Bacteria</th>
<th>Virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribosomes</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Cell wall</td>
<td>Peptidoglycan / Lipopolysaccharide</td>
<td>No cell wall. Protein coat present instead.</td>
</tr>
<tr>
<td>Living attributes</td>
<td>Living organism</td>
<td>Opinions differ on whether viruses are a form of life or organic structures that interact with living organisms.</td>
</tr>
<tr>
<td>Introduction (from Wikipedia)</td>
<td>Bacteria constitute a large domain of prokaryotic microorganisms. Typically a few micrometres in length, bacteria have a number of shapes, ranging from spheres to rods and spirals.</td>
<td>A virus is a small infectious agent that replicates only inside the living cells of other organisms.</td>
</tr>
<tr>
<td>Structures</td>
<td>DNA and RNA floating freely in cytoplasm. Has cell wall and cell membrane.</td>
<td>DNA or RNA enclosed inside a coat of protein.</td>
</tr>
<tr>
<td>Treatment</td>
<td>Antibiotics</td>
<td>Vaccines prevent the spread and antiviral medications help to slow reproduction but can not stop it completely.</td>
</tr>
<tr>
<td>Enzymes</td>
<td>Yes</td>
<td>Yes, in some</td>
</tr>
<tr>
<td>Virulence</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Infection</td>
<td>Localized</td>
<td>Systemic</td>
</tr>
<tr>
<td>Benefits</td>
<td>Some bacteria are beneficial (e.g. certain bacteria are required in the gut)</td>
<td>Viruses are not beneficial. However, a particular virus may be able to destroy brain tumors. Viruses can be useful in genetic engineering.</td>
</tr>
<tr>
<td>Reproduction</td>
<td>Fission- a form of asexual reproduction</td>
<td>Invades a host cell and takes over the cell causing it to make copies of the viral DNA/RNA. Destroys the host cell releasing new viruses.</td>
</tr>
<tr>
<td>Size</td>
<td>Larger (1000nm)</td>
<td>Smaller (20 - 400nm)</td>
</tr>
</tbody>
</table>
Since early ages, human beings were fascinated by the things around them, things in the sky, the sky itself, natural phenomena like earthquakes, volcanoes, winds, fire etc. Although we couldn’t make sense of most of them, still we knew that the nature is not random. For example, everything always goes in the downward direction when we set them free, sun and the stars always go from east to west, showing up again after a fixed interval of time.

That shows that we are governed by some laws. And that is what we do in physics; we try to find those laws.

Physics is the study of nature, its phenomenon and its laws. We try to build a model on how different things work based on the underlying laws that govern it.

Aristotle, a 4th century BC Greek philosopher was one of the first in the written history, who tried to explain things happening in the surrounding. He thought that there are two laws of the universe:

1) Earthly laws that govern earthly motion like falling of a stone.
2) Heavenly laws that govern the motion of stars.

Greeks at that time were fascinated by the night sky. They started collecting data about the position of stars every day.

Eclipses were extraordinary events; it felt like suspension to the laws of the heavens. But from the data they found that eclipses also repeat themselves in some pattern. Ptolemy, another Greek philosopher was able to predict eclipses with great precision.

100 years later, Johannes Kepler working on the astronomical data of Tycho Brahe, gave three laws of planetary motion that explained how planets revolve around the sun.

Kepler’s first law says that all the planets revolve around the sun in an elliptical orbit with Sun at one of the foci.

\[ \frac{dA}{dt} = \text{constant} \]

Kepler’s second law says planets while revolving around the sun sweep equal area in equal time.

At that time, apart from Indian and Chinese civilization, the entire world believed in geocentric model, that is earth is at the center of the universe and everything we see in the sky revolves around us.

But the geocentric model had a few problems. As it turned out there are two types of things in the sky. Ones that twinkle, they clearly seem to revolve around us. We called them stars. Another one that do not twinkle, they do not seem to follow a clear pattern around us. We called them wanderers or planets.

Copernicus in 15th century AD rectified the problem of retrograde motion of planets by giving us heliocentric theory, in which sun is at the center and all the planets including our earth revolve around it. He showed that planets do not follow a clear circular pattern in the sky as they are not revolving around us but the Sun.

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Kepler’s second law says planets while revolving around the sun sweep equal area in equal time.
This essentially means that the planets do not circle the Sun with same speed as they are revolving in an elliptical orbit.

