The Pale Blue Dot – The Place We call Home
by Nitin Uchil

We have progressed as a civilization by learning from nature, and created science and mathematics to understand its functioning. In doing so we have tapped into Earth's resources to mine, drill, cultivate and forage; built large metropolises, traversed the seas, learned to fly and enabled communications. Our consternations as peoples have also manifested as wars which have only intensified in magnitude with our technological prowess.

Today, as we plan our next iteration as a civilization, there is need to reflect on our checkered past – to glean the good from the bad, the possible from the improbable, the basics and the fundamentals. We need to understand the complexity of the systems that we are undertaking to build, so that as we progress, we account for the knowns and unknowns, and are mindful of its workings and the consequences. There is this push to escape from earth and its problems, but as carbon based entities are we fit to live beyond our earthly confines? Can we build systems to do this that are purpose driven, safe and effective; and yet enable us to stay true to our cherished belief of freedom?

Also, if we can occupy Mars, why can't we save Earth? Utilizing the Pale Blue Dot as the backdrop, here is a summary of my intentions, as I put forth an assimilation of engineering and technology systems coupled with our learnings from history to embark on providing a basis for products and services for Industry 4.0 and beyond.

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PREMISE

“Look again at that dot. That’s here. That’s home. That’s us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every “superstar,” every “supreme leader,” every saint and sinner in the history of our species lived there.

The Earth is a very small stage in a vast cosmic arena. Think of the rivers of blood spilled by all those generals and emperors so that, in glory and triumph, they could become the momentary masters of a fraction of a dot. Think of the endless cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner, how frequent their misunderstandings, how eager they are to kill one another, how fervent their hatreds.

Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.

It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we’ve ever known.”

— Carl Sagan, Pale Blue Dot, 1994

Pale Blue Dot *is a photograph of planet Earth taken on February 14, 1990, by the Voyager 1 space probe from a record distance of about 6 billion kilometers (3.7 billion miles, 40.5 AU), as part of that day's Family Portrait series of images of the Solar System. Voyager 1, which had completed its primary mission and was leaving the Solar System, was commanded by NASA to turn its camera around and take one last photograph of Earth across a great expanse of space, at the request of astronomer and author Carl Sagan. He acknowledged that such a picture would not have had much scientific value, as the Earth would appear too small for Voyager's cameras to make out any detail, but it would be meaningful as a perspective on humanity's place in the universe. The phrase "Pale Blue Dot" was coined by Sagan himself in his reflections on the photograph's significance, documented in his 1994 book of the same name*

BACKGROUND

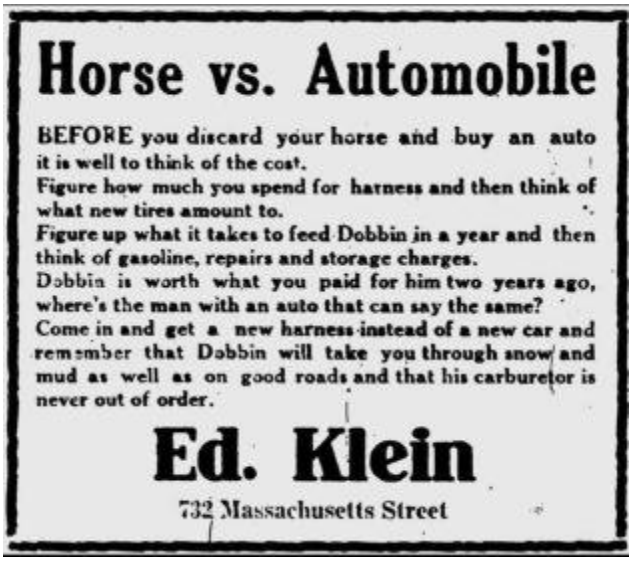
As I embark on my brand-new undertaking, the above statements by **Carl Sagan** are a poignant depiction of our place in the universe. It is also a reminder that the little blue dot you see is all we have and have ever known. It is important to be mindful of the changes we make when we flaunt our technological prowess, be it in terms of harming peoples by developing weapons of mass destruction or engaging in war and terror activities, or even changing climatic conditions by human population explosion and its consequences like deforestation and pollution.

"Progress is the mode of mankind" is one of the themes in **Victor Hugo**'s Les Miserables. Set in the backdrop of the French Revolution, it is a story of how progress can also be harsh, stops its forward momentum and even backtracks from benefiting society. The discourses between **Einstein** and **Freud** are also a salient testament that as a species we have also indulged in the bad. Einstein admired Freud's work and believed that some of his psychological insights could help him unravel the eternal problem of man's affinity for violence. In their correspondence on Violence, Peace, and Human Nature, the two of them discuss human nature at length and muse on both tangible and abstract ways of reducing violence and war in the world. This dialogue goes into considerable depth to fathom the psychological roots of mass violence. Both great minds then struggle and find no immediate solution to the problem of war. Rightly or wrongly Freud proposed that education and inculcating culture in individuals and societies may hold promise in the long run.

