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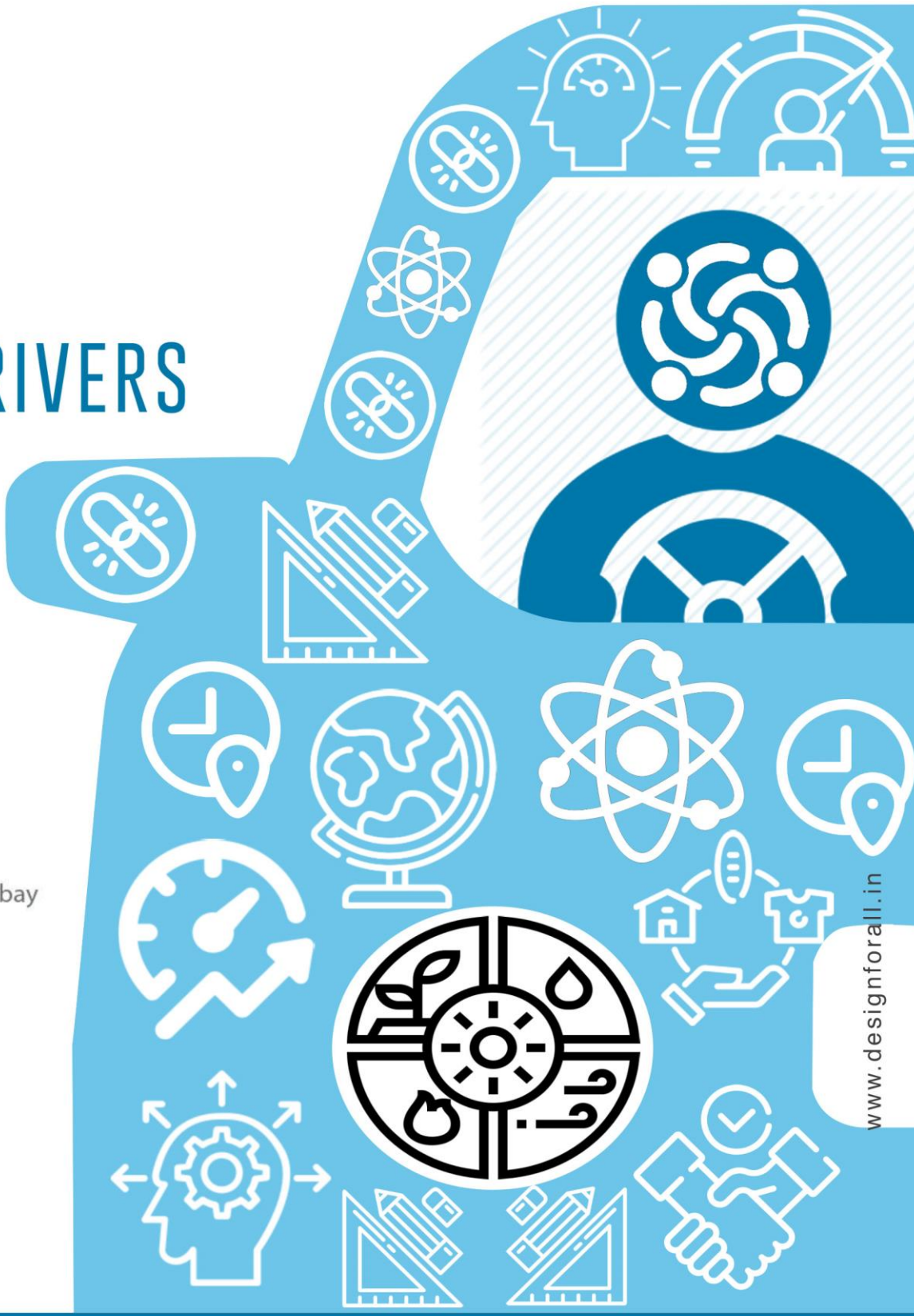
DESIGN FOR ALL

DESIGN DRIVERS



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NOTE FROM THE GUEST EDITOR

Dear friends,

Warm greetings and a very happy Rainy season.

When the blue drops of life leave the clouds to embrace the thirsty arms of brown earth, they make the whole world green brimming with life. However, a few extra showers and the life comes to stand still and disaster enfolds. This also unveils our place in the universe and the natural balance of ecosystem. Slowly yet steadily humans are realizing the extent of their efforts and after-effects of their interventions.

Every object is a repository of information. It recites lots of stories about how it came into being and how it was used. It is a window into the society in which it was conceptualized and also indicates technical capabilities of the time in which it was built. It gives information about what was in the designers' mind when the object was conceptualized. What did he/she prioritize when the thought of creating the object crossed his mind, what motivated, guided or drove him/her to come up with a specific design.

Design is a conscious and complex activity that is fueled by needs (of the individuals and the society) but requires balance between creativity and engineering. The designers, who are visionaries and

creators of tomorrow, often experience a much bigger responsibility to bring the change with more sensible choice of design drivers.

While the students learn elements of design, concepts of scale, proportion, etc. at a design school, it is imperative to learn about these design drivers and how they are evolving with time. These drivers would become guiding forces enabling designers to practice design as a deliberate activity aimed at the desired outcomes.

At IIT Bombay, Professor Lalit Kumar Das and myself took a task to deliberate and detail out what these important design drivers should mean and how we can make them easy to understand and apply in regular design activities. Our objective was to study different aspects of each design driver, detail out its meaning and briefly outline some pointers to how it helps designers prioritize certain aspects, address specific challenges, and create solutions that align with the desired outcome. We worked with a group of MDes (Masters of Design) students from IDC School of Design, IIT Bombay for a period of 16 weeks. During the study, the research group went through journals, conference papers, books, website articles and gathered information. The literature review was synthesized, analyzed, compiled and further consolidated by incorporating real-life examples and personal experiences.

This study features design drivers focusing on gaining knowledge (laws of science), utilizing specific skills (design skills), keen observation (available resources), develop empathy (human need) and many others.

This issue of *Design for All* features eleven such design drivers:

1. Available Resource

What is available is limited and must be used very carefully. In the study "Available Resources as a Design Driver," the influence of resources on design is examined, highlighting the significance of understanding and utilizing available resources to meet the needs of living organisms. It explores the potential for programmable materials, where properties can be altered with an interface, opening up new possibilities for design.

2. Performance

"Performance as a Design Driver" explores how performance optimization has driven advancements across various domains such as transportation, technology, sports, and architecture. It showcases how performance-driven design not only improves human creations but also finds inspiration from the remarkable adaptations found in biological systems.

3. Human Need

Another study, "Human Need as a Driver," emphasizes the importance of human needs in shaping the design world. It features popular theories such as Maslow's Hierarchy of Needs as a framework for understanding and addressing fundamental human requirements, from basic needs to personal growth and self-actualization. The paper also explores the manifestation of human need as a design driver in extended space and time, particularly in the context of space exploration.

4. Cultural Knowledge

Culture refers to a certain way of living. "Cultural Knowledge as a Design Driver" sheds light on integrating cultural knowledge into the design process. By considering a particular culture or community's collective understanding, values, and traditions, designers can create products that resonate with diverse audiences

and promote deeper association through cultural inclusivity. The paper explores the impact of cultural knowledge on design practices and the evolution of human civilisation.

5. Law of Science

"Laws of science" may become boundary conditions and also facilitate interesting creative explorations. This study examines how the laws of science influence design in both the man-made and natural world. It expounds the fundamental principles that govern the universe and their impact on the design of objects, structures, and systems. The manifestation of these laws in the natural world and their relationship to scientific understanding and human creativity are analysed.

6. Design Tools

The role of "Design tools" in the creative process is discussed, from historical progression to modern computational systems. It explores the impact of new tools like virtual reality and rapid prototyping, visualization techniques and AI-based generative design. The future of design is envisioned as human augmentation, where tools enhance cognitive abilities and unlock innovation and creativity.