Kepler’s third law compares the period of revolution and radius of the orbit of a planet to those of other planets. And it says,

$$\frac{T^2}{R^3} = \text{constant}$$

Where, $T$ is the time period of revolution of a planet and $R$ being mean radius of its elliptical orbit.

It says, Time period is proportional to Mean radius raised to the power $3/2$.

Or, $T^2 \propto R^3$

Next comes Galileo, a 17th century physicist who gave us three basic points, which is a common knowledge now but wasn’t known before his time.

All things fall at the same rate irrespective of their mass.

Free fall is not a constant velocity motion but an accelerated motion. Anything near earth falls at the rate of $9.8 \text{ m/s}^2$ or $32 \text{ ft/s}^2$.

Velocity of a body doesn’t change until unless you apply a force.

Isaac Newton, an English Physicist and Mathematician had all these knowledge at his disposal. That is why he said “If I have seen further, it is by standing on the shoulders of giants.”

We all know the apple story. But he did not ask the question “Why does apple fall?” It was known that earth pulls everything towards it.

Rather he asked the question, “If apple falls, does the moon also fall?”

Answer turned out to be “yes” and he found that same force responsible for falling of the apple and falling of the moon. At that time he had already found laws of the motion and using Kepler’s 3rd law he found out the force is inversely proportional to the square of distance between bodies.

He finally assembled all the information into one single law known as Newton’s Universal Law of Gravitation. It says every object having mass attracts every other object having mass with a force called gravitational force and,

**Force of gravity**

\[
\alpha = \frac{\text{mass of object 1} \times \text{mass of object 2}}{\text{distance form centers}^2}
\]

Newton’s major accomplishment was to say that everything attracts every other thing and that needs courage because there are million ways to prove him wrong, if it turned out to be a wrong theory.

Albert Einstein, in 1915 published a paper on General Theory of Relativity modifying the newton’s universal law of gravitation. In this theory, gravity is not a force but the attraction between bodies as a consequence of the curvature of space-time. A massive body creates a curve in the space-time hence the straight lined inertial trajectory becomes curved. And planets/moons revolve around that curved path.

However, there are some cases where even general relativity cannot quite give us meaningful results. Specifically, there are cases where general relativity is incompatible with the understanding of quantum physics, places where things are massive as well as very small like center of a black hole or at the time of big bang.

What is needed, however, is a comprehensive theory of gravity that can fully incorporate quantum physics. Physicists have many candidates for such a theory, the most popular of which is string theory, but none of them yield sufficient experimental evidence.

In addition to the need for a quantum theory of gravity, there are two experimentally driven mysteries related to gravity that still need to be resolved. Scientists have found that for our current understanding of gravity to apply to the universe, there must be an unseen attractive force (called dark matter) that helps hold galaxies together and an unseen repulsive force (called dark energy) that pushes distant galaxies apart at faster rates.

So we still don’t have a complete theory of gravity. Some new ideas are needed.

- Pallav Raj
CUPCAKE FLOWER LIGHTS

These lights were inspired by all the beautiful blooms I’ve been seeing around town. I wanted to bring them indoors, but they could make for some colourful outdoor lighting too. Making these floral garlands couldn’t be faster.

Materials you will need:
Cupcake papers (large and small), string lights, scissors, and an exacto knife.

1. To make leaves – fold a small cupcake paper in half 2 times, and with the folded point at the bottom cut a leaf shape.

2. To make an 8-petal flower – fold a small cupcake paper in half 3 times, and with the folded point at the bottom cut around the top.

3. To make a 16-petal flower – fold a large cupcake paper in half 4 times, and with the folded point at the bottom cut around the top.

4. Cut a small X in the center of each paper.

5. Layer cupcake papers onto each lightbulb to make flowers.
You might have heard about Pluto, our family member from the solar system that spends its days gloomily going around the sun beyond Neptune, occasionally coming a little closer. It is so far and so tiny that we cannot see it properly with our best telescopes. Yet it has captured our imagination throughout history and no other astronomical object has ever stirred so much controversy. There were even protests in support of Pluto. There is even a verb named after it. But more on that later.

In 2014, Pluto’s enigmatic life was over; it had spilled its beans. For long we did not know what Pluto looked like or what it was made of. In 2014, the space probe New Horizons took pictures and measurements of Pluto and its moons, thus changing our perception of the planet. We no longer think it is a dead, icy and cold object. Let us take a brief diversion to look into its history and why asking questions is a part of it.

