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Why 'The Mandalorian' Uses Virtual Sets over Green Screen



While filming this scene from Disney's "The Mandalorian," the actors could see their surroundings, but the surroundings weren't actually there. All of this is just LED screens displaying backgrounds pre-made in a video game engine.

Compare that with this fight scene from "Avengers: Endgame." Where actors jumped around in a sea of green, imagining how VFX artists would make this planet look once filming had ended.

"The Mandalorian" is one of the first major productions to choose LED walls over green screens. And the benefits for the actors are just the tip of the iceberg. LED walls make the lighting better, filming smoother, and in certain cases, cost a lot less than using green screens. But to understand why the team behind "The Mandalorian" chose these LED screens, we have to understand just how they work.

"Mandalorian" showrunner Jon Favreau revolutionized virtual production while directing "The Lion King" and "The Jungle Book." However, the process for these two remakes still relied heavily on blue screen and post-production work. For "The Mandalorian," LED wall technologies seemed like the next logical step given the show's production budget and time frame.

Now, you may be thinking, 'This isn't so new, I've seen something like this before.' And you're right, kind of. The predecessor to what we see on "The Mandalorian" is a driving scene like this one, from "Dr. No." You've got the actor in the car and behind them, a screen with footage of the road they've traveled. But the technology was limited. Say you want to move the camera angle during the scene. That projected footage can't move with the camera.

But by using Unreal Engine, tech borrowed from the video game field, that problem is solved. Artists can create a photorealistic 3D background that moves strictly with the camera's field of view, known as the frustum. So if the camera swings around and changes angles, the background shifts in precisely the same way. This allows motion-tracked cameras to execute traditional cinematography techniques within the virtual set, achieving cinematic movements like the parallax effect, where an object in the foreground moves at a different speed than the background, amplifies the illusion of filming at an actual location. Now that LED screens can move with the camera's eye, virtual sets can solve a bunch of green screen problems. The biggest one probably being lighting.

"We've all seen movies, TV shows, where the

lighting on the day didn't necessarily match the post-production work that was added many, many months later." That's Richard Bluff, Industrial Light and Magic's VFX supervisor for "The Mandalorian." He says lighting is one of the key benefits of working with virtual sets. The light coming from the LEDs provide realistic colors and reflections on the actors and props, something you simply can't achieve with green screen. They are also able to completely avoid the problem of spill. To better understand that, we talked to Kim Libreri at Epic Games, creators of Unreal Engine, which was used to build the virtual sets for "The Mandalorian." "The problem with the green screen is that you have to have a green screen behind you. And what that does is that instead of projecting beautiful lighting for what the environment would be behind you, it basically puts a lot of green light on you. And we call that "spill." If you wrap an actor with a big 360 LED wall, you can light in a way that you would never be able to do on a green screen. So you can really make it feel like the characters are embedded in their environments."

This green screen spill would've been an even bigger problem than usual for "The Mandalorian," whose main character gets a shiny new suit of armor early on in the season. So realistic lighting from the LEDs makes the show look better. But virtual sets help with practical concerns too. Take this scene in the office of The Client, played by Werner Herzog. In a scene like this, surely, they just built a simple set, right? Wrong. All of this is that same LED screen. According to Richard, only the desk, the floor, and one or two columns were really there.

"Everything else was displayed on the screen. But this allowed us to limit the amount of stage space that we used in shooting season one of "Mandalorian," which has, understandably, a big impact on time and budget."

To be fair, the initial investment in a virtual set like this is huge. However, the creators claim that money saved from traveling to locations, building new sets, and costly post-production, can make the investment worth it. Along with saving time and money, the team developed a system that allowed artists to make changes and control the world on the day of shooting. Settings like exposure, color, animation playback, and fill lighting are available to the filmmakers at

a moment's notice. If they want to move a mountain from one side of the virtual set to the other, they can, right there on set. Not only is it helpful for the actor, who no longer has to imagine where that mountain is, but it's a game changer for the director of photography. "Because in the distance, if there's a mountain range that is a story point, then the DP's no longer guessing where those elements are, he can frame up to them", says Richard.

The virtual set constructed for season one was 75 feet in diameter, 21 feet high, and also had a roof composed of LEDs. The cast and crew referred to this space as "The Volume." "And we had doors that can kinda close in to almost give you full 360-degree coverage of LED screens, minus the floor. It's driven by a small group of machines running Unreal and our Stagecraft technologies," says Richard.