7. Durability, Reliability and Availability

This paper explores the role of "Durability, reliability, and availability" as essential design drivers. It discusses how these factors influence design decisions and the creation of sustainable and resilient solutions. Inspiration is drawn from human biology and nature to create efficient and long-lasting designs.

8. Geography

The influence of "Geography" on design is examined, including its impact on the environment, culture, socio-economic development, and architecture. It explains how geography shapes evolution, influences socioeconomic factors, and influences architectural decisions and adaptations. The future colonisation of other planets is also considered, highlighting the need for designs driven by unique geographic conditions.

9. Past and Present

This study explores how the knowledge of 'the past and the present' drive innovation and lays foundations for design for future. It discusses their influence on evolution of design thinking, aesthetics, technology, and sustainability. By leveraging insights from history and addressing current challenges, designers can create solutions that pave the way for a better future.

10. Realization

This paper discusses the importance of 'Realization' in the realm of design, emphasizing the need to understand purpose. Realisation enables optimal and lasting results that do not harm the surroundings. The paper explores different levels of realization, including self-realization, collective realization, and ideation to realization, and proposes designers to create outcomes that are truly favourable and beneficial.

11. Limitations and Potentials

This study explores the role of "limitations in human existence" in driving progress and fostering innovation. It highlights how limitations ignite creativity and resilience in areas such as sports and language, leading to ground breaking solutions. It asserts that limitations are necessary for structure and purpose, encouraging

individuals to embrace them as growth catalysts and push beyond constraints, unlocking their true potential.

Through these 11 studies, the study group tried to investigate several essential facets of design drivers and how these can be adopted. The study is merely a first step towards developing an understanding of how we make conscious choices as a designer and choose to align with some guiding principles over other. These design drivers help designers to address specific challenges and create solutions that align with the desired outcome. I sincerely hope that these studies lead to the further discussions over these design drivers leading to more elaborate studies.

Acknowledgement

I sincerely thank Professor Lalit Kumar Das (Distinguished Visiting professor, IIT Bombay) for his continuous mentoring and guidance during the study. I wish to acknowledge the efforts of students who attended the course DE713: Angshuman Das, Praveen Kumar, Akhil Krishna Pradeep, Prateek Pagore, Pratik Bansode, Arka Hazra, Mohammed Jaseel, Manan Sharma, Manish Sharma, Rahul R, Tekhengutso Therieh(Batch of 2021-2023 MDes students, IITB) who took keen interest in the study and worked tirelessly for 16 weeks. Lastly, I offer my sincere gratitude to Krishnanunni K U (PhD Researcher, IITB) for his help in the compilation of works in a standard format.

Warm regards,

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AVAILABLE RESOURCES AS A DESIGN DRIVER

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Abstract

A resource, from an ecological perspective, is what satisfies the needs of a living organism. Humans have created for purposes it has justified as needs, and in the process of creation, has been significantly influenced by the availability of resources. This influence of resources is explored in this article. Only when an entity is understood, when its existence is identified and comprehended by intelligence, it becomes a potential resource. In the biological world, design exists, unlike in the man-made world, wherein creation is natural or guided by natural processes. Man-made resources are now available resources to birds and animals. The matter is going to be programmable, where one will be able to alter any possible property of the material with an interface.

Key Words: ***Resource, Design, Design driver, Nature, Man-made, Future.***

1. Introduction

The mind is a powerful entity, and what it can conjure is limitless. Where humanity stands today is all an outcome of human minds.

The mind has been able to perceive what is around us and, in the journey, to thrive, materialized aids for the journey. These aids have manifested as both tangible and intangible entities, and in the physical world of tangibility, humans have utilized the resources of the universe.

A resource, from an ecological perspective, is what satisfies the needs of a living organism. But for humans alone, a resource is a material or entity which is available in its environment, and which is technologically accessible, economically feasible and culturally sustainable.

Humans have created for purposes it has justified as needs, and in the process of creation, has been significantly influenced by the availability of resources. This influence of resources is explored in this article.

Manifestation of the driver in the man-made world

Of all the available resources that have driven and shaped the man-made world, the most perceptible manifestation has been from material resources. What is scientifically categorized as material science today, has shaped the evolution of the homo-sapiens and the development of civilizations from the time humans gained intelligence.

A resource can only become a resource when beings develop knowledge around an entity. Only when an entity is understood, when its existence is identified and comprehended by intelligence, it becomes a potential resource. There is a definite possibility that our perception in our entire existence limits us since humans can only fathom what their senses and capabilities enable them to do. The universe hosts unlimited resources that we cannot tap into, since we do not possess the adequate capacity to perceive its existence. We do not know what we do not know. We design using

a resource based on how we can perceive it. Maybe metal was not meant to be molten and reshaped, but serve as something completely different with a greater purpose. The design would be on another trajectory if our understanding of the world had been different. A honey bee sees the world much differently due to its capability to see the UV range of the light spectrum. Their capability paints a drastically different picture of a flower unseen to man.

Physical manifestations of ideas have always been largely defined by the behaviour of the material being used. A physically synthesized object is bound by the constraints inherent to the properties of the medium used. This aspect has either limited humans or has been driven by it to search for a medium that breaks these constraints. In this quest to realize an idea at its best, humans have, over history, either discovered newer materials or synthesized them, intentionally or even by accident. As the knowledge of chemicals and materials increased, humans started bending the properties of naturally occurring materials to suit their specific needs.

Availability of resources has driven designs in different scales and, in some cases, to the extent that civilizations and communities have built their identities and cultures around the exclusive availability of it. Assam is recognized for its scenic grandeur, its tea, and for being a biodiversity hotspot for endangered species popularly. But the natural resource that bears geographical identification in Assam is the Muga Silk, which forms a critical pillar in the Assamese identity. There are communities in the state, like in Dhakuakhana, which make their livelihood through rearing Muga silkworms, and then there are places like Sualkuchi, which are recognised globally because they weave magic with silk. In this village, almost the entire population is involved in creating marvels in looms. The gorgeous and sophisticated designs have their

mentions even in Kautilya's Arthashastra , and patronized by rulers later, Sualkuchi took shape as a weaving village. The village was filled with rhythmic sounds of the flying shuttles and the looms, used to weave fabrics with motifs of the flora and fauna of Assam, and the jaapi for the royalty in golden zari. But today, this fabric, which is soft yet durable, and with an incomparable golden sheen that gets glossier with every wash, is getting mixed with imported yarns due to a decline in muga silk's availability. A village shaped around a resource, which birthed the identity and culture of a community, is struggling today due to the lack of the same resource. A resource made exclusively available by suitable ecosystems in the floodplains of Assam is declining in availability due to unfavourable conditions induced by humans.

In the beginning, designs were driven by what was readily available in nature. Humans utilized what they could perceive with their senses. Bones, fibers, feathers, animal hides, and clay were used to make shelters, jewellery and weapons. As humans started using stones and eventually started sharpening them, agriculture began to develop, and humans became better hunters. This marked the Stone Age, and as humans discovered gold, copper and silver as materials, and started experimenting with them for ornamentation and decoration, humanity progressed into the next phase. These metals were too soft for any large-scale applications initially, but it was learnt that they could be beaten into shapes and melted and poured into intricate forms. By chance or by experimentation, humans created a harder and more durable material by adding other materials into molten copper, leading to the creation of the first metal alloy, Bronze, a technological advancement that marked the beginning of the Bronze Age. Iron had not been made useful till this age, but soon humanity could reach higher temperatures in furnaces, which opened new avenues. Beyond metallurgy, porcelain

and ceramics came into being. The development of lenses meant that humans could now see things beyond their normal range of vision, into the ever-expanding universe or the magnificence of the micro-world. Humanity developed acid batteries, plaster, vulcanized rubber, coloured photography using silver, and the first solar cells, which influenced how physical entities were designed. During the early 1800s, Aluminum utensils used to be unique and only honoured guests were served in them, while the rest were served on Silver plates, owing to the rarity of the metal. Its value and perception drastically dropped from precious to an everyday commodity when researchers developed new ways to extract this metallic resource, and Aluminum became abundant. Throughout history, the discovery of a new material resource has shaped the physical world along with it. Silicon and crystallography similarly marked the Information Age and the Silicon Age, where computational devices were born. This age started a cycle where crystallography enabled capable computers, which helped develop crystallography through faster and more complex calculations and helped develop better computers.