Science is not just a tool to describe the world around us. Why? Because it serves a more important purpose: prediction. The laws we study in science are laws because they have to be obeyed no matter what, no matter where. If you try, you might recall one important contribution by Newton: The universal law of gravitation. Using this law and Kepler’s laws we can predict the motion of planets around the sun. In 1846, Neptune was discovered after predicting its existence due to the differences in the predicted and actual orbit of Uranus. But this discovery did not seem to account for the problem. You see, when planets come close to each other their mutual gravity pulls and tugs them, changing their orbits from the normal path. This meant that there was some other planet waiting to be discovered beyond Neptune. After years of searching, Pluto was discovered in 1930 by Clyde Tombaugh.

So, we found the solution to our problem? Not quite. Turns out that Pluto is too small to affect the orbit of Uranus. In 1989, Voyager 2 space probe did a flyby of Neptune and its measurements revealed its actual mass. Plugging this mass into the equations revealed that the differences in Uranus orbit can be accounted by Neptune only. So here’s a lesson from this exercise, you not only need laws to make predictions but you need the right numbers which you can only get by making good measurements. That also makes Pluto’s discovery an accident! Oops.

Don’t worry, all that effort did not go to waste. We found a new planet after all! All because someone asked why Uranus’s orbit was not as it should be. The quest for an answer took us though a journey of discovery and exploration that has led us to open our minds and look.

After Pluto was found, we found that it had a large moon: Charon. Soon we were finding all sorts of objects like Pluto beyond Neptune which astronomers dubbed rather simplistically as Trans-neptunian objects. It seemed that Pluto was not alone but was part of a number of objects dotting the solar system beyond Neptune known as the Kuiper Belt. So the International Astronomical Union in 2006 demoted the planet status it had enjoyed all these years to dwarf planet. They had good reason too; Pluto is smaller than our moon. You can fit Pluto easily on the continent of North America. It also has a very big moon Charon, so big that Charon and Pluto revolve around each other like an astronomical dance. But the clincher was that Pluto’s gravity is so weak that its orbit is messy, filled with debris and rocks which any respectable planet would have cleared by now. To top this ignominy, the term “Plutoed” now means to be demoted. No wonder people took to the streets! So just because Pluto was well, Plutoed, does that mean we should not study it? Pluto’s discovery has thrown up a lot of questions. For example: How was it formed? Why is it full ice? Why is it not like its neighbours – the gas giants? What is its chemical composition? Does it have any more moons (it already has five)!

To answer these questions The New Horizons space probe was launched to study Pluto and other Trans-neptunian objects in 2006. It took nine years to reach Pluto and its family of moons but it seems it was worth the wait. We now know that Pluto does not have a dead surface like mars but is geologically active with mountains of ice and glaciers. We also know what Pluto’s moons look like (our space telescopes could not see them clearly).

But the journey has thrown up a new series of questions. Why is Pluto’s atmosphere denser than we expected. What is causing the glaciers and mountains to form? Why is Pluto’s color orangish-pink? So many questions – so much to be answered. But we are only just beginning to uncover Pluto’s secrets.

So should we still be asking questions? Yes. The more we question our beliefs the more exciting paths we can find. The more we know, the more we should ask why! Remember Pluto’s story that began by asking a question because of a mistake in calculation that was not only resolved but revealed whole new worlds. So begin your journey by asking questions! Work to find the answers – you will realize that you will go back with more than just that! There are new worlds waiting to be found. Maybe you will find another planet or perhaps a new solar system. Whatever it may be, it’s bound to be exciting. Even though we demoted Pluto, it has led us to new exciting discoveries. Truly Pluto has a big heart!

Join us on this journey of questioning everything, solving them and finding new worlds!
HOW THE MONKEY BECAME A TRICKSTER

Brazilian Folktale

Once upon a time there was a beautiful garden in which grew all sorts of fruits. Many beasts lived in the garden and they were permitted to eat the fruits whenever they wished. But they were asked to observe one rule. They must make a low, polite bow to the fruit tree, call it by its name, and say, “Please give me a taste of your fruit.” They had to be very careful to remember the tree’s correct name and not to forget to say “please.” It was also very important that they should remember not to be greedy. They must always leave plenty of fruit for the other beasts who might pass that way, and plenty to adorn the tree itself and to furnish seed so that other trees might grow. If they wished to eat figs they had to say, “O, fig tree, O, fig tree, please give me a taste of your fruit.”