At the end of the day, the big question is, do virtual sets really mean the end for green screens? Well, even "The Mandalorian," with its technological advances, used a version of a green screen, but via the LED wall. Another capability of virtual sets is to choose pinpointed areas of the wall and turn those green.

"Now, we now have the ability to limit the amount of green screen that's visible behind the character. So now it doesn't wrap around the entire stage, it's just a little piece, but also, they gain the lighting from that environment. Which gives us a more seamless result in post-production," says Richard. Additionally, scenes involving explosives are best kept to traditional methods. This is to prevent LEDs from getting damaged.

So will green screens survive this wave of tech innovation?

"Eventually, of course, we hope never to use green screen. But I still see that there will be a future for it in the short-term, because there's likely always a need to remove people, to add additional action behind them. But we are getting to the point where the amount of green screen that's being used is massively reduced and the sky's the limit right now," says Richard.

Srinivasrao Challapalli
Asst. Professor

WAR OF WORDS AND THE WORLD OF BINARIES



Everything under the sun functions by the dictates of the law of binary opposition. This means there are two sides to everything – whatever be the subject matter, issue, action, event, situation or person. Being aware of the latent presence of the law of binary opposition can be liberating when you are party to an argument.

In the context of an argument, this simply means when you agree with something, you disagree with some other thing, albeit not overtly. This duality may not necessarily be a boon to humanity. But, knowing the presence of this element is more than crucial when you take part in an argument based exercise such as a debate or a moot court competition. This allows you to concentrate on bringing the whole truth to the table (as opposed to defeating the opponent which some contenders tend to position as their sole aim) which ought to be the primary purpose of a debate.

Scholars consider proverbs to be timeless tools that come handy when you put forward your point especially in a war of words where confrontation is not a mere feature of the system

but the structure itself. Proverbs summarize the wisdom of mankind, which it has acquired through ages and hence is an obvious choice for contenders.

If you notice, you will find there is an interesting binary for every proverb. Here are a few:

The pen is mightier than the sword.

But

Actions speak louder than words.

The best things in life are free.

But

There is no such thing as free lunch.

Absence makes hearts grow fonder.

But

Out of sight, out of mind.

All good things come to those who wait

But

Time and tide wait for no man.

Selvi S

Asst. Professor

Yeh Hai Mumbai Meri Jaan!



'Ae dil hai mushkil, jeena yaha, jara hatke, jara bachke, yeh hai Bombay meri jaan...!'. Bombay...Bumbai...Mumbai! Mumbai, the sound of this word lets us know the royalness of the city. Actually, Mumbai is not even a city, it's a feeling! A feeling which can be experienced only after 'living' the city. The feeling where roads are never empty and people breathe on the local train timings. It's a feeling where night outs and 4 AM chai-poha is the most satisfying meal ever.

A city which manifests dreams! I remember one of my students who was from Kashmir told me once, "Ma'am, I want to work in the film industry, Socha hai Bumbai aaunga, films banaunga!". But, Mumbai not only allows us to dream but also teaches us to survive. Survive through the struggle, and survive to become a 'Mumbaikar'. As famous Marathi author, PL Deshpande says, "If you want to become a Mumbaikar, then the first thing you need to do is, be born in Mumbai. Once you are in Mumbai, you automatically become a Mumbaikar, in fact, you can't become anyone else. If you are an outsider, willing to become a Mumbaikar, you should understand that the past has no value in Mumbai. Mumbai always follows the present and future".

Another fascinating thing about Mumbai is its lifeline...local trains. While traveling in a local train, one can learn to deal with various situations in life. Local train traveling does improve your decision making skills. During rush hour, after getting on board, deciding where to sit is a live-die situation. Local trains also teach you to adjust. Even though the bench seat is entirely full, one should be able to say, "thoda sarko, thoda sarko". A Mumbaikar's life is incomplete without local trains. Journalist - Writer Arun Sadhu, in his book 'Mukti' developed a character whose life is entirely dependent on local trains, he does his job only to travel via local trains, after retirement, he still catches his fixed timed local train and travels the entire Mumbai. Every Mumbaikar has their own local train family, where they eat, travel, live together which defines them as a Mumbaikar! Mumbai and Mumbaikars are like a phoenix! A phoenix that rises from the ashes. The fogged and blunt wind of Mumbai carries the feeling of independence and liberty. The moist climate here transfers the sentence to wake and conquer the world.

