



# AURORA

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## Our Team

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- Embryo is a forum for on-line, live and interactive lectures, run by students and faculties of BITS-Pilani. It was conceived and initiated by a group of 6 BITS Pilani Alumni in the Silicon Valley in 2006 with an aim to transform classroom education.
- Often, a lecture or two in the right area by the right person can change the course of one's career. Embryo proposes to free education from the barriers of distance, time and human resources. Leveraging web-based technologies.
- Embryo acts as a bridge between the knowledge seekers (students), and the potential speakers. Such a powerful method truly realizes the dream of borderless classrooms and bottomless learning resources.



# Embryo hosted events at a Glance

This year the situations were different, the platform was different but we continued to spread information and guidance through our talks and notable speakers. We started our year by hosting a new series called 'QuaranTime Conversations' that covered various fields like Computational Chemistry and Biology, Filmography, cyber security, GMAT preparation etc. We invited Subrahmanyam Pulipaka to shed light on how to publish a research paper being a college student, we also had Harsh Goela and Aditya Goela with us to share some insights on how to start investing in the stock market. For Civil services aspirants we were honored to have Anuraj Jain AIR-24 a BITS Pilani 2015 alumnus on board with us to share some strategies on how can BITSIANs crack the UPSC examinations. Another talk was hosted for the people who wanted to learn more about cryptocurrency by David Yermack, an MBA holder from Harvard Business School. We saw a huge turnout for our panel discussion 'CAT Champs 2021' for all those CAT aspirants to help them strategize and solve their queries regarding the examination and admission process. To end the year on a high note we organized a panel discussion called 'Gateway to GRE' for all the students who want to excel in the world's largest assessment programs for graduate admissions, the GRE.

We not only worked to guide or to acquaint knowledge but we also had events to entertain and ease the pandemic crisis and difficult circumstances. Though we were not fortunate enough to have Oasis or BOSM and the void of an offline fest cannot be filled we tried our best and brought in some celebrities on board with us via online platforms. We were grateful to have bollywood actress **Nimrat Kaur** with us via 'Insta live with Bits Embryo'. We invited **Nayana Shyam** for an interactive session with us in an Instagram Live event. Another fun event was with **Prajakta Kohli aka Mostlysane** where we got a chance to interact with the famous youtuber. We did not restrict ourselves to the entertainment industry only, we invited **Vijay Shankar** one of India's top cricketers and **Ajay Jayaram** an ace badminton player with us for Instagram live events respectively in association with BOSM. We had a thrilling journey this year with many hurdles. However we made the most of the situation and hope that others could also enjoy amidst lockdown situations.

In this 39th year of APOGEE and the nth edition of AIC (APOGEE Innovation Challenge) by BITS Embryo, the participants witnessed 8 leading companies across the globe challenging their critical thinking, technical skills, and problem-solving proficiency by calling to solve their real-World problem statement. The colossal task was met with a fitting reward, with prizes worth more than 4.5 lakh rupees, including cash. 3 Internship offers were also rewarded. The companies this year were- Bosch, Yamaha, Zulip, Germentor, Ford, Ant Studio, GE Healthcare, and DesignBoat. The online event saw the participation of over 400 students from various colleges.



# AUGMENTED REALITY

-Apoorva Ojha

Augmented reality (AR) is an updated version of the actual physical world achieved using various digital visual elements, sound, or other sensory stimuli delivered via technology. It has travelled a long journey from a concept of science-fiction movies to a science-based reality. Augmented reality is a system that integrates three features, a combination of natural and virtual worlds, real-time interaction of objects, and appropriate three-dimensional matriculation of virtual and natural things. The core technology behind the development of AR technology is AR cloud technology. This technology uses a unique interface to provide constant, contextual and collaborated digital content overlaid onto individuals, items, and locations. This technology empowers the unification of the real and virtual world to create captivating experiences.