In one corner of the garden grew the most splendid tree of all. It was tall and beautiful and the rosy-cheeked fruit upon its wide spreading branches looked wonderfully tempting. No beast had ever tasted that fruit, for no beast could ever remember its name.

In a tiny house near the edge of the garden dwelt a little old woman who knew the names of all the fruit trees which grew in the garden. The beasts often went to her and asked the name of the wonderful fruit tree, but the tree was so far distant from the tiny house of the little old woman that no beast could ever remember the long, hard name by the time he reached the fruit tree.

At last the monkey thought of a trick. He always played the guitar when the beasts gathered together in the garden to dance. The monkey went to the tiny house of the little old woman, carrying his guitar under his arm. When she told him the long hard name of the wonderful fruit tree he made up a little tune to it, all his own, and sang it over and over again all the way from the tiny house of the little old woman to the corner of the garden where the wonderful fruit tree grew. When any of the other beasts met him and asked him what new song he was singing to his guitar, he said never a word.

At last he reached the corner of the garden where the wonderful fruit tree grew. He had never seen it look so beautiful. The rosy-cheeked fruit glowed in the bright sunlight. The monkey could hardly wait to make his bow, say the long hard name over twice and ask for the fruit with a “please.” What a beautiful colour and what a delicious odour that fruit had! The monkey had never in all his life been so near to anything which smelled so good.

He took a big bite. What a face he made! That beautiful sweet smelling fruit was bitter and sour, and it had a nasty taste. He threw it away from him as far as he could.

The monkey never forgot the tree’s long hard name and the little tune he had sung. Nor did he forget how the fruit tasted. He never took a bite of it again; but, after that, his favourite trick was to treat the other beasts to the wonderful fruit just to see them make faces when they tasted it.

He took a big bite. What a face he made! That beautiful sweet smelling fruit was bitter and sour, and it had a nasty taste. He threw it away from him as far as he could.
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SURVIVAL OF THE FITTEST?

What does the title remind you of? - Evolution would be my guess. For long we have been defining evolution as the process in which only the fittest individuals and species survive what nature throws at them, and over many years only their traits survive. But is it really so? Is it possible that animals and plants throughout the world can shed bad traits and still survive?

The common definition seems to suggest this is not possible; as though evolution is a battle of the species in which only the best survive. It seems that species have to become better and better over time so that they become perfect for the ecosystem in which they live. But this is clearly not so, humans can't do everything. We are not some perfect creation of nature shaped by evolution. In fact it seems that some of the designs that evolution has thrown up are quite silly and stupid.

Let me explain. Consider our eyes, it contains a lens and cornea which focuses light onto a retina which registers the light as an electrical signal that can be processed by the brain. The retina is made up of rods and cones that actually do the work of registering signals. In effect, the eye is like a camera containing a lens, a sensor and some electrical circuitry (we have nerves instead) that process the image. Indeed, the eye is a marvel of natural engineering and design which helps us make sense of the world around us. But this hides a major design flaw - it has a blind spot. If you don’t know what it means - take a white sheet of paper and mark a small black dot on it. Now close one eye and hold the sheet at reading distance. Move the paper around without moving your eyeballs. At some point the dot disappears even though it is in your range of vision. This is because the dot is being imaged at your blind spot of the retina where there are no rods or cones. At this spot the nerves converge and bunch up into the optic nerve that carries information to the brain.

The structure of the retina is such that the rods and cones in our eye faces away from the light (thus, away from the lens). The nerves that connect these sensory cells connect from the front side where the light falls. These nerves then converge at the blind spot. Equivalently, this is like having your camera sensor face backwards with the wires facing the light. The wires would then collect into a main cable that goes through a hole drilled into the center of the sensor. This appears crazy as you could have just placed the sensor in the right direction to face the light. But that is exactly how the retina is designed. Fortunately, the nerves are mostly transparent and let most of the light (not all) reach the rods and cones. It would have been better if the sensory cells faced the lens. That way, it would receive more light and there would be no blind spot - a great evolutionary advantage, a fitter design. Yet no mammal, fish or bird has it that way. In fact, the Octopus and its relative, the squid have the fittest design with no blind spot. Their eyes have the same structure except for the retina (scientists call this convergent evolution). So why don’t we have this design even after millions of years of evolution?