A resource becomes more complex in its composition and constituents over time. A natural resource such as zinc was used for medicinal values and direct usage until humans learned to smelt and developed new resources such as brass, which as an alloy, had its applications throughout human evolution. From being a natural resource, zinc also manifested as galvanic cells, which, again as a resource, paved the path for electrical batteries. Batteries as a resource also continued a network of diverse electrical applications.

E.g. of resources driving the design. When humans were using coal or dried dung cakes for fires, it was crucial to contain the fire, direct the heat, and protect it from the weather. This led to the design of fire pits, earthen chulhas, and metallic chulhas. When Gas

was discovered as a cleaner fuel source, the underlying principle of a flame stayed the same; what needed to be designed as a way to dispense the gas, light it and regulate it. This led to the design of a gas stove. So as the resource became available, the plan changed.

Manifestation of the Driver in the biological world

The Biological world can be viewed from a range of lenses. From the nano or micro-world to the flora and fauna level, or from a lens of an entire ecosystem. What is more naturally observable is from the lens of flora and fauna. In the biological world, design exists, unlike in the artificial world, wherein creation is natural or guided by natural processes. Within these processes, the design is driven by the resources available or the lack of one.

Plants originally used to photosynthesise using their stems and did not bear leaves. Leaves came to being forty million years after the leafless plants had colonized Earth due to a drop in carbon dioxide levels in the atmosphere. Depletion of the available resource led to this morphological design change in plants. Similarly, cactus leaves' design changed into spikes due to the lack of availability of water as a resource. Had the water been adequately available, preserving it and its retention would not have arisen, and leaves would have remained as flatter and wider entities on cacti. Morphological changes occur over prolonged exposure to a resource in both flora and fauna.

Another way available resources have influenced design in the biological world is how organisms use natural resources for creation. All species of fauna are creators in a way. Beavers build dams on rivers by felling large trees to create winter homes for themselves. These vertebrates can also waterproof their dams using mud around the rivers. Some birds use mud and dung to make their shelter, baked and hardened by the sun. In the insect

world, termites use chewed remains of wood, faeces, and mud to create mounds that can spread across acres. Australian leaf-curling spiders use a sustainable resource, a dead leaf, to build their shelter and a nursery for their offspring. Recently, these spiders have been seen using discarded paper scraps as a substitute for leaves.

As natural resources are depleted, and all new materials are introduced into the world with human interventions, man-made resources are so widespread that birds and animals have started to utilize them. It is now a common sight where birds make nests with straws and wires, and synthetic ropes. These artificial resources are now available resources to birds and animals.

How the driver could impact design in extended space and time

New material discoveries are still happening with advancements in technology, and humans are constantly gaining new knowledge. But more than naturally occurring materials, the future of resources is going to be driven by artificially synthesised materials. Humans will create materials that will fit exactly what the requirement is. The matter is going to be programmable, where one will be able to alter any potential property of the material with an interface. Any combination of the properties will be configured to fit the use case exactly. This will enable designs where the characteristics of a single material will change across an entire design. This material will become the basis of all humankind's creations, and imagination will be the only limit to the possibilities. This will be a material resource that will be infinitely customisable and with an infinite life cycle as the same building block could be utilized for a different application if the need ever changes. This resource can change its shape and size and duplicate itself or consume other matter. The

material will have a standard energy level when synthesized. With every duplication, it will lose half its energy to the second copy and will regain its energy when it consumes another copy of itself. It will gain energy from consuming other kinds of materials also. The level of energy it will achieve will depend on the type of material it consumes. To make room for newer and well-informed designs using this new building block, the existing materials which are going to become wastes will be converted into energy. This material will consume all the non-sustainable matter and gain energy from it, which it will use to make more copies of its programmable self. Eventually, the world will be built with a single programmable material. As this material evolves, it will also be able to mimic naturally occurring biological characteristics. With this, the natural world will be assisted in regaining the balance it has lost over millions of years. With the Age of this single base material world, humankind will do away with property ownership, since one material can be anything and everything.

Everyone will be able to use any amount of this material as and when required and reset it back when the usage is complete. Humans will still be able to keep making newer versions of the matter, but there will be no excess either since the resource will be able to keep consuming the extras. People will voluntarily keep a check on the amount of this matter. With decentralized unlimited help, disparity amongst humans will vanish. Mankind will move towards unity consciousness where the concept of self disappears, and the sense of oneness, respect, love, and compassion exists amongst all beings and existence.

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PERFORMANCE AS A DESIGN DRIVER

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Abstract

The driving force of performance in design extends across various aspects of human life, spanning transportation, technology, sports, and architecture. It has led to transformative developments such as the evolution of vehicles, the continuous improvement of technology, the optimization of sports equipment, and the creation of sustainable and comfortable architectural designs.

Moreover, performance-driven design is not limited to human creations but is also evident in biological systems. The remarkable adaptations found in organisms demonstrate how performance optimization has shaped their efficient movement and survival abilities. This understanding inspires biomechanics and bio-inspired design advancements, resulting in robotic systems, innovative materials, and medical breakthroughs. Looking beyond our immediate surroundings, performance as a design driver plays a crucial role in space exploration. The design of spacecraft, spacesuits, and life support systems emphasizes optimization to ensure mission success and the well-being of astronauts. As we consider future scenarios such as long-duration missions and futuristic technologies, performance-driven design becomes

indispensable for sustaining life in space and enabling human exploration of distant regions.

Key Words: ***Performance-driven Design, Design driver, Technology, Man-made, Future.***

Embracing performance as a guiding principle empowers innovation and sets the stage for a great future where integrating technology, human ingenuity, and performance leads to extraordinary achievements.

Introduction

Performance is an inherent aspect of our daily lives, encompassing various activities in which we engage. Whether it's work, sports, technology, or transportation, our performance can be felt, measured, or deduced. As imperfect beings, humans are prone to making mistakes when executing tasks. However, through a continuous pursuit of improvement and innovation, we strive to enhance our performance in all aspects of life. Understanding performance concepts and employing techniques to optimize human performance can have a profound impact on productivity, efficiency, and overall success.

Performance manifests as a crucial design driver in numerous domains, shaping the way we create, innovate, and interact with the man-made world. Let's delve deeper into some key areas where performance drives design and leads to advancements and breakthroughs.

Manifestation of Driver in the Man-Made World

Transportation: Throughout history, the evolution of transportation has been driven by the constant pursuit of improved performance. From the invention of the wheel to the development of

sophisticated automobiles and aircraft, advancements in transportation have shaped societies and opened up new possibilities.

The Industrial Revolution in the 18th and 19th centuries marked a significant turning point in transportation. The introduction of steam power revolutionized locomotion, leading to the development of steam-powered trains and ships. These innovations enabled faster and more efficient transportation of goods and people, connecting regions and fueling economic growth.

In the early 20th century, the advent of the internal combustion engine sparked a revolution in automobile design. The mass production of cars, pioneered by Henry Ford and the assembly line, made personal transportation accessible to the masses. Cars became faster, more reliable, and more affordable, revolutionizing mobility and transforming cities and landscapes.

Today, the transportation industry continues to witness transformative changes driven by the pursuit of performance. As concerns over climate change and sustainability grow, there is a growing focus on developing alternative fuel sources and improving energy efficiency.

Electric vehicles (EVs) are gaining traction as a cleaner and more sustainable mode of transportation. Advancements in battery technology have increased the range and charging capabilities of EVs, making them viable alternatives to traditional combustion engine vehicles. Governments and automakers around the world are investing heavily in the development of EV infrastructure and incentivizing the adoption of electric vehicles.

Furthermore, the emergence of autonomous vehicles has the potential to revolutionize transportation in the coming decades.

Self-driving cars powered by artificial intelligence and advanced sensors have the potential to enhance safety, reduce congestion, and optimize traffic flow. As technology continues to evolve, autonomous vehicles are expected to become more prevalent, reshaping the way we commute and interact with transportation systems.