The different versions of the Industrial Revolution have effected changes to civilization in enormous ways.

- The **First Industrial Revolution** was the Age of Mechanical Production where we moved from an agrarian society to an urban centric production basis beyond the needs of agriculture. This was facilitated by the invention of steam engines and electricity.
- The **Second Industrial Revolution** was the Age of Science and Mass Production where we forayed into the different disciples of science: physics, chemistry, math and space, and also harmonized assembly lines so that we could create products at scale.
- In the **Third Industrial Revolution** we used digital technologies to facilitate communication, just-in-time processes and real time interactions to optimize the producer-customer experience.
- In his book **The Fourth Industrial Revolution**, Klaus Schwab, the founder and executive chairman of the World Economic Forum, the International Organization for Public-Private Cooperation describes an industrial revolution as the appearance of "*new technologies and novel ways of perceiving the world that trigger a profound change in economic and social structures*." He asserts that there are four distinct periods of industrial revolution throughout history, including the one we're beginning right now called Industry 4.0.

At the turn into the 20th century, there was a bit of consternation about moving to motorized vehicles from horses and carriages. Alongside is a real advertisement placed by a Horse Buggy company that lists the demerits of buying an automobile. The book **Horseless Carriage: The Birth of the Motor Age** details this metamorphosis in the way we travel, and also how the initial designs of the motor cars also had a place in the dash for the driver to keep their imaginary whip. We still



Horse vs. Automobile

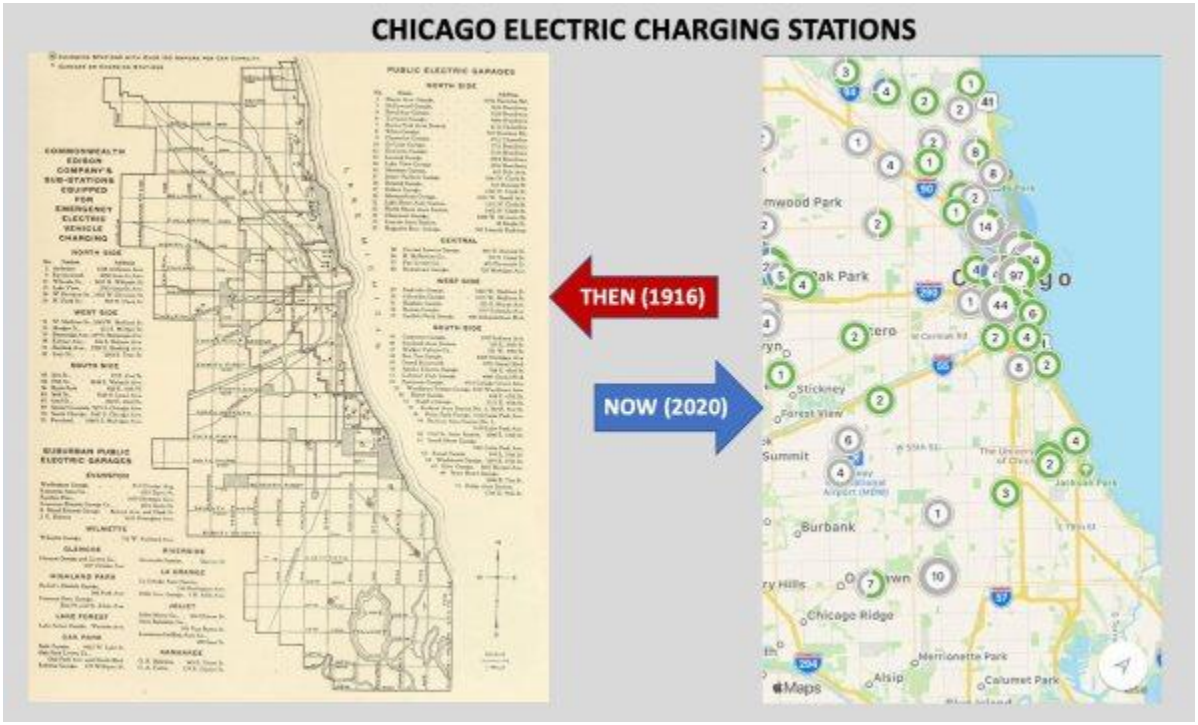
BEFORE you discard your horse and buy an auto it is well to think of the cost.
Figure how much you spend for harness and then think of what new tires amount to.
Figure up what it takes to feed Dobbin in a year and then think of gasoline, repairs and storage charges.
Dobbin is worth what you paid for him two years ago, where's the man with an auto that can say the same?
Come in and get a new harness instead of a new car and remember that Dobbin will take you through snow and mud as well as on good roads and that his carburetor is never out of order.