Nowadays, we carry augmented realities in our smartphones. It has widespread usage in our day-to-day lives the enhanced navigation systems that show the live view of the road, the game Pokémon-go and the Snapchat filters of them are based on the augmented reality. However, we might underestimate the technology being restricted to its usage in our smartphones, but with the development of appropriate platforms, AR can be expanded to some glasses or goggles. The commercial use of the technology has exploded due to its use by market leaders like Microsoft, Apple, Google, Facebook, and Amazon. The market for augmented reality is worth \$15.3 billion quoted by MarketsandMarkets. By the end of 2020, there were 598 million units of AR active devices, and it is estimated to grow to 1.73 billion by 2024.

The augmented reality, when combined with other science-based technologies, can give many valuable contributions to the world. Augmented reality, mixed reality, and artificial intelligence can together flawlessly predict consumer needs based on their profiles, search history, and purchase history. Human-machine systems using the augmented reality and artificial intelligence can accurately diagnose diseases, predict outcomes, and suggest the best course of action to doctors. These two technologies together can also indicate the possible flaws in an architectural plan.

Augmented reality has the potential to make the impossible possible. It can make our lives even more hassle-free and has significant market potential. Remarkably it has received positive reviews from the people using it. The future of augmented reality will emerge entwined with artificial intelligence and virtual reality, and it would also bring an array of sophistication in the industrial aspect.

# HUMANOID ROBOTS

-Prashansa Mamgain

The Merriam-Webster definition of a humanoid is a nonhuman creature or being with characteristics (such as the ability to walk upright) resembling those of a human. The design may be for functional purposes, such as interacting with human tools and environments, for research to study movement or to conduct trials, or for other purposes.

Why are they being created?

Humanoid robots are mainly being developed to perform human tasks like personal assistance, through which they should be able to assist the sick and elderly, and dirty or dangerous jobs. Since they have to work in close relation to people they need to be "user friendly", be able to identify and simulate emotions, smart enough to navigate the surroundings, and satisfy a ton of other requirements. But some humanoids are made for experimental purposes. As the name suggests, they can only be used for experiments, such as when you study locomotion and the likes. They can be made to perform human-like tasks including jumping, running, crossing obstacles, the possibilities are endless. Some of the most popular humanoids in existence right now are:

- ATLAS was unveiled in 2013 and was developed by Boston Dynamics, and was promoted as the 'world's most dynamic robot'. It was made to carry out search and rescue missions. It can navigate its way through tough terrain and obstacles in its path using its range sensing, stereo vision, and other sensors.
- If you loved Big Hero 6 you would love Robear. This experimental robot was considered as a possible solution to the problem of increasing shortage of caregivers that Japan is set to witness over the course of this century. It integrates three kinds of sensors, including torque sensors and Smart Rubber capacitance-type tactile sensors made entirely from rubber. This facilitates gentle movements that ensure that the robot can carry out power dependent tasks such as lifting or carrying patients without causing them discomfort.
- Pepper is built by SoftBank Robotics to serve as a humanoid companion, Pepper was made to communicate naturally and intuitively. It can read primary human emotions such as anger, joy or sadness by interpreting one's facial expressions, the tone of voice and other non-verbal cues, and 'behave' accordingly.
- Sophia became one of the most popular robots after she was granted a one-of-a-kind citizenship by the Kingdom of Saudi Arabia in 2017. Sophia was activated in April 2015 and developed by Hanson Robotics. Her AI allows her to hold eye contact, recognize faces and understand human speech. She can respond with prewritten responses for specific questions which gives the illusion of a conversation. Although, she may lack any real cognizance she remains a very important and innovative project.