There are two reasons: First, even with the flawed design we can still make do. Fish, mammals and birds can survive despite having a blind spot by adjusting their ways. Second, nature builds up on existing blue prints, usually adding to it without changing the fundamentals much, if it is not a serious disadvantage. So, our ancestor animals which lived in the sea probably had the flawed design and we simply evolved with it. The octopus' ancestors had the better one and evolved along another path independently producing a similar eye structure. So this means it’s not survival of the fittest working here, it is survival of the fair enough. The design we have is not the best but is passable enough to survive. Nature does not need a 100% in the test of survival; it just needs a passing grade!

Each species on earth tries to occupy a special niche in the ecosystem. Only when another species or nature threatens that occupation, does the species have a motive and mechanism to evolve. For this reason many species around the earth still are the same even after millions of years while others evolved. Some species seem to do counter-intuitive things to occupy niches. Take the Sea Squirt for example; it is a small animal that spends its life filtering organic matter from water in the sea while being permanently attached to a rock. It does not have any brain, only a rudimentary nervous system without any eyes. Yet this humble squirt is more closely related to us in the tree of life than the highly intelligent octopus. To know why, we must look at its childhood when it is just a larva. The larva has a brain, a simple spinal cord (notochord), simple eyes and can move about much like a mammal or fish. Yet when it grows into an adult, it loses its brain, eyes and mobility to become attached to the sea floor.

What just happened? An advanced creature seems to turn into a simple blob in the sea by sacrificing important organs that could have made it fitter. This however, is not the point. The sea squirt has evolved as such because it occupies a position in the ecosystem that has few takers. In this way the species is able to survive. After all, that is the point of evolution - first to survive, only then maybe to become the fittest.

So as you read through the article we began by asking questions, challenging existing notions and in the process we have found some answers. We also saw that as we looked for the answer we could expand our ideas of evolution to see its entire spectrum rather than being confined to a black and white definition. This is after all the power of asking why something is as it is. Join us in that quest for knowledge by using the power of asking a simple question!

-Nithilaksh PL
1. What is a quadriga?
2. What was the name of William Tell’s son (the apple head boy)?
3. Laika was the first ever dog to do what?
4. Who was the first actor to appear on cover of Time magazine?
5. Who tells the story in The Arabian Nights?
6. What is the center of Gravity?
7. What is the last thing you take off before bed?
8. I have keys but no locks. I have space but no room. You can enter but can’t go outside. What am I?
9. What is next in this sequence: JFMAMJASON_?
10. What is a quadriga?
Expect to hear a whole lot more about Li-Fi - a wireless technology that transmits high-speed data using visible light communication (VLC) - in the coming months. With scientists achieving speeds of 224 gigabits per second in the lab using Li-Fi earlier this year, the potential for this technology to change everything about the way we use the Internet is huge.

Li-Fi was invented by Harald Haas from the University of Edinburgh, Scotland back in 2011, when he demonstrated for the first time that by flickering the light from a single LED, he could transmit far more data than a cellular tower. Think back to that lab-based record of 224 gigabits per second - that’s 18 movies of 1.5 GB each being downloaded every single second.

The technology uses Visible Light Communication (VLC), a medium that uses visible light between 400 and 800 terahertz (THz). It works basically like an incredibly advanced form of Morse code - just like switching a torch on and off according to a certain pattern can relay a secret message, flicking an LED on and off at extreme speeds can be used to write and transmit things in binary code.

And now, scientists have taken Li-Fi out of the lab for the first time, trialling it in offices and industrial environments in Tallinn, Estonia, reporting that they can achieve data transmission at 1 GB per second - that’s 100 times faster than current average Wi-Fi speeds.

And while you might be worried about how all that flickering in an office environment would drive you crazy, don’t worry - we’re talking LEDs that can be switched on and off at speeds imperceptible to the naked eye.

Li-Fi allows for greater security on local networks as light cannot pass through walls, which also means there is less interference between devices. Perhaps the most significant advantage is the speed that the technology offers. Researchers have achieved speeds of 224 gigabits per second in lab conditions. While Cuthbertson says Li-Fi will probably not completely replace Wi-Fi in the coming decades, the two technologies could be used together to achieve more efficient and secure networks.

Our homes, offices, and industry buildings have already been fitted with infrastructure to provide Wi-Fi, and ripping all of this out to replace it with Li-Fi technology isn’t particularly feasible, so the idea is to retrofit the devices we have right now to work with Li-Fi technology. Research teams around the world are working on just that. Li-Fi experts reported for the Conversation last month that Haas and his team have launched PureLiFi, a company that offers a plug-and-play application for secure wireless Internet access with a capacity of 11.5 MB per second, which is comparable to first generation Wi-Fi. And French tech company Oledcomm is in the process of installing its own Li-Fi technology in local hospitals.