Ed. Klein

732 Massachusetts Street

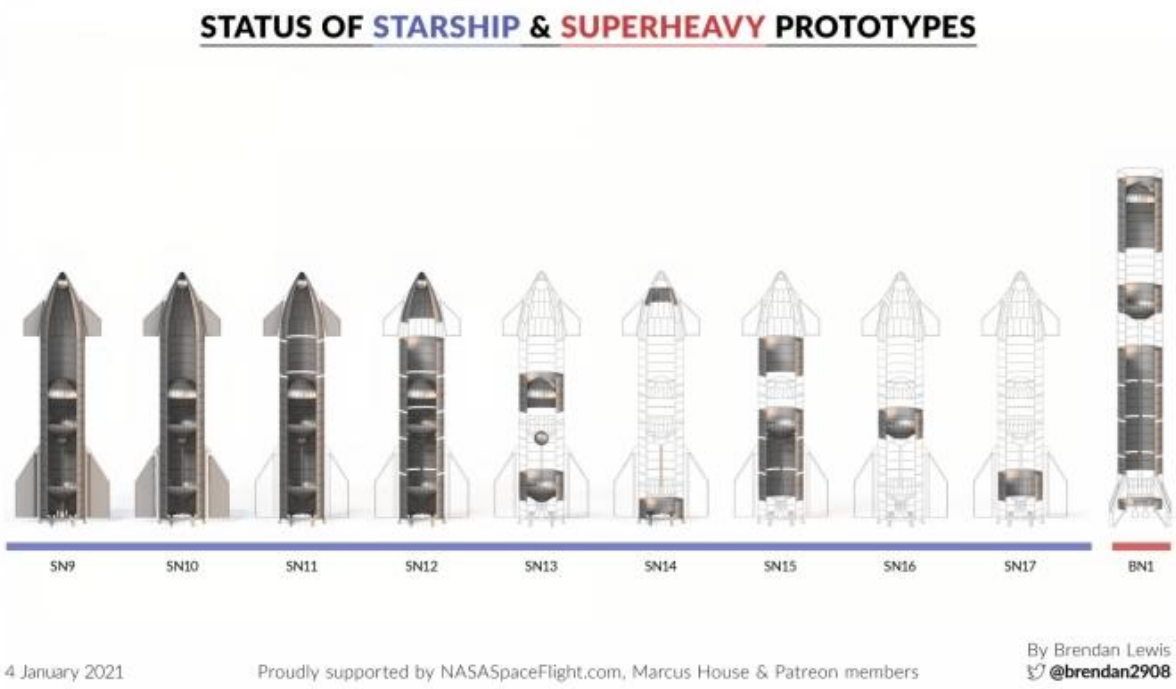
count power in terms of the unit invented to denote the capacity of a steam powered engine to replace horses. Horse-power anyone?

Albeit, electric cars are the in-thing in today's vehicle market, with Tesla in the forefront, electric motors are not new. Right from the start of Industrial Revolution in the 1800s, trains, trams and trolleys have been part of transportation as the large cities came to be. I remember having taken the tram in the mid 1960's in what was then called Bombay that had a series of trams and trolleys that ran the length of the city. Of course these lost out because of the needs of overhead wiring or the third rail which became a safety hazard as the cities became more populated. We still see vestiges of this in cities like San Francisco and Seattle. There was a far bit of electric cars then too, before the Internal Combustion Engine (ICE) industry killed their market. I was surprised to find a detailed map of electric charging stations around the Chicagoland area – there were much more of these stations than there are today.



Of late, there has been a buzz of activity related to Mars. Since our current technology has limitations, when we sent out 3 successive probes (run by different nations US, China and the UAE) in 2020, it was the two week window once in two years that made our traverse thru the vast expanse between the planets possible. The 3 missions reached Mars almost simultaneously and the more famous of them has already landed the Perseverance (Percy) to travel on Mars's terrain and will have a robot fly over the surface using a drone copter.

Elon Musk has been advancing our technological prowess with PayPal, SpaceX, Tesla, Hyperloop, Boring Company and Neuralink. Making the world more connected with Starlink satellites and his ambition to make humankind a multi-planetary species with his ambitions to terraform Mars, Elon has probably effected more change than anyone else has, thus far.



Via SpaceX, Elon Musk has been trying to launch larger versions of his more successful reusable rockets, the Starship but has not yet succeeded to pin the landing in three attempts – SN8, SN9 and now SN10. I know that this debacle will not stop Musk in trying several more times as is already illustrated in the plan above. But using controlled chemical explosions to minutely manage the path and orientation of large space crafts would work in space, these would succumb to the non-linear effects of chemical reactions,

gravity, atmospheric drag and other unknowns aka the butterfly effect that would make it impossible even with the most sophisticated AI to manage correctly.