# GENETIC ENGINEERING

-Suhani Modi

From bacteria-made insulin that obviates the use of animal pancreases to a better understanding of infectious diseases and improved treatments, genetic engineering has redefined modern medicine. Genetic engineering, also called genetic modification, is the direct manipulation of an organism's genome using biotechnology. It is a set of technologies used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved or novel organisms. New DNA may be inserted in the host genome by first isolating and copying the genetic material of interest using molecular cloning methods to generate a DNA sequence, or by synthesizing the DNA and then inserting this construct into the host organism. Genes may be removed, or "knocked out", using a nuclease. Gene targeting is a different technique that uses homologous recombination to change an endogenous gene and can be used to delete a gene, remove exons, add a gene, or introduce point mutations. Medicine, research, industry and agriculture are a few sectors where genetic engineering applies. It can be used on various plants, animals and microorganisms. The first microorganism to be genetically modified was bacteria. Genetic engineering can be applied to manufacturing of drugs, gene therapy, human growth hormones and vaccines. Genes and other genetic information from a wide range of organisms can be inserted into bacteria for storage and modification, creating genetically modified bacteria in the process.

Medicines like insulin, human growth hormone, and vaccines, supplements such as tryptophan, aid in the production of food (chymosin in cheese making) and fuels are produced using genetic engineering. The crops that are drought-resistant, disease-resistant can be grown using genetic engineering. Diseases such as malaria, dengue can be eliminated by sterilizing the mosquitoes using genetic engineering. Even though genetic engineering has mind boggling advantages, the production of genetically-engineered entities may result in an adverse manner and produce undesired results which are unforeseen. With the introduction of a genetically-engineered entity into one ecosystem for a desirable result, may lead to distortion of the existing biodiversity. Genetically-engineered crops can also produce adverse health effects. The concept of genetic-engineering is debated for its bioethics where community against it argue over the right of distorting or molding the nature as per our needs.



# MANDELA EFFECT

-Prashansa Mamgain

Do you know of those times when you are so convinced of an incident only to discover you were wrong? But you could have sworn you were right and didn't like a lot of people agree with you too? So how can all of you be wrong? Hereby introducing Mandela Effect.

## Origin of Mandela effect

In 2009 Fiona Broome, a blogger and a self-identified "paranormal consultant," detailed how she remembered former South African President Nelson Mandela dying in the 1980s. Broome was shocked to discover she was not alone in this. The nation mourned, his wife gave a memorable eulogy. This was all on the news. Lots and lots of people remember this happening. (Of course, none of this actually happened. Mandela was released from prison in 1990 and was president of South Africa from 1994 to 1999 and he died in 2013) It was then when the term "Mandela Effect" was coined and people officially started talking about this super cool phenomenon.

## So what is it exactly?

So we have established that Mandela Effect refers to a situation in which a large mass of people believe that an event occurred when it in fact did not. So, therefore it must be a false memories phenomenon. However, it is slightly different from a "false memory" as this phenomenon affects large random groups of people who do not share anything in common, not so much as similar emotional factors associated with the event. It also seems stronger than simply misremembering a detail, which is why people tend to be so adamant with claims of their memories.

## What causes the Mandela Effect?

1. The concept of false memories of course does provide one potential explanation for the Mandela effect. The term false memories is pretty self-explanatory, they are untrue or distorted recollections of an event. Some false memories contain elements of fact, closely resembling the actual event in question. However, others are entirely false. Memory inaccuracy can also arise from what's known as "source monitoring errors". US professor of psychology, Jim Coan, demonstrated how easily this can happen using the "Lost in the Mall" procedure. The lost-in-the-mall study concludes that an entirely false memory can be implanted by suggestion. In the experiment, participants were given short narratives, all supposedly provided by family members, describing childhood events, and asked them to recall the events, one of these however was entirely false. It told of the person, as child of 5 or 6, being lost in a shopping mall for an extended period of time before finally being rescued by an elderly person and reunited with his or her family. In the study, nearly 25% of the small sample of participants reported to be able to remember this event, even though it never actually occurred. Many This was interpreted to mean that the very act of imagining the events led to the creation of false memories.

2. Confabulation often described as "honestly lying", is the unconscious manufacture of fabricated or misinterpreted memories. Someone with confabulation subconsciously creates stories as a way to conceal their memory loss. They aren't aware that they aren't telling the truth. They don't have any doubt about the things they are saying, even if those around them know the story is untrue.