If applications like these and the Velmenni trial in Estonia prove successful, we could achieve the dream outlined by Haas in his 2011 TED talk - everyone gaining access to the Internet via LED light bulbs in their home.

“All we need to do is fit a small microchip to every potential illumination device and this would then combine two basic functionalities: illumination and wireless data transmission,” Haas said. “In the future we will not only have 14 billion light bulbs, we may have 14 billion Li-Fis deployed worldwide for a cleaner, greener, and even brighter future.”
DESIGN AND TEST A PARACHUTE

Learn about air resistance while making an awesome parachute! Design one that can fall slowly to the ground by modifying the design till it is perfect.

You will need:
- A plastic bag or light material
- Scissors
- String
- A small object to act as the weight, a little action figure would be perfect.

Instructions:
- Cut out a large square from your plastic bag or material.
- Trim the edges so it looks like an octagon (an eight sided shape).
- Cut a small whole near the edge of each side.
- Attach 8 pieces of string of the same length to each of the holes.
- Tie the pieces of string to the object you are using as a weight.
- Use a chair or find a high spot to drop your parachute and test how well it worked, remember that you want it to drop as slow as possible.

What’s happening?
Hopefully your parachute will descend slowly to the ground, giving your weight a comfortable landing. When you release the parachute the weight pulls down on the strings and opens up a large surface area of material that uses air resistance to slow it down. The larger the surface area the more air resistance and the slower the parachute will drop.

Cutting a small hole in the middle of the parachute will allow air to slowly pass through it rather than spilling out over one side, this should help the parachute fall straighter.
THE TALE OF NUMBERS
A JOURNEY INTO THE ESSENCE OF LIFE

Numbers are everywhere. A mere look at the world around us would convince anyone about that. If it weren’t for numbers, there wouldn’t have been any phone conversations, no dates on the calendar, money wouldn’t have mattered at all, nobody could have told which class they were in, and the new traffic convention in Delhi wouldn’t have been possible.

Worst of all, Math wouldn’t have been this interesting!

Everything has already picked up pace ever since we moved to a digital world. The word digital itself seems to have been derived from the word digit. Everything around us is getting automated. From things as small as a bread toaster to things as complex as huge robots. Any idea how this automation is achieved? Well, this is majorly driven by using electronics and complex computations. These computations are done by different kinds of computers. When it comes to computers, there are only two numbers which are responsible for the audio, video, games and pretty much everything that a computer can do. It may seem hard to digest this fact but yes, the digital world is basically just two digits, 0 and 1, called the Binary digits. These two numbers are literally the language of computers. But numbers were used as languages long before anyone of us were even born! Ever wondered how numbers evolved to the form they have now? If yes, read on.

It all started with the findings of the Ishango bone (Figure 1) which dated back to nearly 20,000 BC, somewhere in Congo. This bone contained notches in 3 rows. The left and the right rows contained 60 notches each and the central row contained 48 notches (Figure 2). Did you observe the engravings on this? These are similar to tally marks. That means, someone began to count as early as the 20,000BC! Counting is hence supposed to have such an old history.

Fast forward a few years, in a place called Sumer (around 4000 BC), people implemented the ideas of using physical objects to represent numbers. The number 1 was represented using a token. The general practice was if someone had 6 tokens, it meant that he had 6 items. If he got one more item, he takes one more token. On losing an item, a token was taken away. A dedicated body of officials was on this role – to monitor these tokens. Thus, numbers and counting resulted in one of the first Governance systems in the world – which was a major break-through in human civilization.

After this token system, Sumerians invented writing as well. It is said that numbers were the world’s first writing. Since tokens were used for trade, they became important. As the number of tokens and the people using them increased, it became important to keep records. Numbers thus became the world’s first writing. Sumerians used clay and wrote on it by engraving shapes similar to their tokens. Since, they had somewhat conical token, the writings were somewhat triangular in shape. One token meant 1, 3 tokens in a row meant 1, 1 and 1 and so on. Being a small civilization, Sumerians were never bothered by the need for larger numbers. The word of numbers travelled fast and others came to know about the new way of representing things. The number 1, which was not in the form it is now, was born.