Recently, I wrote a blog article titled "**Occupy Mars?**" (see Sidebar) where I questioned the sensibility of sending humans to colonize Mars and the moon. In it I posit that we need our pets, our germs and our viruses (despite the Covid) to survive. Humankind cannot live in a pristine and constantly monitored environment – it is antithesis to our belief in freedom. Also, if we have plentiful resources to occupy Mars, why can't we save Earth or at least have it as our first priority?

SIDEBAR – Occupy Mars?

"Oddly enough, I actually think the odds [of a Mars colony] are pretty good. At this point I am certain there is a way. I'm certain success is one of the possible outcomes for establishing a self-sustaining Mars colony, in fact a growing Mars colony. I'm certain that it's possible. Whereas until maybe a fear years ago I was unsure whether success was even one of the possible outcomes."

— Elon Musk

The red planet is up-front and center in the news nowadays. SpaceX and NASA and Boeing are working on an planning to launch large rockets with humans to eventually colonize the red planet. There are three missions to Mars from 3 different countries – USA, China and UAE – that are orbiting Mars with some planning to land there and even bring samples back.

But would going to Mars make us free?

Freedom has always been the bane of mankind. Claims are made that human kind is not a one planet species. Perhaps a lot of this has to do with Science Fiction shows like Star Trek and movies like Star Wars. But I posit that we need our pets, our germs and our viruses (despite the Covid) to survive and humankind cannot live in a pristine and constantly monitored environment.

In the latest Musk interview on the Joe Rogan show @Spotify where they discuss the colonization of Mars, aliens, falcon landing, cars (hover mode on the Roadster?, the new no stalks but yoke steering on the Model S, Cybertruck, the Tesla makes the other cars seem dumb, their exercise in hubris – the Model X – Faberge Egg of cars – falcon doors, "you could actually do an operation in a X/S with the bio-wepon defense mode on", safety), air less tires, glass technology, solar, boring tunnels, sprinter vans, starlink, cell phone radiation, 5G, neuralink, Samsung vs Apple, Orwellian world in the making with Google and Facebook, the existential threat of AI, sentience, air-bag

deployment intelligence, carbon tax, Austin, Douglas Don't Panic Adams and life in general. I don't think anyone is asking the hard question.

https://open.spotify.com/episode/2aB2swgyXqbFA06AxPlFmr (3+ hrs long)

Engineering is easy as compared to biology because you think inside the box. Although Musk believes in fundamental principles and does use physics in thinking outside the confines of the known knowns, biologic is infinitely complex.

Multi species planet to a multi-planet species?

When Musk talks about humankind being a multi-planet species what about other species, what about our pets, what about the bacteria and virus we carry along with us, and the most important – procreation.

Also, we worry about global warming with the rise in CO2 whose percentage is 400 parts per million (0.04%) and are planning to occupy a planet whose CO2 concentration is more than 95%.

And how would an environment devoid of magnetic fields and low gravity and a different atmosphere make us free?

Al Gore, in defining global warming as an existential crisis for Earth called it an Inconvenient Truth, but I would posit like the Church Lady (Dana Carvey) puts it in SNL – It's a matter of convenience.

…. and, yes, the answer to life, the universe and everything is 42?

"Occupy Mars," Elon Musk's Twitter feed read on Wednesday. But for the SpaceX CEO, who aims to build a city on Mars by 2050, the first image may have made a rather crucial mistake.

The image, shared with Musk's 32 million Twitter followers, summarizes one of the space-faring company's main missions. Musk aims to transform humanity into a multi-planetary species, using the Starship to send up to 100 people at a time to the red planet.

The "Occupy Mars" slogan has featured on SpaceX t-shirts, and Wednesday's photo harkened back to one of Musk's most ambitious ideas.

There's just one problem: that's not Mars. The image actually shows the moon during a lunar eclipse.

In the far-flung future, Musk has talked about the possibility of terraforming the planet to make it into a more hospitable place. One idea would be to heat the planet at the poles and release its carbon dioxide stores, which means humans could walk around the surface with just a breathing apparatus. Releasing these stores could involve nuclear fusion explosions with low fallout.

Perhaps little wonder, then, that SpaceX now sells a "Nuke Mars" t-shirt. (but then, isn't that an image of our blue earth?).

I also firmly believe that human biology is too fickle to withstand the expanse of space and time, as is wonderfully described as a consequence in a novel by **Arthur C Clarke** that "perhaps the stars are not for man". In the novel "Childhood's End", understanding man's quest for adventure and to reach for the stars, a race of alien beings gently nudges humans against exploring beyond the near reaches of the solar system by fulfilling most of their desires. Thus, mankind was able to eventually achieve oneness with the universe by introspection rather than external conquest.

But this does not mean that we should not try!

SETTING

It is great to be a physicist and do engineering if you can, but it is time for engineers to do physics and expand our technological footprint with firmly grounded basics rather than just be inspired by the fundamental principles of physics.