Shruti Joshi
Asst. Professor

#KnowTheSigns of Modern Slavery



Exploitation = Modern Slavery



2021 GLOBAL ESTIMATES OF MODERN SLAVERY

The latest Global Estimates of Modern Slavery was published by the International Labour Organization (ILO), International Organization for Migration (IOM) and International Human Rights group "Walk Free."

What is Modern Slavery?

- The term modern slavery is not **defined under any law**.
- It is a general term used to **describe situations of exploitative nature in which the person cannot refuse or leave** due to threats, violence, deception, and abuse of power.
- Modern slavery includes exploitative acts such as forced labour and debt bondage, **forced marriage, and human trafficking**.

Highlights of the Report:

The Report revealed that last year, some 50 million people (approximately 28 million in forced labour and 22 million in forced marriages) were living in modern slavery. It means there are 6.4 victims of modern slavery for every 1,000 people in the world. Women and children were the most vulnerable according to the report. Findings of the report also said that 10 million more people were trapped in modern slavery in 2021 against the 2016 global estimates. 1 in 4 victims of modern slavery are children.

Out of the 28 million people trapped in forced labour, 17.3 million people are exploited in the private sector such as domestic work, construction or agriculture; 6.3 million persons in forced commercial sexual exploitation, and 3.9 million persons in forced labour imposed by state authorities. Women and girls account for more than three quarters of those in forced commercial sexual exploitation.

The Arab states had the highest prevalence of modern slavery with people from Asia-Pacific region subjected into it. Increases in child and forced marriages have been reported in Afghanistan, Bangladesh, India, Indonesia, Sudan, Egypt, Yemen, Jordan, Senegal, Uganda and the Democratic Republic of the Congo. The COVID-19 pandemic increased the risk of modern slavery further making the target of ending slavery among children by 2025 and universally by 2030. The report states that this crisis has resulted in unprecedented rise in chronic poverty, lowering of education rates, growth in migration due to distress, and alarming rise in reports of gender-based violence. These factors are closely linked with increased vulnerability to forced marriages. Once forced to marry, there is greater risk of further exploitation, including sexual exploitation, domestic servitude and violence and other forms of forced labour both inside and outside the home.

Recommendations by the Report

The report proposes a number of recommended actions which include:

- 1) Improving and enforcing laws and labour inspections
- 2) Ending state-imposed forced labour
- 3) Stronger measures to combat forced labour
- 4) Extending social protection
- 5) Strengthening legal protections
- 6) Addressing the increased risk of trafficking and forced labour for migrant workers and
- 7) Greater support for women, girls and vulnerable individuals.

Viraj Bandekar

Asst. Professor



PR, AI and OE

Public Relations has always been an astounding concept for me personally. The way PR has evolved and is..... clearly defines its exorbitant scale and colossal scope as an industry. Many stalwarts of Public Relation practices believe that AI (Artificial Intelligence) is a breakthrough in the industry under the ambit of technology, which happens to contemplate enhanced; AI-assisted recommendations suggesting contacts to pitch, AI predicting a pitches chances of earning coverage, Better collaboration for PR teams, Podcast monitoring, integration with Google Analytics to measure referral traffic from earned media. In media relations, you are constantly on the hunt for reporters and influencers writing about your industry.

Media relations being a meticulous part under the broader umbrella of Public Relations plays an essential role when it comes to media outreach. It would be nice if the tools enabled by AI pivots to support your efforts and analyze your activity automatically keeping an eye out for recommendations on your behalf. To simplify, the tool says, "We saw you pitched X reporter, you might also pitch Y reporter too because they cover Z topic."

Prolific traits of AI ensures OE (optimistic estimate) associated with predicting pitches along with chances of earning coverage. As per Sword and the Script Media, LLC a veteran-owned boutique public relations and marketing consultancy specializing in PR, marketing and social media for the business-to-business (B2B) technology community. "AI apps have imbibed features that shall analyze millions of stories from thousands of reporters to produce the probability of a journalist covering your story."