In the realm of aviation, the pursuit of performance has led to advancements in aircraft design and propulsion systems. Fuel efficiency and reducing carbon emissions are key priorities for the aviation industry. Manufacturers are investing in the development of more efficient engines, lightweight materials, and aerodynamic designs to improve the performance and environmental impact of aircraft. Additionally, the concept of supersonic air travel is being revisited, with companies exploring the possibility of bringing back faster-than-sound passenger flights, which could revolutionize long-distance travel.

Looking to the future, the transportation industry is also exploring innovative concepts such as hyperloop systems and flying taxis. Hyperloop, a high-speed transportation system utilizing near-vacuum tubes, could potentially enable travel at speeds exceeding 600 miles per hour. Flying taxis, powered by electric vertical takeoff and landing (eVTOL) technology, aim to provide urban aerial mobility, reducing congestion and offering efficient transportation options in densely populated areas.

By leveraging technology, sustainable practices, and innovative design approaches, the transportation sector continues to push the boundaries of performance. The ongoing quest for faster, more efficient, and environmentally friendly transportation solutions will shape the way we move and connect in the present and future, paving the way for a more interconnected and sustainable world.

Technology: Performance is a fundamental consideration in the world of technology, driving continuous innovation and improvement. From smartphones to computers, electronic devices are designed to deliver faster processing speeds, higher storage capacities, and seamless user experiences.

Microprocessor manufacturers follow Moore's Law, which predicts that the number of transistors on a microchip will double approximately every two years, leading to exponential growth in computing power. This drives advancements in fields such as artificial intelligence, machine learning, data analytics, and scientific research, enabling us to tackle complex problems and develop innovative solutions.

In addition, network infrastructure and connectivity technologies have experienced significant performance-driven advancements. The introduction of 5G networks promises faster data transfer speeds, reduced latency, and improved connectivity, supporting emerging technologies such as autonomous vehicles, smart cities, and the Internet of Things (IoT).

Sports: Performance as a design driver has a profound impact on the world of sports. Athletes and sports enthusiasts continually seek ways to enhance performance, pushing the limits of human capabilities.

Sports equipment undergoes rigorous design and engineering processes to maximize performance. From tennis rackets with improved stability and power to running shoes with enhanced cushioning and grip, performance-driven design in sports equipment aims to optimize athletes' abilities and improve their overall performance.

Advancements in sports science and training methodologies have also contributed to performance optimization. Sports teams and athletes utilize technologies such as motion capture, biomechanical analysis, and data analytics to gain insights into performance metrics, identify areas for improvement, and develop customized training programs.

Architecture: Performance-driven design is instrumental in the field of architecture, where buildings are conceived to optimize functionality, energy efficiency, and occupant comfort.

Sustainable design practices have gained prominence, aiming to reduce the environmental impact of buildings. Architects employ strategies such as passive solar design, efficient insulation, renewable energy integration, and water conservation systems to achieve energy-efficient and environmentally friendly structures.

In addition to sustainability, occupant comfort and well-being are key considerations in performance-driven architecture. Buildings are designed to provide optimal lighting conditions, acoustics, air quality, and thermal comfort, ensuring a pleasant and productive environment for occupants.

Performance as a design driver spans various fields and industries, serving as a catalyst for innovation, efficiency, and improved outcomes. By understanding and harnessing the power of performance, we can continue to push the boundaries of what is possible, creating a world where excellence is the norm and where our capabilities are amplified by the thoughtful integration of performance-driven design.

Manifestation of Driver in the Biological World

The concept of performance as a design driver extends beyond the man-made world and finds its manifestation in the biological realm.

Nature is a masterful designer, continually optimizing performance in various biological systems and organisms.

Evolutionary Adaptations: Through millions of years of evolution, organisms have developed remarkable adaptations that enhance their performance in their respective environments. From the intricate design of bird wings for efficient flight to the streamlined bodies of aquatic creatures for optimized swimming, nature's designs exhibit unparalleled efficiency and functionality.

For example, the cheetah, known as the fastest land animal, has evolved a slender body, long legs, and a flexible spine to maximize speed during pursuits. Its anatomy allows for rapid acceleration, precise maneuverability, and minimal energy expenditure, enabling it to excel in the chase for prey.

In the plant kingdom, the venus flytrap showcases a remarkable performance-driven adaptation. This carnivorous plant has specialized leaves that can snap shut rapidly when triggered by the presence of prey. This efficient trapping mechanism ensures a higher likelihood of capturing insects for nourishment in nutrient-poor environments.

Biomechanics: Biomechanics, as a field of study, illuminates how performance as a design driver is evident in the optimization of biological systems. Animals exemplify this concept through their remarkable adaptations for efficient movement and force generation. In the realm of biomechanics, the musculoskeletal system is a captivating example. The intricate arrangement of muscles, tendons, and bones in animals enables them to achieve optimal performance. Take, for instance, the remarkable jumping ability of fleas. Their muscles, leg joints, and muscle fibers are designed in such a way that they can generate powerful jumps

relative to their tiny size. This biomechanical optimization allows fleas to propel themselves incredibly long distances compared to their body length, showcasing the impact of performance-driven design in the animal kingdom.

By studying the biomechanics of various organisms, scientists and engineers gain valuable insights into performance-driven design. These principles inspire the development of innovative technologies, such as biomimetic designs for prosthetics and robotics. By harnessing the lessons learned from nature's exceptional performers, we can continue to push the boundaries of design and create more efficient and high-performing solutions in various fields. Performance as a design driver in biomechanics opens up new avenues for enhancing human capabilities and creating groundbreaking advancements.

Bio-inspired Design: Observing and studying nature's performance-driven designs has inspired scientists and engineers to develop innovative solutions in various fields.

In the field of robotics, biomimicry has led to the creation of robots with enhanced capabilities. For instance, researchers have developed robotic systems that mimic the movement and agility of animals like snakes, cheetahs, and birds. These biomimetic robots can navigate challenging terrains, perform complex tasks, and exhibit impressive performance characteristics based on the principles observed in nature.

Similarly, in materials science, biomimicry has enabled the development of lightweight, strong, and flexible materials inspired by natural structures such as spider silk or the microscopic structure of bone. These bio-inspired materials have the potential to revolutionize industries such as aerospace, automotive, and construction by offering superior performance and sustainability.

In the medical field, biomimicry has inspired the design of prosthetics and implants that mimic the functionality and performance of natural body parts. From artificial limbs with enhanced dexterity to heart valves that replicate the efficiency of natural valves, these innovations aim to restore and optimize human performance.

How the Driver Could Impact Design in Extended Space and Time:

When exploring the concept of performance as a design driver, it is important to consider its implications beyond our immediate surroundings and the constraints of time. The impact of performance-driven design extends to the realms of extended space and time, encompassing areas such as space exploration, long-duration missions, and futuristic technologies.

Space Exploration: Performance plays a critical role in the design of spacecraft and equipment for space exploration. The extreme conditions of space demand highly optimized and reliable systems to ensure mission success and the safety of astronauts.

Spacecraft are meticulously designed to achieve maximum performance in terms of propulsion efficiency, power generation, and thermal management. Lightweight materials and advanced engineering techniques are employed to overcome the challenges of operating in microgravity environments and to conserve resources such as fuel and energy.

Furthermore, performance-driven design is crucial in the development of spacesuits. These specialized garments provide life support, mobility, and protection for astronauts during extravehicular activities (EVAs). Spacesuit designs must consider

factors such as comfort, flexibility, durability, and resistance to extreme temperatures, radiation, and micrometeoroids.

Long-Duration Missions: As we venture further into space and contemplate long-duration missions to destinations such as Mars, performance-driven design becomes even more crucial. The sustainability and efficiency of life support systems, including food production, waste management, and resource utilization, are paramount.

Designing spacecraft and habitats that can support human life for extended periods requires a deep understanding of performance requirements. Systems must be optimized to ensure reliable power generation, efficient recycling of resources, and robust life support capabilities.