Other than his contention that humankind is an interplanetary species, Elon believes that everyone should be an engineer (because Engineers Rule!), – and I appreciate this since I am one. Although this is coming from a physicist who tries very hard to be an engineer, I feel that an assimilation of characteristics is needed for a holistic solution. Too long has one domain being preferred over the other – science over philosophy is a good example in the end of the middle ages, engineering over others during the Industrial revolution, and recently Technology over Engineering because it ensures a job.

Here is a summary of the different professions that need to be assimilated together to orchestrate tomorrows landscape of products and services:

- As **mathematicians**, we are fascinated by numbers – its algebra, the geometric patterns it produces and the feeling of immense satisfaction when we Q.E.D. (finally solve a problem, Initialism of Quod Erat Demonstrandum – "what had to be proved; what was to be demonstrated": placed at the end of a mathematical proof to show that the theorem under discussion is proved.).

- As **scientists,** we are intrigued by nature and the universe, and are constantly on the quest of their origins, their progression and their demise, and are exalted when we achieve that Eureka moment of discovery.
- As **engineers**, we want to devise things that mirror us and our surroundings, to create machines that simplify our tasks or go beyond our human capabilities, and get excited when we make things work.
- As **technologists**, we want to enable connection, communication and collaboration so that peoples can converse freely, accurately, meaningfully and without limitation, to create digital equivalences and virtual scenarios to enable us to interact with or experience the real without leaving our location.
- As **financiers and elected officials**, we are economic advisors to the over health and wealth of our progress, and there is always a tussle between facilitating singular contributions (capitalistic) versus enabling the welfare of the whole (socialistic). The way how countries do trade and practice international relationships has been a key driver to our assessment as a civilization.
- As **medical professionals,** we strive to cure illnesses and prolong life by inventing vaccines, sequence DNA to reduce genetic defects and provide treatments for physical and mental conditions for wellness as we age.
- As **philosophers,** we want to contemplate on the nature of being, how we perceive things and what does it mean to be conscious.
- As **designers and futurists**, we want to ideate with the art of the possible to create and enable next generation human-centric products that assist in our living and help us answer the elements of consequence – the why's, what's, when's, where's, who's and how's – in a collaborative, iterative and agile setting.

There are also a host of other professions or disciplines of knowledge that enable our coordinated existence as a civilization. All of these are proficiencies are encompassed in the cognitive sciences and its application in IT and AI.

ASSIMILATION

"Sally, I'm a cop. I have keen instincts. Right now my instincts are telling me that I don't know what the hell is going on" is a quote by Don in the popular comedy show, 3rd Rock

from the Sun. The **Johari window** quantifies complexity by the assessment of knowns and unknowns. In a prior whitepaper on building **a tapestry for optimized data and information management based on tenets of Cybernetics**, There, I had utilized the Johari Window to demarcate the regions of knowns vs unknowns to classify data storage into defined schemas based on type, creation, ingestion and usage, management and its analysis. In a similar vein, here is the classification of knowns and unknowns for the professions.

- In **Engineering,** we work with known-knowns to build products to cater to a specific utility. In doing so we have created tools – mechanical and virtual to enable us to use science and mathematics to better understand the behaviors of the objects by virtual simulation and facilitate us to build and automate its construction utilizing robots. We used to have a funny joke about mathematicians vs engineers when we were in undergrad: Given a problem to meet a girl who is on the other side of the road and the condition is that the traverse can be made only half a distance to the goal in each second, how many seconds would a mathematician or an engineer (not chickens, well that is a totally different matter) take to reach the girl? The mathematician would say that it is impossible, the engineers reply would be that he would be close enough very soon to do anything humanly possible! Talk about low tolerances (pun intended). But it is said of engineering that product development is never really done – and you have to shoot the engineer to deliver the product.
- In **Information Technology,** it is all about capturing the knowns and accounting for the unknowns as we progressed in the journey of Digital Transformation. Unlike engineering, there are infinite possibilities to achieve the desired outcome depending upon business strategies, integration techniques and creative front end depictions.
- For **Artificial Intelligence,** we take known solutions to train a network so that it can solve more complex unknown problems that it encounters most times with success. Today's AI (classified as Narrow AI) faces what is known as the brittleness issue in the sense that some of its failures will be catastrophic. There is also this notion of Superintelligence that people feel will encroach on our very sense of privacy by knowing all that we know (aka Big Brother, Orwellian World 1984) and also the Technological Singularity where machines would think human life

unnecessary, and obliterate and obviate us. In proposing an evolution to our current definition of Artificial Intelligence, I have created a concept for **Existential Intelligence (EI)**, a tenet based on contextual perception, pragmatism and evolution classified as the **5th order of Cybernetics** that I plan to expand further and use in all the products and services that will be created. EI will also account for unknowns by adapting to environmental conditions and reacting to untrained circumstances to solve new un-known problems.