Audio is changing how we search for – and consume information. Podcasts are increasingly part of that trend. More than 100 million Americans listen to podcasts monthly, according to The Infinite Dial 2020 by Edison Research. Critical Mention has built its own podcast monitoring feature. It includes the ability to edit clips, and "speech-to-text technology" for searching keywords. Other vendors, including Cision, Meltwater, Muck Rack, Propel and Burrelles have all partnered with broadcast monitoring specialist TVEyes to provide it.

Propel says that while TVEyes is "the basis" of broadcast monitoring, the company has "built layers of data and analysis on top of it" that "enables certain functionality that no other broadcast monitoring tools have." Muck Rack makes a similar claim. It says it has "integrated TVEyes in such a way that makes the experience organic and seamless all-in-one platform." Muck Rack also has also created a podcast contact database.

To understand marketing attribution of earned media. Let's say if a prospective buyer reads coverage you earned and then downloads a white paper a week later, or even makes a purchase, you'd want to be able to attribute those outcomes with your effort. That's the sort of information you need for PR measurement and to mathematically calculate ROI (where $ROI = \text{return}/\text{cost} \times 100$). Cision and Onclusive are two companies that have monitoring tools that do this. Cision calls their tool Impact and uses the same technology and partnerships that digital advertisers use to get the information. The above mentioned AI sites and apps vitally embarks to imprint the idea of OE(Optimistic Estimate). Features and functioning of AI that has grown exponentially seems riveting for the Public Relations stream. It is for definite to stay and boom as far as it can be farsighted as of now.

Kinjal Sheth Tandon
Asst. Professor

Soft Skill dynamics: Importance and Relevance



The need for soft skills has increased more than one could have imagined, leaders are looking for demonstrable soft skills along with hard skills to get the job done efficiently. Hence soft skills play a crucial part in career and day-to-day affairs.

What are Soft Skills?

These are individual competencies that contribute to your professional growth and achievement. These could relate to work integrity, social and emotional intelligence, individual working style, communication skills, career attributes, active listening skills, and interpretational skills.

These are non-technical skills that have a great influence on performance at the workplace and are difficult to measure unlike hard skills or technical skills that are picked up during on-job training in schools or colleges.

These are difficult to learn in a classroom environment. But one could have developed some of the skills while in school, college, or have had some amount of work experience. Like team building, collaboration, time management, creative thinking, empathy etc.

Why Are Soft Skills Important?

Employers and hiring experts, while reviewing prospective candidature primarily because these skills are transferable. This means that even though a candidate may not have all the required hard skills or technical skills, but if they possess certain skills like teamwork, problem-solving, critical thinking, and leadership skills, it makes them flexible to be hired in various domains and levels.

Hence these non-cognitive skills as they are referred to most of the time take precedence

over technical skills during the hiring process. These skills help the recruiter differentiate between an ideal candidate and an adequate candidate who could be hired and be groomed to grow in a role. Employers value people with soft skills as it helps foster relationship building both internally with colleagues and externally with clients and customers and enables the business to flourish by resolving any conflicts that may arise. While cognitive skills and certifications are vital, it is not the only thing that gets a job done, your personality traits and attitude make you a sought-after employee.

Hiring managers know that the non-cognitive skills have led to efficiency gain and increased productivity which has resulted in business growth. Below are a few crucial skills that every recruiter looks for in an ideal candidature:

- Decision-Making
- Critical & Creative Thinking
- Communication Skills
- Teamwork
- Emotional Intelligence (EI)
- Empathy
- Time Management
- Conflict Resolution
- Problem Solving
- Flexibility

One of the most sought-after soft skills is time management, which is a process of organizing, prioritizing, planning, and delivering the work within the stipulated time frame. When working with a group of people, it's obvious that there may be disagreements and not everyone will be in consensus. There could be various reasons for conflicts to arise like: miscommunication, poor management, a difference of opinion due to personality clashes, and different working styles.