This new language travelled to Egypt in nearly 3000 BC, which was one of the largest civilizations ever. They invented several new symbols for different numbers. A rope for number 1, a U shaped rope for number 10, a coiled rope for number 100, etc.

Egyptians invented a symbol for the number 1 million, a number so large that Sumerians never even dreamed of. It was a kneeling prisoner with both hands raised. Apart from symbols, Egyptians also invented a way to measure distance. The length of a man’s arm from elbow to the fingertip plus the width of palm was defined as 1 cubit. Sometimes, a cubit is also defined as the length from elbow to the fingertip. It was the first ever unit to measure length. They measured this for a man, copied it and used it in the same way as rulers are used today.

They could construct beautiful buildings with astonishing accuracy using that unit of distance. The Great Pyramid of Giza was constructed using cubit as a unit of measurement. It is the only ancient wonder of the world which is still standing.

Ever wondered how numbers evolved to the form they have now? If yes, read on …
500 BC. This is the reason that this number system is also known as the Hindu-Arabic Numeral System.

Indians went ahead and created something which was strange, extraordinary and truly special. The invention which didn’t just change history, it created one. 0 was invented, and for the first time in human history, it was possible to represent nothing with a number. The idea that nothingness could be represented using something – a representation was something which most of the scholars back then could not comprehend. This was a revolutionary turn in the events of evolution of numbers. The first evidence of 0, the first 0 ever written, can be found in Chatur-Bhuj Temple in Gwalior, Madhya Pradesh, India.

It may strike that a number which represents nothing should be unimportant. But when it is put next to 1, it becomes 10 which larger than all single-digit numbers. As the number of Os increased, larger and larger numbers are formed. This tag-team of 1 and 0 is extremely important. Computers communicate with Os and Is. In Binary system, any number can be represented using 1 and 0. For e.g. 2 is represented by 10 and 2000 is represented by 1111010000.

After the invention of 0, the subsequent invention of numbers like 10, 100, 1000, etc. took place. These numbers which start from 0, 1, 2, 3...and go till infinity are called whole numbers. That’s the definition of whole numbers that students study today. Later, the term ‘natural numbers’ was coined. It was mentioned in Ars Conjectandi, a paper written by a Swiss mathematician Jacques Bernoulli. The paper was published in 1713, nearly eight years after his death. He excluded 0 from the list of natural numbers. Natural numbers are defined as the counting numbers. The term counting numbers because nobody starts counting from 0, they always start from 1. The term “natural numbers” was hence coined after the term “whole numbers”.

After that, the story of 0 spread world-wide. Numbers were there everywhere. With a lot of numbers, came a lot of calculations. The usefulness of calculations was shadowed by human error in the calculations, no matter how carefully the calculations were done. To solve this problem, a mathematician by the name Leibniz came up with a device which would do all the calculations. A calculator as it is known now. Leibniz built a calculating machine named it Step Reckoner. That machine also used only two numbers, 0 and 1 for the calculations. The problem of human error was resolved. Later, in southern England, Colossus, the first working computer was invented, which again used only Os and Is. A binary system that is responsible for all the astounding technology that we have, wouldn’t be possible without just two of infinite numbers. Numbers which are used today are in decimal system, which was discovered in India.

That’s how the numbers which we use today were invented in India. For e.g. 11 is written as 11 in the decimal system or as 1011 in the binary system. The usefulness of calculations was shadowed by human error in the calculations, no matter how carefully the calculations were done. To solve this problem, a mathematician by the name Leibniz came up with a device which would do all the calculations. A calculator as it is known now. Leibniz built a calculating machine named it Step Reckoner. That machine also used only two numbers, 0 and 1 for the calculations. The problem of human error was resolved. Later, in southern England, Colossus, the first working computer was invented, which again used only Os and Is. A binary system that is responsible for all the astounding technology that we have, wouldn’t be possible without just two of infinite numbers. Numbers which are used today are in decimal system, which was discovered in India. After that, the story of 0 spread world-wide. Numbers were there everywhere. With a lot of numbers, came a lot of calculations. The usefulness of calculations was shadowed by human error in the calculations, no matter how carefully the calculations were done. To solve this problem, a mathematician by the name Leibniz came up with a device which would do all the calculations. A calculator as it is known now. Leibniz built a calculating machine named it Step Reckoner. That machine also used only two numbers, 0 and 1 for the calculations. The problem of human error was resolved. Later, in southern England, Colossus, the first working computer was invented, which again used only Os and Is. A binary system that is responsible for all the astounding technology that we have, wouldn’t be possible without just two of infinite numbers. Numbers which are used today are in decimal system, which was discovered in India.