- **Bioinformatics** develops methods and software tools for understanding biological data. Elon Musk's Neuralink is defining a new way of **Mind-Machine interactions**. from being able to solve simple issues (why have a smart phone?) to complex medical conditions like enabling sight, sound and speech, and helping people with paralysis. Utilizing such brain introspections and its analysis using Neuromorphic Engineering, Big Data techniques and Cloud based ubiquitous communications, I plan to build the next hardware and software based mind-machine interfaces to enhance communication skills not only for the physically challenged but also to enable faster, real-time and pertinent communication with the physical and digital worlds.
- The next generation of **Intelligent Computing** will extend AI into areas that correspond to human cognition, such as analytic or critical thinking, interpretation and autonomous adaptation utilizing newer technologies like **Quantum Computing** and **Genetic Programming**. This is crucial to overcoming the so-called "brittleness" of AI solutions based on neural network training and inference, which depend on literal, deterministic views of events that lack context and commonsense understanding. One of the key objectives in cybernetics is to seek a coherent theory for explaining the mechanisms of both natural and machine (artificial) intelligence and their correspondence. Intelligent Computing must be able to address novel situations and abstraction to automate ordinary human activities.
- **Cybernetics** has typically been defined as the interaction between mind and machine. With more and more intelligent machines coming to the foray driven by AI, there is need to understand the ramifications this next industrial revolution brings to properly coordinate the complexities that arise in coordinating thought

and action, intelligence and the act of performing the task so that unintended circumstances are obviated.

INTENTION

For true disruption, a coordinated effort is needed from folks from all professions – to totally re-define the box, if you will. This leads to the tremendous jumps in our progression as a civilization to eventually approach what has been defined as the Kardashev scale. The Kardashev scale, a method of measuring a civilization's level of technological advancement based on the amount of energy a civilization is able to use, was proposed by Soviet astronomer Nikolai Kardashev in 1964. The scale has three designated categories:

- **A Type I civilization**—also called a **planetary civilization**—can use and store all of the energy available on its planet.
- **A Type II civilization**—also called a **stellar civilization**—can harness the total energy of its planet's parent star – the most popular hypothetical concept being the Dyson sphere—a device which would encompass the entire star and transfer its energy to the planet(s).
- **A Type III civilization**—also called a **galactic civilization**—can control energy on the scale of its entire host galaxy.

Broadening the study of engineering within each of the other subjects is the key endeavor of this venture. Albeit engineers like a defined box to be able to build things, sometimes it is the out-of-box thinking of the scientists that helps generate new innovations and better ideas to solve things. Coupled with the agile techniques for Design and Engineering provided by the new Bauhaus Construct, a solid methodology can be evolved for the next generation of products and services that advance the technological underpinnings utilizing new age systems.

These are some of the emerging technologies facilitating Industry 4.0 that will be part of the ecosystem of the new company:

- **Adaptive Engineering, Digital PLM, Digital Thread and Digital Twin –** the aim here is to build a complete ecosystem for product design, development and manufacturing, and tie it seamlessly to the marketing, sales, support and service functions that is currently decoupled with the upstream processes.

- **Smart (Additive, Subtractive and Discrete) Manufacturing –** the intent here is to utilize new materials and enable manufacturing using a hybrid approach between 3D printing, traditional manufacturing and assembling externally procured parts based on feasibility, appropriateness, cost and cycle time. The goal here is to expand on lean techniques, utilize latest technology and provide for mass manufacturing of customized products with inbuilt smart capabilities.
- **5G, IoT and Smart Devices –** Connected Technologies will be utilized in conjunction with Big Data and Analytics to provide a concerted feedback, notification and processing automation for the flow and after-market tie to the product. This technology will be based on the conviction that each product has its own "life" that can be monitored at each stage until it reaches its end-of-life. Examples of this that are already in use are predictive maintenance of vehicles and how paper printers can order their own ink based on a subscription service.
- **AR, VR and XR** – As augmented and virtual reality (AR and VR – collectively mixed reality, or XR) technology and hardware continue to evolve and become more accessible, enterprises are expanding the range of use cases for XR across their organizations. What used to be seen as merely a marketing "gimmick" has evolved to now measurably impact the entire product lifecycle and customer experience. Here I plan to integrate with HoloLens and Magic Leap to deliver mixed and immersive experiences to customers and users of the systems that will be created.
- **Existential Intelligence (EI) the Next AI –** In several whitepapers the concept of the 5th order of cybernetics was developed to evolve the next generation of intelligence and mechanics that would have perception and be contextual. Called EI, this will be the basis for embedding smartness via tenets in philosophy and evolution to enable intelligent products make pragmatic decisions.
- **Blockchain Distributed Ledger –** Utilize this technology for internal management of master data via a private blockchain and seamlessly communicate with partners and services to prevent duplication and enable optimization, security and immutability.
- **Quantum Computing –** Research into the workings of Quantum Computing to provide for a Neuromorphic basis for the computational needs for the next generation products and services being devised.