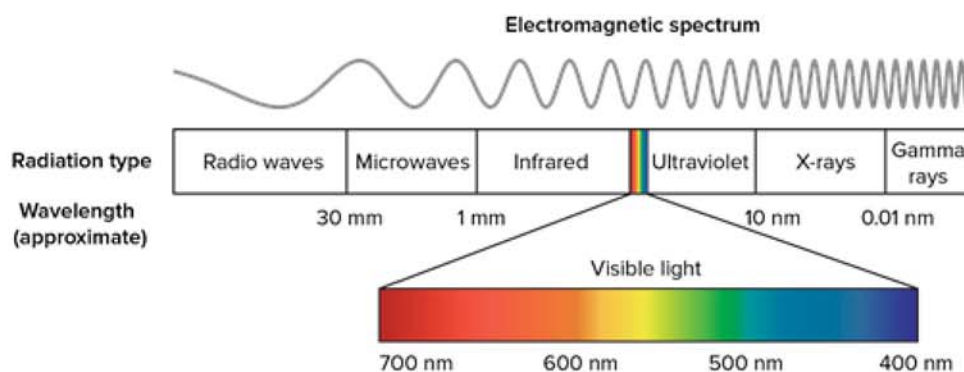
The way we work and communicate has changed phenomenally in the 21st century, which is an era of the digital world. Communication skills and dynamics are being picked up to be competitive and have completely revolutionized traditional communications.

Dr. Kiran Walia
Asst. Professor

LOOKING BACK IN TIME

It took more than 20 years to build, and it will allow humanity to see into the beginning of time itself. The James Webb Space Telescope, which safely launched on a rocket on Christmas Day 2021 to its cosmic destination a million miles away from Earth, is the successor to NASA's Hubble Space Telescope, but 100 times more powerful. It promises to open up new vistas and scientists are convinced that what the telescope shows will have them rubbing their eyes in astonishment all over again.

The Webb telescope, developed by NASA in collaboration with the European Space Agency and the Canadian Space Agency, has been dubbed "the world's largest and most sophisticated space science observatory." It is named after NASA Administrator James E. Webb, who served from 1961 to 1968, and is most widely associated with the Apollo lunar missions. To make the mission possible, technological improvements and perhaps new technologies were required. Some of the inventions have already enhanced life on Earth, like as a technology developed by Webb engineers that is now used for LASIK eye surgery. It will be the "most powerful space research telescope ever built," according to NASA, and will profoundly change "how we think about the night sky and our place in the cosmos." While Hubble gave fascinating insights into galaxies, the presence of black holes, and the formation of stars, it did so by viewing the universe through visible and ultraviolet light. Webb, on the other hand, focuses on infrared waves, which NASA describes as "a wavelength crucial for peeking through gas and dust to detect distant objects." By utilising near-infrared and mid-infrared wavelengths, the Webb telescope will give Hubble's extraordinary resolution with much greater sensitivity. The telescope is so sensitive that it could conceivably identify a bumblebee's heat signature from the Moon's distance, and it can observe the entire cosmos, from planets to stars to nebulae to galaxies and beyond.



The primary goal will be to look at the universe's oldest stars in order to understand how the universe started and expanded following the Big Bang. That's because, by casting its gaze billions of kilometres into space, the Webb telescope will be peering back in time. You know how this works: because light from all stars arrives with a delay – a ray from the Sun, our nearest star, takes eight minutes to reach Earth – what we finally see is how that star looked when the light ray left it. That is, if the Sun went out, humans on Earth would only notice after eight minutes. When the Webb telescope looks at a star whose light takes billions of years to reach it, it is essentially staring back in time.

The universe is expected to be roughly 13.8 billion years old, and the Webb telescope will look back over 13.5 billion years to view the earliest stars and galaxies growing out of the blackness of the early universe.

Sudeep Mehta

Asst. Professor

Dolls and Visual Communication

Toys have been a part of any culture since time immemorial. They have evolved over the years and are a representation of the culture of a community, society, and country at large. Since globalization has brought the world at our doorstep, the toys from other cultures have also become a part of the global culture. The popularity of the toy industry is reflected in the traditional Laiphadibi doll-maker from Kongsam Imphal Kongsam Ibomcha Singh receiving national recognition in the form of Padma Shri for 2022.

Indian dolls have evolved over the past 5000 years, from the Indus Valley Civilization to the current millennium. The famous dancing doll from the Indus Valley Civilization is a bronze statue of a girl, but the other statues found are of either bronze or terra cotta. These toys had both traditional and cultural values. It is also a representation of religion that were used for some rituals and then later given to children to play with.