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Bagan in central Burma is one of the world’s greatest archeological sites, a sight to rival Machu Picchu or Angkor Wat but – for the time being at least – without the visitors. Rising from the plain’s canopy of green are temples, dozens of them, hundreds of them, beautiful, other-worldly silhouettes that were built by the kings of Bagan between 1057 and 1287, when their kingdom was swept away by earthquakes and Kublai Khan and his invading Mongols. Some 2,230 of an original 4,450 temples survived. Most are superbly preserved or have been restored by UNESCO, among others, and many contain frescoes and carvings and statues of Buddha, big and small. Only a handful are regularly visited, and though tourist numbers are increasing and the hawkers are beginning to appear, this is still, by the standards of sites of a similar beauty and stature, a gloriously unsullied destination.

When to travel

Bagan is hot most of the year. The best time to visit is between November and February, when temperatures hit 30C (86F). Avoid March to May, when temperatures can reach 43C (110F). Rainfall is highest in June and October. If you can, visit during a full moon, a popular time for local festivals.

Quick Facts

- Myanmar gained independence from Britain in 1948
- 90% of local people are Buddhist
- Myanmar is one of 3 countries who don’t use the metric system (along with U.S.A and Liberia)
- Rice and Green Tea are typically served with every meal
- Wine-making is a popular industry

View by balloon

The best initial way to see the temples is from a hot-air balloon. The roughly 45-minute flights leave at dawn and drift over much of the site, with glorious views of the river and distant mountains, hazed by mist, as well as a bird’s-eye view of the temples and rural village life. Sunset flights are also available.
A BRIEF HISTORY OF YOUTUBE: FROM ZERO TO FOUR BILLION+ VIDEO VIEWS A DAY

Feb. 2005
It all begins...
(YouTube founded).

Apr. 2005
First video uploaded.
(“Me At The Zoo”).

Jun. 2007
Launched in nine countries.
(...including the UK).

Dec. 2008
HD video launched.
(Channel 4 partnership)

Oct. 2009
One billion daily video views.
(That’s 11.574 per second).

Nov. 2009
Full-HD launched.
(1080p HD).

May 2010
Two billion daily video views.
(That’s 23.143 per second).

Dec. 2010
TrueView ads launched.
(A new kind of ad).

May 2011
Three billion daily video views.
(That’s 34.722 per second).

Dec. 2011
Site gets major redesign.
(First major update).

Jan. 2012
Four billion daily video views.
(That’s 46.296 per second).

Oct. 2006
Google buys YouTube.
(...For $1.65 billion).

Dec. 2008
HD video launched.
(Channel 4 partnership)

Oct. 2009
One billion daily video views.
(That’s 11.574 per second).

May 2011
Three billion daily video views.
(That’s 34.722 per second).

Dec. 2012
First video hits one billion views.
(“Gangnam Style” - PSY).

So where is your YouTube today? How far has YouTube come over the years?

Now: 800 million+ monthly unique visitors.
(That’s more than the entire population of Europe).

Now: 72 hours+ video uploaded per minute.
(That’s over a decade of content every day!).

Now: One million+ partner program members.
(That’s more than the entire population of Delaware).

Now: #2 search engine.
(Bigger than Bing, Yahoo, Ask and AOL combined!).

Now: Four billion hours of video viewed each month.
(That’s over 450,000 years of video viewed each month!)
Canon Inc. is a world-renowned Japanese company that manufactures cameras, printers, camcorders and photocopiers. Headquartered in Ota, Tokyo, the company was established in 1937 by Goro Yoshida, Takeshi Mitarai, Takeo Maeda and Saburo Uchida.

**Shape of the Canon Logo:**
Precision Optical Instruments Laboratory, the parent company of Canon, manufactured a new camera in 1933, and named it “Kwanon”, after the Buddhist god of mercy. The original logo depicts the image of Kwanon with about one thousand arms and flames. The company came up with the name “Canon” in 1935 after its wide and impressive international success.

**Color of the Canon Logo**
The red color in the Canon logo represents energy, determination and business responsibility.

**Font of the Canon Logo:**
The Canon logo uses a custom-designed font which was created by Gio Fuga exclusively for the company.