I plan to integrate the above domains into a cohesive ecosystem to enable imagining, building and supporting the needs of the future. The goal is to merge engineering and technology together and provide a **cybernetic fabric** for the 4th Industrial Revolution and beyond, where products and services will be a coordinated mix of physical, digital and (even) biological processes.

From Stones to Stars, A Responsibility to Awe

"We are all navigating an external world — but only through the prism of our own minds, our own subjective experience… The majesty of the universe is only ever conjured up in the mind."

This is a review of **Rebecca Elson's, A Responsibility to Awe**, a collection of poems and literary work.

Prelude from Dark Matter in Poetic Measure:

There has been much interest recently in collaborations between art and science. One difficulty with such ventures is that you have to bring together scientists who understand and appreciate art, and artists who understand science. This isn't always easy to achieve.

Rebecca Elson, who died in 1999, would have been ideal for such a venture. She was both a successful astronomer and a fine poet, as this remarkable book, which brings together both her science and her art, makes clear. Elson's concern was always to ground her scientific work in human terms. This cannot have been easy when studying the most distant globular cluster system ever observed. But time and again you can see her making connections between the physical and the moral, the universal and the human.

The book sets up a conversation between two apparently very different disciplines and discourses – with surprising and fruitful results. Elson's research was into dark matter, and the relationship between the quantity of dark matter, the amount of gravity it represents and therefore the rate and nature of the universe's expansion. Here is one of her poems, characterised by a remarkably reflective hopefulness, and a willingness to handle the biggest questions in two interrelated forms of human discourse and knowledge.

In her poem, **Let there Always be Light (Searching for Dark Matter),** she states:

For this we go out dark nights, searching
For the dimmest stars,
For signs of unseen things:

Whatever they turn out to be,
Let there be swarms of them,
Enough for immortality,
Always a star where we can warm ourselves.

Elson's poems tend to be highly compressed, and visually very specific. Many of her poems relate science to the human scale, which often results in beautiful metaphors of scientific concepts. In **Antidotes to Fear of Death** she writes:

No outer space, just space,
The light of all the not yet stars
Drifting like a bright mist,
And all of us, and everything
Already there
But unconstrained by form.

In **Inventing Zero**, she writes:

Let it have properties,
And power,
To make things infinite,
Or nothing,
Or simply hold a space

In a poem titled **Evolution** she writes:

We are survivors of immeasurable events,
Flung upon some reach of land,
Small, wet miracles without instructions,
Only the imperative of change

In **Devonian Days**, she writes of the evolution from fish:

We didn't notice in our restlessness,
The webbed toes twitching in our socks,
The itch of evolution,
Or its possibilities

In **Constellations**, she writes:

Imagine they were lambada dancers
Practicing their slow seductions
On the manifold of space

In the poem ***Explaining Relativity***, for example, she gives about as good an explanation of general relativity as one could hope for in three lines:

It's so much more a thing of pliancy, persuasion,
Where space might cup itself around a planet
Like your palm around a stone

It concludes with an essay entitled "**From stones to stars**", which describes her scientific education and career – from assisting with her father's geology fieldwork as a child, to her research into star clusters at Cambridge.

"There are times when the enterprise seems mechanical, when the constraint to pursue the truth seems to suffocate the imagination, and the mysteries of the Universe seem irrelevant to the lives we humans lead down here. But on the whole, understanding the

universe seems a fundamental step in understanding our origins, and in establishing a sense of perspective with respect to space and time that I find comforting. Someone once said to me 'astronomy is like a big circus tent – there is room for everyone.' I feel privileged indeed to be able to spend my days inside a tent with such a dazzling roof."

Jason Silva has rightly summarized her point of view in saying:

We fit the universe through our brains and it comes out in the form of nothing less than poetry. We have a responsibility to awe.

From her obituary:

REBECCA ELSON was a distinguished astronomer and a well-known poet.

Her work as an astronomer ranged from searching for stars in the halo of our own galaxy to exploring regions of rapid star formation halfway across the Universe. Using the deepest image ever taken with the Hubble Space Telescope, Elson and her colleagues at the Institute of Astronomy, Cambridge University, were the first to set strong limits on the contribution normal stars could make to the mysterious dark matter surrounding the Milky Way.

She was also a key participant in exploring how galaxies change in shape over cosmic time through the Hubble Medium Deep Survey. But her principal work focused on globular clusters, massive systems of several hundred thousand stars packed into regions of space only about 10 light years across. These systems provide the benchmark for all theories of star formation and evolution. She identified unpredicted patterns of stellar brightness and temperature in these gravitationally dynamic regions. Teasing out the history of stellar birth, life and death was Elson's craft.