With every passing era and developing technology, dolls also have seen the evolution with different materials being used and dolls becoming more colourful. Each state in India has a cultural representation in the form of colours being used. This is also reflected in the dolls from each state. The toys are made from eco-friendly materials like cloth, clay, terra cotta, cotton, wood, palm leaves, handmade paper for protection of the environment. (Mishra, 2020)

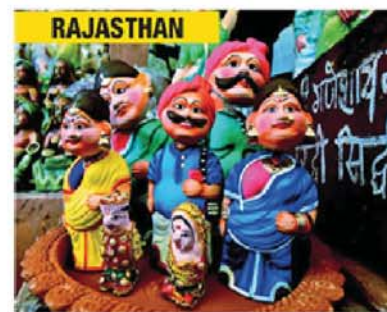
With changing era, toys also become the reflection of societal change and very crucial in the study of history.



Veer, 2004



ARTS OF THE INDUS VALLEY, 2021



(TNN, 2020)

A toy's appeal lies in the way it is perceived by children. They like to have a small world of their own in the form of toys. This world of theirs follows all the traditions, values and norms of the society the children live and will also celebrate all the festivals of that particular society.



Asharikandi Terracotta toys – Assam
Source: Abhijna Museum



The Wooden Toys of Varanasi | Uttar Pradesh
(Sultan, 2020)



Kondapalli Toys – Andhra Pradesh
Source: Adityamadhav83



Thanjavur Dolls – Tamil Nadu
Source: Sksiddharthan

The diverse culture of the Indian subcontinent is also reflected in the different colour, visual representation and the look of the toys from that region.



(Indian Wedding Doll, n.d.)



Clothes of Grooms And Brides in different Indian states
at International Dolls Museum, 2019

The journey from Harappan dolls to Barbie has highlighted the change in form, look and even the material used for making dolls. The range existing today is very vast from cloth to cotton to rag dolls, puppets, hanging dolls, key rings to the plastic dolls most prevalent today.



(ARTS OF THE INDUS VALLEY, 2021)

Today the reflection of the American beauty is seen globally in Barbie dolls. This representation of American beauty is accepted by children in all the countries. The doll has become a symbol of the accepted norm of beauty in real life too, beauty that all women strive to have forever. An article written in The Odyssey explains, "Barbie entered into the world during a time where society needed direction. During the Civil Rights movement, Barbie's real-life structure in society mixed with young girls' imagination and influenced little girls into wanting to be just like her" (George, 2017).

The toy industry in the current scenario has a lot of scope as there are only a few players. The industry will have to innovate and accept that the children and their perspective has changed and this change has to be reflected in the look of the toys once more.

Kanchan Luthra
Asst. Professor



MAGIC OF AUTO TUNE & CREATIVE PITCH CORRECTION TECHNIQUES.

A strong pitch-correction programme called Antares Auto-Tune is already pro standard for polishing wrongly sang vocal performances.

It's one of the few genuinely unique musical advancements of the last few years, in my opinion. Other devices may use more cutting-edge technology, but Auto-Tune offers a workable solution to the very real issue of pitching errors through a software programme.

Primary purpose is to tighten up vocal pitching, which it does quite well. However, after some further testing, I discovered that the system can also be utilised to create artistic effects and enhance monophonic instrument performances. This article is not a re-review of Auto-Tune, but rather a look at some of its interesting features of it.

The crucial shift with Auto-Tune came when artists began to use it as a real-time process, instead of as a fix-it-it-in-the-mix application after the event. Singing or rapping within the booth, being attentive to their own Auto-Tuned voice through headphones, they learned a way to push the effect. Some engineers will record the vocal in order that there's a "raw" version to be

restored later, but—increasingly in rap—there isn't any uncooked original to figure from.

Rap of the 2010s is where that process has played out most obviously and compellingly: MCs like Future, Chief Keef, and Quavo are almost literally cyborgs, inseparable from the vocal prosthetics that function their bionic super powers. But we will also hear the long-term influence of Auto-Tune on singing styles. Vocalists have learned to bend with the effect, exploiting the super smooth sheen it lends to long sustained notes, and intuitively singing slightly flat because that triggers over-correction in Auto-Tune adds the artefacts which creatively used as an audio effect.