Furthermore, performance-driven design in the context of long-duration missions encompasses considerations such as crew psychology and well-being. Designing living quarters and recreational spaces that promote mental health, social interaction, and stress reduction is vital for the success and sustainability of future space exploration endeavors.

Futuristic Technologies: Looking beyond current space exploration endeavors, performance-driven design has implications for futuristic technologies that may reshape our understanding of extended space and time.

Concepts such as interstellar travel, time dilation, and wormholes present intriguing possibilities for human exploration of distant regions of the universe and bending the constraints of time. These ideas require imaginative and performance-oriented designs to address the challenges of propulsion, energy generation,

navigation, and survivability in environments far beyond our current reach.

Theoretical technologies like warp drives or the utilization of exotic forms of energy pose exciting opportunities and design challenges. Optimizing performance in these theoretical frameworks requires imaginative thinking, incorporating principles from fields such as physics, engineering, and materials science.

Conclusion:

Performance as a design driver transcends boundaries in the fabricated world, the biological world, and extended space and time. Throughout history, the pursuit of survival and improvement has propelled humans to push the limits of design. From ancient architectural marvels to modern technological advancements, performance optimization has driven our quest for efficiency, comfort, and sustainability. Nature's adaptive performance has inspired biomimetic designs and led to breakthroughs in medicine and materials science. In space exploration, meticulous optimization is crucial for astronaut safety and long-duration missions. Performance-driven designs are essential for interstellar travel and time manipulation. As we adapt biologically, our evolution may lead us to establish civilizations in other galaxies. Performance stands as a guiding force, empowering innovation and shaping a brighter future. Embracing performance as a design driver unleashes our boundless potential. With each step forward, we inch closer to a world where performance, technology, and human spirit combine to create awe-inspiring achievements.

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HUMAN NEED AS A DRIVER

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Abstract

The report explores the concept of human need as a driver in design, highlighting its significance in shaping our world and driving innovation. It begins by emphasizing the extent of human needs and the continuous push to fulfill them, acknowledging the importance of drawing inspiration from other biological life forms thriving in harsh environments. It discusses Maslow's Hierarchy of Needs as a framework for understanding and addressing fundamental human requirements, ensuring that designs not only fulfill basic needs but also promote personal growth and self-actualization.

The study then delves into the manifestation of human need as a design driver in the biological world, examining evolutionary adaptation, homeostasis, behaviours and strategies, mutualistic relationships, and ecosystem dynamics. It showcases various examples of extremophiles and their unique coping mechanisms in extreme environments.

Furthermore, the report explores the manifestation of human need as a design driver in extended space and time, focusing on

physiological needs, safety and general needs, and the design considerations for space exploration. It highlights the importance of understanding and addressing human needs for the well-being and success of astronauts.

Finally, it discusses the impact of human need as a driver of design, emphasizing its influence on manufactured products and systems. Overall, this report highlights the critical role of human needs as a driver in design, spanning from biological adaptations to space exploration, and emphasizes the need for designers to prioritize and address these fundamental requirements in their creations.

Key Words: ***Resource, Design, Design driver, Nature, Man-made, Future.***

Introduction

Human need is the very basis of what we see around us today. It is simply the result of a conscious need to achieve something and be able to do it elegantly, starting from micro-level lifesaving drug delivery robots to multibillion-dollar Telescopes expanding human knowledge and everlasting need to explore the universe and above.

The extent of human needs has been vital in shaping our present life. Humans have designed and engineered all the possible creature comforts and ingenious solutions for our daily needs. The interesting fact is that we are not stopping and are continuing to push boundaries regarding what is possible for the future. Designers and Engineers are becoming increasingly aware of the world we live in. It is essential to get inspiration from biological life forms other than humans existing on earth and thriving in harsh and humanly impossible surroundings.

In a world where humans have zero needs, broadly the physiological, safety, social, esteem, and self-actualization needs,

the chance of finding healthy individuals is negligible. People may become unbothered by resource utilisation, and global warming will prevail at its peak. Also, the prestigious scientific inventions and their aftermath, being the present day, will be a sweet dream whatsoever.

Human Need as a Driver:

Human need as a design driver refers to the concept of designing products, services, and systems by focusing on fulfilling the inherent needs and desires of individuals. It involves understanding human psychology, behaviour, and preferences to create effective and meaningful solutions. This approach aims to improve the overall user experience and ensure that the design meets the specific requirements and expectations of users. Several basic laws and principles are often considered when designing with human needs in mind.

Maslow's Hierarchy of Needs

This theory outlines a hierarchical model of human needs, ranging from physiological needs (e.g., food, water) to self-actualization (e.g., personal growth, fulfilment). Designers can consider these needs to ensure their design address fundamental human requirements and promote personal growth. It is usually represented in the form of a five-level pyramid model with different human needs. The base level in the pyramid represents the most basic human need. As per this law, one should satisfy one level before moving on to the next. It is observed that in real-world scenarios, all five stages exist together, either partially satisfied or just in the required amounts for human needs. Designers can apply Maslow's Hierarchy of Needs to create products, services, and systems that address these fundamental human needs. By considering the different levels of the hierarchy, designers can

ensure that their designs not only fulfil basic requirements but also provide opportunities for personal growth and self-actualization.

Manifestation in Biological World

Extreme Life Form on Earth

Earth is a planet of environmental extremes, ranging from numbing cold to blistering heat. Humans live primarily in temperate regions with only a few exceptions, but an eclectic array of other creatures thrive in the inhospitable. These organisms are known as extremophiles. Here are a few examples

Octopus

Octopuses live in coastal marine waters and spend much of their time in dens—small holes and crevices in rocks and coral. They are solitary and territorial. Newly hatched octopuses will eat small foods such as copepods, larval crabs, and sea stars. Adult octopuses feed on crabs, clams, snails, small fishes, and other octopuses. All species of octopus have venom of varying levels of toxicity, which they inject using a beak like a bird's. They typically hunt at night, pouncing on their prey and wrapping it in the webbing between their arms. They penetrate hard-shelled prey with their beaks.

Lab studies and findings have found that octopuses are capable of problem-solving. For example, they can escape from a fabricated maze within a laboratory. They have the same serotonin transporters as humans. The specialised suckers in receptors detect smell, shape etc. They have localised processing of data, in contrast to human brain. Camouflage ability, separate system for vision and learning. These learnings can be helpful for a breakthrough in machine learning. Octopuses have three functioning hearts. Two of the hearts work exclusively to move blood to the gills, while the

third pumps blood through the rest of the body. Rather than iron-based blood, their blood is copper-based, which is more efficient at transporting oxygen at low temperatures and makes their blood blue in colour. They are about 90 per cent muscle, and because they lack bones, they can fit through exceedingly small spaces. Octopuses move using jet propulsion—they suck water into their mantle cavity, then quickly contract their muscles to force the water out through a narrow siphon, aiming the water to steer in a particular direction.

Emperor penguin

These flightless birds from Antarctica spend their mating season where temperatures can go as low as −40 °F. They form colonies and thereby creating a warm space. The penguin at the outer fringes of the territory is allowed in. In this way, they can recycle their body heat. The arteries and veins lie close together so that blood is pre-cooled on the way to a penguin's feet, wings and bill and warmed on the way back to the heart. These animals also do an energy-saving method called porpoising while e swimming. This helps them maintain a steady speed, reduces energy loss from using wings and confuses predators.

Wood frog

When temperatures grow chilly, the wood frog adapts by letting itself freeze, remaining in this unique form of suspended animation until the spring thaw. It can survive being frozen by accumulating glucose, a cryoprotectant, in its tissues. The animal purposefully allows blood to freeze, contrary to the emperor penguin, who prevents this from happening. There are other mechanisms in place to ensure that life continues.

Flat bark beetles

Like the wood frog, the flat bark beetle generates special chemicals to survive the winter cold. It reduces the amount of water in its body while accumulating tissue-protecting proteins, which allow it to survive what nature throws at it. The formation of ice crystals in internal fluids is the biggest threat to its survival, but the beetle produces antifreeze proteins that stop water molecules from grouping together.