CONCLUSION

Today, we stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society. This Fourth Industrial Revolution is being

driven by a staggering range of new technologies that are blurring the boundaries between people, the internet and the physical world. It's a convergence of the digital, physical and biological spheres.

For this next incarnation of industrial revolution, or Industry 4.0 as it is called, I plan to **aggregate technology and engineering** into a unique blend to create the basis for a forward looking company for next generation products and services that are connected end-to-end, and coordinated in design, build and marketing. Called **Numorpho Cybernetic Systems or NUMO**, it will provide a basis for this next iteration of the Industrial revolution that goes beyond assembly line, just-in-time and automated basis to blending the physical, digital and biological realms to build artifacts that are intelligent, sustainable, reliant, aware and even adaptive.

Though we are a miniscule presence on a little blue dot, we have dreams, we have ambitions, we have hope and we mostly live our lives to do good with an expectation of better things to come. In this final chapter, I plan to assimilate my combined experience of being, living and doing to effect possibly a change in evolving us to our next iteration as a civilization.

Stay Tuned.

NI+IN

NOTES

Here are snippets of conversations between Einstein and Freud that complement Sagan's POV.

Einstein: I greatly admire your passion to ascertain the truth–a passion that has come to dominate all else in your thinking. You have shown with irresistible lucidity how inseparably the aggressive and destructive instincts are bound up in the human psyche with those of love and the lust for life. At the same time, your convincing arguments make manifest your deep devotion to the great goal of the internal and external liberation of man from the evils of war. This was the profound hope of all those who have been revered as moral and spiritual leaders beyond the limits of their own time and country, from Jesus to Goethe and Kant. Is it not significant that such men have been universally recognized as leaders, even though their desire to affect the course of human affairs was quite ineffective?

Freud: When I learned of your intention to invite me to a mutual exchange of views upon a subject which not only interested you personally but seemed deserving, too, of public interest, I cordially assented. I expected you to choose a problem lying on the borderland of the knowable, as it stands today, a theme which each of us, physicist and psychologist, might approach from his own angle, to meet at last on common ground, though setting out from different premises. Thus the question which you put me–what is to be done to rid mankind of the war menace?–took me by surprise. And, next, I was dumbfounded by the thought of my (of our, I almost wrote) incompetence; for this struck me as being a matter of practical politics, the statesman's proper study. But then I realized that you did not raise the question in your capacity of scientist or physicist, but as a lover of his fellow men, who responded to the call of the League of Nations much as Fridtjof Nansen, the polar explorer, took on himself the task of succoring homeless and starving victims of the World War. And, next, I reminded myself that I was not being called on to formulate practical proposals but, rather, to explain how this question of preventing wars strikes a psychologist.

The entire discourse can be reviewed **here**

Dr. Shreekumar Vinekar, who has been my advisor and a compatriot in many whitepapers has this to say on the subject: "From our mythology of the instincts we may easily deduce a formula for an indirect method of eliminating war. If the propensity for war be due to the destructive instinct, we have always its counter-agent, Eros, to our hand. All that produces ties of sentiment between man and man must serve us as war's antidote. These ties are of two kinds. First, such relations as those toward a beloved object, void though they be of sexual intent. The psychoanalyst need feel no compunction in mentioning "love" in this connection; religion uses the same language: Love thy neighbor as thyself. A pious injunction, easy to enounce, but hard to carry out! The other bond of sentiment is by way of identification. All that brings out the significant resemblances between men calls into play this feeling of community, identification, whereon is founded, in large measure, the whole edifice of human society. This quality only present in the humans is defined in the West as Agape and in Sanskrit as Atmiyata. Both are emotions of bonding and deep empathic identification devoid of sexual and even aggressive instinct."

Nitin Uchil, Founder & CEO, Numorpho Cybernetic Systems

Nitin is a Strategic Thinker, Product Engineer, Enterprise Architect, Technical Evangelist and Digital Transformer with 20+ years of experience in

- advanced technologies (aerospace & defense),
- product lifecycle management and knowledge-based engineering (automotive),
- business process redesign (manufacturing, telecom, compliance),
- ecommerce, analytics, data mining, front-end experience-driven design and digital architecture (retail, CPG, high-tech electronics, finance, insurance, food, media & entertainment and hospitality).

More recently he has been creating a framework to enable the articulation of Big Data and Analytics using a themed, pragmatic and structured methodology. Currently, he is involved in theming the meld between the Physical and the Digital Realms and formulating the architecture for the Industry 4.0 theme.

Nitin has founded several successful companies, in past lives worked as a Principal Director in a large Consulting Company and in the Aerospace and Automotive domains. He holds a Master's Degree from the University of Oklahoma and a Bachelor's Degree in Engineering from the Indian Institute of Technology, Varanasi.