Knowing the basics of how Auto-Tune operates is helpful before using it. A system like Auto-Tune needs to be able to read the pitch of the incoming signal in order to adjust pitch. Once the pitch has been identified, Auto-Tune employs pitch-shifting methods to adjust the original sound's pitch so that it matches the note that is closest in the user-defined scale. The pitch of a poorly sung note may be corrected to a "illegal" (out-of-key) note since that's what it occurred to be nearest to if Auto-Tune is left set to a

chromatic scale (i.e., one encompassing all notes). It is much preferable to insert only the notes that the piece of music uses.

Getting incoming sounds to the correct pitch is only part of the solution; if that were done too effectively, the result would be a vocal performance that was exceedingly flat and pitch-quantized. Fortunately, there is a slider to control how quickly correction occurs. By carefully tuning this, natural bends and vibrato are preserved, but as soon as the input rests on a particular note for any length of time, perfect pitch is applied.

Because Auto-Tunes feature to control the formant, any sound that is changed much begins to sound artificial. This effect can be creatively misused by purposefully setting enormous intervals. To see what comes out the other end, you could, for instance, create a target scale that only contains octaves and fifths. Then sing a load of made-up 'pseudo-ethnic' nonsense to see what comes out the other end.

In this case, the pitch difference between what you're singing and the nearest scale note is set to determine how your voice will sound. For instance, if you sing a tone that rises steadily, the pitch won't change until you reach close to the next note in the target scale. But as the pitch

shifter strains more to adjust it, the timbre of the fixed note will alter. In this case, the pitch-shifter will make an effort to lower the note's pitch to make up for your larger vocal range, which will result in a darker, bigger timbre.

Because Auto-Tune works so well, I'm always adding to the list of things I want to try using it for. It should be simple to fine-tune a monophonic slide guitar, but you can accelerate pitch correction and convert it back to a chromatic instrument if you like. You may create an electric slide dulcimer by setting a scale!

Likewise, people who can just play a little bit of violin, cello, or fretless bass may discover that their attempts become far more musically helpful after a trip through Auto-Tune. Paul Farrer's experiment proved that it was possible to increase the pitch accuracy of a cello part played quite well without having the effect sound processed.

Perhaps Auto Tune and other pitch correction software and techniques are one of the main reasons why so many non-singers have become famous overnight.

Chandroday Ghosh
Audio Engineer



OPPORTUNITIES AND CHALLENGES FOR INDIA IN THE NEW 'METAVERSE'

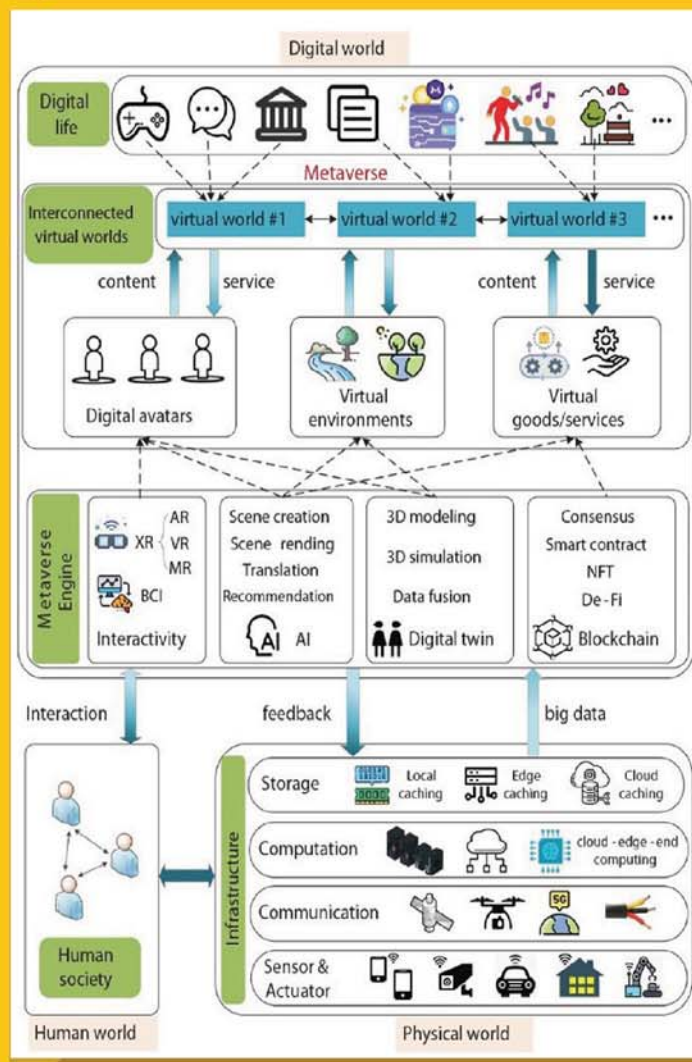
Metaverse is a portmanteau of the words 'meta' and 'universe' that describes a virtual environment created using technologies like blockchain,[a] computer vision,[b] pervasive computing,[c] scene understanding,[d] and ubiquitous interfaces.[e] It is a new form of the internet that is emerging as the very nature of user experience is changing with Web 3.0. For the public, video games and e-gaming is considered to be an entry-point to the metaverse. The growing Indian gaming industry has the potential to leverage this opportunity to shape the metaverse technology and become a global frontrunner. There are a few countries that have had some headstart in exploring the uses of the metaverse. In South Korea, for example, the metaverse is used for hosting virtual meetings using Ifland, a platform developed by SK Telecom where users can participate through their digital avatars. In the United Arab Emirates (UAE), a virtual version of Dubai city, called 'MetaDubai', is being built in the metaverse.