3. If people on Reddit are to be believed, the cause is something else entirely. Alternate Universe Theories may sound super far-fetched but it can always be a possibility. The Mandela Effect, according to some people might be evidence that we're living in an alternate reality. Enthusiasts call evidence of the effects "residue" as if there was a timeline that has since been erased and we're only able to see the residual hints of what once was. A popular theory is that CERN, the European research center, caused a splinter in time and space when it fired up the Large Hadron Collider in 2008 and started flinging atoms at other atoms to discover the roots of the universe. However, there's no evidence to support this theory.

# Evolution and Aliens

-Amey Agarwal

It's a popular view that the vastness of the universe guarantees a friend we have apart from us. A living body. Majority of the perceptions people have about aliens' appearance comes from Hollywood, which most of the times are inspired by the human body itself, with a few exceptions like the 1958 'The Blob'. Many call this a close-minded perception. The different "ways to be alive" present in our own biodiversity suggests those graphic designers were none the wiser.

So how do we, if we can, predict what our alien friend will look like?

One can argue that it'd be logical to count the number of times certain features have evolved independently, i.e. the same feature being evolved in one place without any connection to the others, as it would give us a probabilistic edge on what to expect in extraterrestrial life. They would have a point. E.g. Eyes have evolved independently 40 times; echolocation did four times. Another can argue that this doesn't give reason to assume eyes will occur even once in life on other planets. Even they would have a point. NASA searches for habitable planets (with hopes of alien life present there) by the following rule: Find planets that are like Earth. Look for a planet of similar size around a similar star at a similar distance from one another, etc.

A serious consideration among researchers now is that life on Earth might have started in what would now be extreme conditions of high temperature to us. But who are we to call something extreme? After all, those microscopic creatures back then would probably be surprised today at how we manage to survive in these extreme cold conditions of 24 degrees Celsius, if they possessed the ability to feel that emotion. Astrophysicists used to look for planets in the 'Goldilocks zone', i.e. habitable zone, a range of distance from a star where water could exist in liquid state. We now realize that the energy source providing that adequate heat doesn't have to be a star. Jupiter keeps 'Europa', one of its moons, warm, where water has existed in liquid state for billions of years, in oceans no less.

To put in simple words, the knowledge of the diversity of conditions in which life on Earth has succeeded to arise, survive, and evolve, has multiplied our chances and hopes of finding life outside this planet.

Let's talk about what zoologist 'Arik Kershenbaum' suggests in his book 'The Zoologist's guide to the Galaxy'. The crux of his argument is that aliens, if ever found, will probably not look much different from life on Earth. Kershenbaum believes that "laws of evolution" govern what can possibly happen, due to the physics of the universe. This is because "apparent design" is what sets life apart from non-life. Living things are fine tuned for the goal of replicating the organism. The only way to achieve this design is through natural selection. So, aliens are likely to have undergone/ undergo natural selection. This allows us to make predictions about the look of alien life. The ones discussed here will focus on aliens more complex than a virus, so to say.

Complexity on Earth has arisen through a handful of something called "major transitions in individuality". This refers to the phenomenon of independent organisms coming together to form a new type of individual.

Most likely, this is the only approach to advance beyond a simple replicating molecule. Hence complex aliens are likely to have undergone similar major transitions. We are made up of cells, which in turn are made up of nuclei and mitochondria, which are made up of genes. This is a nested hierarchy of 'units', and aliens will, too, be a result of such a hierarchy. Perhaps those units won't be 'cells' as we know them. But whatever parts units are, they will be ones which were once free living.

Our parts have mechanisms in place that keep all the parts operating together to form an organism. For example, our cells all start as one single cell (the "zygote"). This means all our cells are clones, which is why they cooperate to make us. Aliens will have similar ways of enforcing cooperation between their internal parts, at each level of units.

Our alien friends may not have two legs, or any legs at all, but from an evolutionary standpoint, their structure will be much more familiar than we might have thought.