This animal, again, is quite different from the previous example of the Emperor Penguin, but life continues without any issues. This shows that the coping mechanisms developed by each organism can vary even during the same physical condition.

Pompeii worm

Far below the ocean's surface, away from the life-giving reach of the sun, unique ecosystems have developed around extremely hot mineral-rich hydrothermal vents that form near undersea volcanoes. Researchers have found a virtual menagerie around the vents, including the Pompeii worm, which can survive temperatures as high as 175 °F (79 °C). How it adapts: The woolly worm scuttles back and forth between the hot water rich in nutrients and the cool water rich in oxygen—a movement that also mixes cool water into the tube. But more importantly, a fleece-like layer of bacteria helps insulate the Pompeii worm from the extreme heat. The research found the bacterium *Nautilia profundicola*, a microbe that survives near deep-sea hydrothermal vents. It was found in a fleece-like lining on the backs of Pompeii worms, a type of tubeworm that lives at hydrothermal vents and bacterial mats on the surfaces of the vents' chimney structures. *Nautilia profundicola*,: Nautilia profundicola contains the protein reverse gyrase. Reverse gyrase is

theorized to keep the genome stable and prevent damage by extreme heat.

Extreme Plant life forms:

1. Aloes

Aloes have especially adaptations to survive drought. Their thick waxy leaves can survive in harsh climates with little rain as they have particular water-storing tissues called parenchyma. The grey-green leaves also contain the colourless gel, a popular ingredient in many skincare products to hydrate hair and skin. Scientists at Kew carry out research on Aloe vera and its close relatives. This research delves into aloe gel chemistry, leaf shape, genetics, and evolutionary relationships among Aloe species. The water-storing gel in Aloe vera leaves a drought adaptation. Investigating this gel could change how we use aloes in the future to adapt to life as the planet gets warmer.

2. Baobab trees

The baobab (Adansonia) comes from Madagascar. This island nation is famous for its unique wildlife and diverse plant life. The baobab has adapted to Madagascar's subtropical climate, which has a hot and rainy season followed by a cool, dry season. The trees behave like giant succulents, with up to 80% of their trunks made of water. They can live an exceptionally long time. In the wild, some specimens are estimated to be 1,000 years or more. They have many properties, which makes them valuable to people. The tree's bark is soft and fibrous and can be used to weave rope and cloth. The baobab fruit is also known for its health benefits, with elevated calcium and vitamin C levels.

Manifestation in Extended Space and Time

Immediate Space:

Physiological Needs

The gases in space cannot support human life. Most of the space contains no gases at all—it is what scientists call a vacuum. Spacecraft must provide their passengers with oxygen to breathe. Spacecrafts carry their sources of oxygen and nitrogen. These gases are circulated throughout the spacecraft to provide similar air to the one we breathe on Earth. Astronauts must also carry their entire food supply when they travel to space. When humans first crossed to play, they carried freeze-dried food on their missions.

The astronauts would add water to the food to eat it. NASA has worked to improve the menu for astronauts. Travellers in space can now eat many foods, including soups, crackers, and fruits. According to a NASA food specialist, "Astronauts must consume little salt." Bone loss is a problem that every astronaut experiences and overeating salt can make this problem worse. On Earth, we use around 350 litres of water per person per day for drinking, cooking, washing, flushing toilets, etc. Astronauts on the ISS use only 12 litres per person per day. Water recycling is critical in the closed environment of the ISS. The ECLSS recycles 93% of the water used and produced by ISS astronauts. Water used for washing is cleaned to make drinking water. Excess water vapour in the air onboard the ISS is condensed into liquid water. Even astronauts' sweat and urine are collected and recycled into drinking water.

Safety and General needs

To create electricity for spacecraft, NASA uses a fuel cell. Fuel cells convert hydrogen gas into electricity. Water is created when the hydrogen is converted to electricity. The spacecraft uses electricity,

and the astronauts use water. Astronauts must be careful to conserve water and recycle it whenever possible. Rest is important for all human bodies. It is a little harder to go to bed on a spacecraft. Because there is no sunset in space, most astronauts wear blindfolds to block the sun. There is also no gravity in space. Astronauts sleep in special sleeping bags that are strapped down. The straps keep the bags from bumping into objects on the spacecraft.

Space Exploration

In designing for space exploration, understanding and addressing human needs becomes crucial for the success and well-being of astronauts. Several studies and international papers have explored this topic: NASA's Human Research Program (HRP): NASA conducts extensive research to understand the physiological, psychological, and social factors that affect astronauts during long-duration space missions. This research aims to develop design guidelines and technologies that support crew health and well-being. Space Human Factors and Habitability: Various studies have examined the impact of microgravity, confinement, isolation, and other unique aspects of space environments on human performance and well-being. Designing spacecraft interiors, habitats, and equipment with these factors in mind can enhance comfort, safety, and productivity during space missions. Behavioral Health and Performance: Understanding how the space environment influences crew behavior and performance is vital. Research on stress management, social dynamics, cognitive workload, and communication systems can inform the design of interfaces, workspaces, and communication tools that promote teamwork and mitigate psychological challenges. Human-Centered Design for Space Habitats: Researchers and designers explore human-centered

design principles to create livable and functional habitats for long-duration space missions. This involves considering factors such as lighting, acoustics, privacy, and personal space to ensure the well-being and efficiency of astronauts.

Driver's Effect on Design:

The various manufactured products and systems are directly influenced by the human and biological needs. For a product/system, the designer's intent is to enable it to perform at the highest possible level, solving a spectrum of problems. But every product will ideally have already satisfied the physiological, social and safety needs of a human.For example, A submarine going under a deep ocean is designed with a multitude of parameters under consideration. The sole purpose of such a vehicle for surveillance is an aspect of safety. Apart from surveillance, a submarine is also used for oceanic research, species studies etc. Human have developed a system to solve a multitude of issues within the same context, that is the ocean. We should also address the fact that a submarine also provides habitable and a normal working environment for people within it. This implies a vehicle used for science and experiments has already solved the physiological, safety and social need of a human before its sole purpose of finding deep sea secrets are achieved. Imagine, if the basic human requirements are not present, say the vehicle interior is not at the mum air pressure, or say the lighting is proper for working, or there is a barrier between everyone onboard, there is no way the final mission will be achieved, and the sole purpose of a submarine's existence is futile.

Driver's Effect on Society

Another broad example of human and biological needs as a design driver is the society, we live in. In India, there exists an

extraordinarily complex but magical system that each Indian goes through. Several many religions and hundreds of communities thrive in a magical symbiosis; the kind of life framework we have developed is something unique. The dynamics of the nation never stopped, and this was possible because of the human and biological needs required in such a system. Imagine an India, where people fight on the street because someone throws a plastic wrapper or accidentally scrubbed shoulders while walking, and people complain because of a congested train/bus. Even though such incidents happen, they are exceedingly rare, and people consider them normal and move on with life. They have adapted their life to the surrounding chaos. This society was not designed overnight, but is the result of many years of co-existence of millions of humans, animals, and plants, with each of them seeking to achieve physiological, social, safety, esteem, and self-actualisation needs. It is evident that the Indian system has flaws. Still, the point is that the highly diversified and most densely populated country with its varied cultures and communities continues to exist.

The example mentioned above can be associated with a coral reef. A coral reef consists of corals that are the main builders of the world's shallow-water marine coral reefs. They represent intimate diverse symbioses between coral animals, other microscopic eukaryotes, prokaryotes, and viruses. These myriads of species exist together.

Situational human needs and how they change

Just as humans work on regaining the lost natural resources and global warming, they also respond to day-to-day situations. For an individual working at his/her most productive level, a physiological imbalance in the form of a simple viral fever can drastically reduce productivity. At this moment, the primary focus is shifted on how to

recover from the viral infections, and the required actions such as medication, and rest comes in. Another simple example is a family going on a vacation, and suddenly a close relative gets extremely sick and is hospitalised. The family members on vacation would suddenly shift their mood and mindset to a sad state, and their primary goal will be to assist the hospitalised person in any way.