This brief explains the cutting-edge metaverse technology, including its applications and characteristics, and outlines its intersection with the gaming industry. It highlights recent advancements in the technology, and the opportunities and challenges they present to India.

An Emerging Concept

The architecture of the metaverse is a combination of the human, physical, and digital worlds (see Figure 1).

Figure 1: Architecture of the metaverse



Source: Wang,

Yuntao et al., "A Survey on Metaverse: Fundamentals, Security, and Privacy." [1]

While equipped with a Head-Mounted Display (HMD), users control their digital avatar that interacts, plays, and socialises with other avatars using immersive technology. To build a virtual world, physical infrastructure such as sensors and actuators for multi-sensory data perception, a high-speed communication network for transmission of data, and high computation processing capabilities and storage are equally important to provide a seamless experience for the transition to the virtual world.

Communication networks, chips, processors, and cloud computing will also be active participants in the evolution of the metaverse, making it multi-technology. Hyper-spatiotemporality is another characteristic of the metaverse—i.e., it breaks the boundary of time and space. Though metaverse creates a virtual world parallel to the real world, unlike in the real world, metaverse breaks the limitation of space and time as it operates on a space and time that is distinct from the real world. It allows transcending the constraints of both, time—by returning to the past and approaching the future, and of the physical space by crossing space in the metaverse.

AI helps enrich the metaverse ecosystem by empowering users in content creation through recommendations and performing personalised avatars. AI and analytics help derive knowledge about the user and model the services according to their preferences to offer a more vivid and unique experience. Meanwhile, technologies such as blockchain help in monetisation of content and trading between avatars. Digital assets such as Non-Fungible Tokens (NFT) [f] act as a barter commodity in the metaverse that can also be converted into currencies in the real world.

In the virtual world, a completely new universe is open to users. Virtual Reality is a type of immersive technology [g] that includes 360-degree viewing, Augmented Reality [h] (AR), and Mixed Reality (MR). While VR isolates the users from the outside world using a head-mounted display, 360-degree viewing and AR extend the reality. AR is in use in many industries, including social media in Snapchat filters, and gaming such as Pokemon Go.

Extended Reality (XR), meanwhile, creates a computer-generated three-dimensional world that allows humans to experience and communicate in the virtual world which is a persistent universe that does not switch off with the device. Leveraging the technologies of VR, AR, and MR, the metaverse will evolve with enhanced functionalities with the help of blockchain, AI, and connectivity technologies.

Activities in the initial stages of the metaverse are imitations of their real-world counterparts in the virtual world, where two parallel spaces are present. In the second stage of the metaverse, users can create native content such as avatars that are only present in the virtual world. This stage provides an opportunity for massive content creation, promoting innovation in the digital world that can transform the process of the physical world, thereby blurring the lines between the two spaces. The mature stage of the metaverse will be a self-sustaining surreal world that subsumes the real world into itself. The complete integration of the virtual and real worlds can be experienced in the mature stage of the metaverse.

Shalu Balan

Asst. Professor

A well-educated mind will always have
more questions than answers

– Helen Keller

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