All life on Earth has a common DNA code. That is, the same system of 4-letter coded DNA dictates and directs life, and its replication. We currently have only one such way. So as much as we can predict from evolution, there is still a plethora of mystery awaiting us, and a sea of researchers ready with a blank sheet and a pen in their hand. And who knows what advancements behold us when the two finally meet.

# QUANTUM COMPUTING

-Suhani Modi

The technology sector is undoubtedly a huge investment opportunity for investors worldwide. In the last decade, it has become the largest segment of the market, eclipsing all other sectors, including the financial and the industrial ones. Now more than ever, technology is associated with innovation and invention and it is now integrated into all other existing sectors. With this growing need of innovations and inventions, Computers are getting smaller and faster day by day because electronic components are getting smaller and smaller. But this process is about to meet its physical limit. Electricity is flow of electrons. Since size of transistors is shrinking to size of few atoms, transistors cannot be used as switch because electron may transfer themselves to the other side of blocked passage by the process called quantum tunnelling.

Quantum Computing is an area of computing focused on developing computer technology based on the principles of quantum theory, which explains the behaviour of energy and material on the atomic and subatomic levels. Classical computers that we use today can only encode information in bits that take the value of 1 or 0. This restricts their ability. Quantum computing, on the other hand, uses quantum bits or qubits. It harnesses the unique ability of subatomic particles that allows them to exist in more than one state i.e., a 1 and a 0 at the same time. Superposition and entanglement are two features of quantum physics on which these supercomputers are based. This empowers quantum computers to handle operations at speeds exponentially higher than conventional computers and at much lesser energy consumption.

Quantum computing can help in artificial intelligence and machine learning by processing through complex problems in very less time, which would have taken traditional computers thousands of years. Some of the critical problems in computational chemistry that could be solved via quantum computing are — improving the nitrogen-fixation process for creating ammonia-based fertilizer; creating a room-temperature superconductor; removing carbon dioxide for a better climate; and creating solid-state batteries. Advancements in computing could enhance the efficiency of drug design and development dramatically, by allowing companies to carry out more drug discoveries to uncover new medical treatments for the better pharmaceutical industry. Quantum computers tap directly into an unimaginably vast fabric of reality—the strange and counterintuitive world of quantum mechanics hence tackling a lot of computational problems efficiently with quantum algorithms than with their classical counterparts.

## HOW A QUANTUM COMPUTER WORKS

Principle of superposition allows parallelism in the calculations

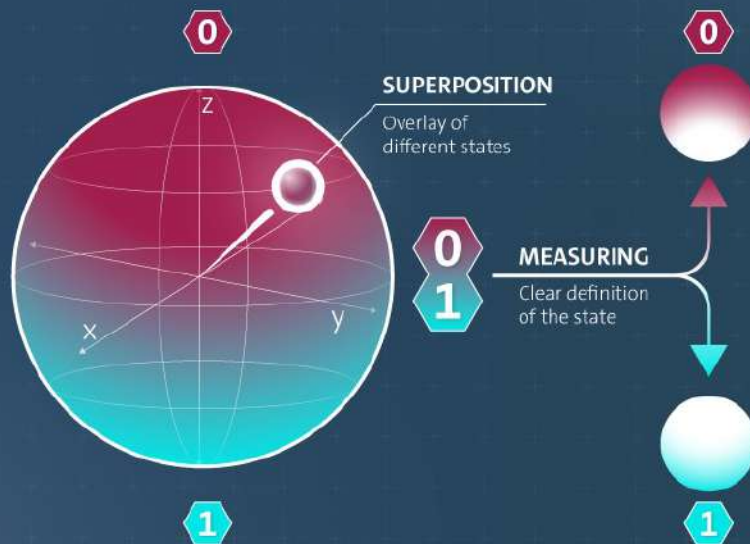
### Classical Bit

Binary system



### quantum bit "qubit"

Arbitrarily manipulable two-state quantum system



Parallel arithmetic operations possible

Exponential multiplication per qubit

Massive amounts of data can be handled in plausible time