The conclusion is that humans working hard for a long-term objective or goal can shift the whole of his/her focus from the plan to a more localised and unexpected situational change that may arise in their lives.

In the case of a creator, he/she must be able to shift the focus onto diverse topics during the design process. There may arise unexpected challenges in the execution of a design, in terms of its engineering feasibility or aesthetic feel. The creator behind the invention may be forced to rethink the whole idea to solve the issue.

Past, Present and Future of Human Needs

Even though basic human needs remain the same, many daily needs keep changing with many external factors. The everyday items a person used 100 years ago will be quite different from what we use today. This is due to the advancements in human capabilities in Engineering and the understanding of the world. Hundreds of years ago, humans commonly used animals as the means of transport in most parts of the world. There were very few vehicles, that too exceedingly rare. The industrial revolution followed this era, and humans developed all sorts of machinery and equipment for every situation, be it farming, transportation, medical, aerospace, education, infrastructure etc. Humans discovered various natural energy resources and utilised them for his/her own good over er the past many years. After all these years, we have the most

advanced automobiles taking us from place to place in utmost comfort. It is vital to appreciate the fact that the kind of technology we have access to daily, was designed because of this human need causing humans themselves to optimise and reinvent new things.

Now, in today's world, there is increasing tension and concern regarding resource utilization. It is true that human needs as the primary design driver have led to the exhaustion of natural resources. The usage of resources was not highly organised or thought out in the first place. Now, we are trying to do a patchwork of the irreversible mistakes regarding resource utilization by promoting sustainable energy sources, organic products, saving energy through many ways and many other programmes. There is an acute shortage of petroleum products around the world, leading to increased fuel prices. Considering most of the automobile sector operates on petroleum, human needs have played a counterintuitive move for humans. t has been observed that the world is moving towards electricity. It is obvious in the current situation, with increased greenhouse gases, high fuel prices and resource shortage, moving g to 'non-polluting' means of energy for propulsion, that is, electricity is a smart move. But as a designer and engineer, the decision-making in this switch is not extremely easy.

Electric Trend

Countries are pushing towards a completely electrified transport system by 2030-2035. In a country like India, with a remarkably high population density, the process of phasing out all ICE vehicles and replacing them with EV (Electric Vehicles) counterparts will be a highly energy-intensive process. Volvo has released a study showing the life cycle analysis between an Electric XC40 vs ICE XC40. It is said that the EV takes around 1,10,000 to 1,25,000km of

running to break even with the ICE counterpart in terms of net CO2 emissions. But in India, a vehicle rarely runs for 1.25 lakh km, especially in the modern era, where people like to change cars every 5 –6 years. With current technology, EVs (Electric Vehicles) are as bad or even worse than an ICE cars in terms of CO2 emissions. The point here is that we need to be extra careful in making the switch.

The future trends and Needs: The smart devices

Apart from electrification, which is inevitable in the future, humans also seek advancements in the entertainment field. It is impossible to exist in the current professional world without a personal electronic device such as a mobile phone or laptop. They have become much more than a means of communication. The scope of world communication has expanded and diversified to a different level altogether. Social media sites are playing a significant role in information transfer and communication between people. In a future setting, the human need for socialising can reach different heights. Hologram technology can enable a 3D mock-up of the person to be viewed by the person at another end of the mobile/device being used. This can increase the interaction and add an emotional aspect to online meetings, which could be faster and more exciting. VR and AR are being developed at a remarkably high rate for the most realistic experience for users. AR techniques embedded in wearable glasses will change the game in terms of product visualisation, idea generation and troubleshooting. In a few years, the mobile screen we all have may be replaced by stylish and modern wearable devices, giving AR view. The apparatus may interact with each other and share their views. For example, a person viewing a concept cat model in his AR wearable device can choose who else around him/her can view the same model from his/her own perspective. Gesture controls will be like natural

controls for humans. These technologies today are very premature and is glitchy at times.

In a design school, students wearing smart device can quickly develop concepts in 3d space on any scale he/she wants, and the professor wearing the same device can see the product from his perspective. The device may be connected to the PC/ which may again be in AR and not a physical product. The storage will be completely cloud-based. This will reduce data loss and piracy.

Today's wants, Tomorrow's needs?

Predicting the future is a challenging task. It requires factual knowledge and information about past and present trends in technology and design. Even with this knowledge, the prediction may need to be corrected.

Most of the technologies we use today were quite rare and expensive 20 years ago but are affordable and easily accessible in the present world. What could be the thing that is so rare and unattainable yet tempting now, that will be the most accessible and common thing in the future? The proposals for this concept can be plenty. In the Indian context, one is a world where each and every individual is aware of required societal laws and follows them to create a peaceful society. A society where everyone is given the opportunity to learn and grow as a person. A society where everyone is aided with mobility solutions. A society that does not question individual life choices focuses on supporting each and every individual to be successful in his/her own ways.

One can find that the above-mentioned points are all human needs. Still, in the present context, only some are possible due to many reasons, such as economic, resource constrain, and technological constrain.

The future must not be materialistic, rather it must be human-centric and natural. Just as how latest trends gather popularity and fade away after a few years, we are now at the crest of the materialistic and technology-rich society; now, we need to incorporate more human touch, and more personal and natural interaction between humans. Only then will we be able to develop a society where every individual is happy and able to be productive in his/her own ways.

The Summary

The concept of "human need as a design driver" is expected to have a significant impact on future trends in various fields. Here are some ways it can influence future trends:

User-Centered Design: The focus on human needs will continue to drive the shift towards user-centered design approaches across industries. Designers will increasingly prioritize understanding and empathizing with users, conducting user research, and incorporating user feedback into the design process. This trend will lead to the development of products and services that are more tailored to individual preferences and requirements. Personalization and Customization: With the growing emphasis on human needs, there will be an increased demand for personalized and customizable products and services. Companies will strive to offer flexible options that allow users to customize their experiences based on their unique preferences, leading to more personalized and satisfying user interactions. Well-being and Sustainability: Designing with human needs in mind will involve considering the well-being and sustainability aspects of products, services, and environments. Future trends will focus on creating designs that promote physical and mental well-being, such

as ergonomic furniture, wellness technologies, and stress-reducing environments. Additionally, there will be a greater emphasis on sustainable design practices, incorporating eco-friendly materials, energy-efficient systems, and environmentally conscious solutions. Assistive and Inclusive Design: Human-centered design will drive advancements in assistive and inclusive technologies. Designers will aim to create products and services that cater to a wider range of abilities, ensuring that individuals with disabilities can access and benefit from them. This trend will lead to more inclusive and accessible design solutions across various industries, promoting equal opportunities and improving the quality of life for all individuals. Technological Integration: The concept of human need as a design driver will shape the integration of technology into our lives. Future trends will focus on designing technologies that seamlessly integrate into human routines and enhance our capabilities without causing excessive cognitive load or dependency. Technologies such as artificial intelligence, augmented reality, and virtual reality will be designed to adapt to human needs, facilitating intuitive interactions and improving overall user experiences. Ethical Design: The consideration of human needs will lead to a stronger emphasis on ethical design practices. Designers will consider the potential impact of their designs on individuals and society. There will be an increased focus on privacy, data security, and responsible use of technology to ensure that designs prioritize the well-being and ethical concerns of users.

In summary, the concept of "human need as a design driver" will influence future trends by placing a greater emphasis on user-centered, personalized, sustainable, inclusive, and ethically conscious designs. These trends will result in products, services, and systems that better cater to human needs, enhance user

experiences, and contribute to overall well-being and societal progress.

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CULTURAL KNOWLEDGE AS A DESIGN DRIVER

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Abstract

This paper explores the concept of cultural knowledge as a design driver in the creation of products and experiences. Cultural knowledge encompasses the collective understanding, values, and traditions of a particular culture or community. By integrating cultural knowledge into the design process, designers can create products that resonate with the target audience, cater to their unique needs, and promote cultural inclusivity. This abstract highlights the significance of cultural knowledge as a design driver, emphasizing the importance of understanding cultural nuances, symbolism, and context. The paper discusses the manifestation of cultural knowledge in the man-made world through examples of design-driven innovations. It also explores the potential impact of cultural knowledge as a driver on future design practices and the evolution of human civilization. By recognizing and leveraging cultural knowledge, designers can foster meaningful connections, promote cross-cultural understanding, and create products that enrich people's lives while honoring the diverse tapestry of human cultures.

Key Words: ***Culture, Design process, Design driver, Nature, Man-made, Future.***

Introduction

What is knowledge? According to the Dictionary, knowledge is the fact or condition of knowing something with familiarity gained through experience or association. Experience is what is essential in the case of gaining knowledge. On the other hand, when we compare science with knowledge, we understand that science is a systematic enterprise that builds and organizes knowledge through testable explanations and predictions about the universe. Although they seem similar, the knowledge we would consider in our discussion is the raw and unorganized experience we get in our day-to-day lives.

The term "belief" is often bought as a synonym for knowledge, which would be far from the truth; for example, we may believe a person. He told us that the bus would arrive at 10.30, and we believed him, though it came half an hour earlier, and we missed it ("Lecture 3: Belief and Knowledge - Belief", n.d.). Knowledge is backed up by evidence.

Seven core types of knowledge work together to shape the way we exchange information and learn new concepts (Pettersen, n.d.). Below are the types of knowledge.

When systematically written and shared through different mediums, knowledge is called explicit knowledge; one example could be the religious scriptures of different religions. When the knowledge provided in these scriptures is implied to live life in a particular way, gain experience and slowly get better at it, when you gain lessons from the explicit knowledge to solve other problems, it becomes implicit knowledge.

Tacit knowledge, on the other hand, is a thing that is understood without any documentation; an example of this would be if a person in Indian culture would not get up when his food is served or when his plate is having food as it is considered disrespectful towards the food as well as the cook.

Cultures with specific food and the steps involved in the creation of specific masalas and recipes for the pickles are passed on from generation to generation in the form of procedural knowledge. Knowing how to perform the activities is taught from person to person through a live demonstration of actions.

Declarative knowledge, in simple terms, could be interpreted as a documented understanding of an incident or reporting of an incident. Indian Epics could be considered declarative knowledge where the incidents are depicted in extreme detail and could be recreated if required from the scriptures.

Posterior knowledge is the type of knowledge one gain from their individual experience; people listening to the same story might end up with different knowledge as the people personally tend to focus on different things in a story. The lessons learnt by people from the same incident would be dependent on their perspective of the incident.

Prior knowledge, as the name suggests, is the ability to gauge what would happen in the future based on the experience the person had earlier. People know that rain is followed by winter, which is further followed by summer based on all the previous experiences of the people around as well as themselves.

Meaning of Cultural Knowledge

Cultural knowledge **is the information known by an individual not because of formal education but as a result of living everyday life,**

talking to relatives, observing surroundings, or practising family traditions. Knowledge of this kind is often subconscious. Culture, at its core, is like a protocol that we follow in certain environments. We understand what is right, wrong, acceptable, and not acceptable based on our upbringing. We behave differently at each stage of a social gathering. For example, a group of people who are work colleagues acts differently in the workplace, and as soon as they are out of the workplace, their behaviour changes. At times cultural knowledge can be unrecognized by those who hold the knowledge and (can be) undervalued by those who rely more heavily upon scientific or academic reasoning to make a decision.

The mental components of culture, such as beliefs, laws, and attitudes, are included in cultural knowledge. The components of cultural knowledge are norms & values, symbols, reality constructs, and worldviews.

1. ***Norms are guidelines on how members of a particular culture should conduct themselves. Norms define what acceptable and usual behaviour for individuals is; values are conceptions of how individuals wish to live and the kind of life they seek.***

2. Symbols are something that represents something else. For example, when driving a car, the red light means stop. The red symbolizes the concept of "stop."

3. People make mental maps of things and divide everything into categories. This is called the cultural construction of reality. For example, people are divided into family, friends, and strangers.

4. ***Worldview is the way people interpret reality and see themselves and the world around them. For example, some cultures see themselves as conquering nature, while other cultures try to live in harmony with nature.***

A huge part of the culture is a form of Tacit Knowledge. Something which is not written but understood by people, there is a common understanding that everyone agrees to and adheres to the same. One the most simplistic example one could think of is the game of "gully Cricket," a sport which is supposed to be played on open grounds and is changed as per the surroundings and resources available. Players of "gully cricket" have a common mind; if you look at the game's setup, it is the most amazing scene of quick negotiations for rules and agreements among the players. Things move smoothly and swiftly considering the game setup; although some weak players do crib regarding some aspects, the conflicts are quickly resolved. Incidents during these games prompt the players to change the rules as the game progresses. These players of gully cricket have a great understanding of teamwork; no matter which "gully" these players are, they know how to play with changing players and terrain. There is an appreciation and a sense of competition which helps the players push each other and improve their skills. Even though, at times, there are intense emotions involved during the game, all is forgotten and forgiven after the game.

Even though we see this as just a sport, these people's values and behavioural aspects are reflected in other aspects of life, such as Work and Social elements, when it comes to the common development of the people.

Manifestation of the driver in the manmade world

During the implementation of the knowledge, we do not focus on the why part of the knowledge. Knowing that things fall down and hence we implement things in that order rather than focusing on why it happens. The why portion is left for the development of the implementation in the longer run.

In the manmade world, when space exploration would seem difficult or far-fetched, there would be people turning towards virtual reality and creating a culture of their own to develop, build and live in this virtual world. We can see these elements already being initiated through tech giants using the term "metaverse" to create virtual worlds for people. Even in a virtual world, there would be a culture based on real-life products such as cult films, games, etc. People tend to form closed groups where they can gather and talk about their mutual interests, create canons and explore their imagination.

As society grows, it develops habits similar to individual developing habits; these habits then convert to a certain set of rules to which people adhere in common understanding. There is a reason why people living in different regions of the world have different cultures. These cultures are developed over human evolution, influenced by geography, socio-political changes, and migration of people from place to place. Such migration of people tends to create a mixed culture where one would find elements of many different cultures fused together.

Culture as a design driver acts as an inspiration as well as a limitation during application in the human world, which contains all these mixed cultures with its variation.

Ice Stupas - Ladakh

The glaciers of Ladakh, India, have decreased due to climate change, and temperatures and rainfall are unpredictable. Barley, apples, and other crops require to be watered in the spring, but the glacier melt only occurs in the summer. Sonam Wangchuk, an engineer, has developed a method to transport the glaciers to the people in order to spare farmers a barren harvest. According to him, the concept of religion needs to be modernized in order to

address issues like global warming. The recent formation of an "ice stupa" raises the possibility of a fresh framework for climate-adaptive design thinking. The region's decreasing glacial meltwater supply has prompted the development of an innovative water management approach that uses community engagement, ecological understanding, and religious imagery to maximize a finite natural resource. The purpose of artificial glaciers is to freeze and store water that continuously flows and evaporates throughout the winter down streams and into rivers. Rather, this ice will thaw in the spring, just as the fields require irrigation. Artificial glaciers are a familiar idea in Ladakh. In the highest parts of the Alps, their distant ancestors practised a technique known as "grafting glaciers." It resembled the religious mud buildings known as chortens or stupas in the area.

Here, the ice stupas of Ladakh show a nuanced reaction to social, environmental, and cultural limitations beyond merely serving as a water store for agricultural use. By doing this, the project offers a practical model for water management in northern India as well as insightful information on the developing field of planning for climate change.

Using Cultural knowledge, the designers called these artificial ice towers "stupas," which led to people accepting the change positively and even helping in building these structures more dedicatedly, which impacted the local lifestyle.

Living roots bridge - Meghalaya

A large portion of the state benefits from the frequent heavy rains, but the indigenous Khasi people, who inhabit the dense woods of Meghalaya, have long faced difficulties. The normally calm rivers that meander through the state's deep valleys turn into powerful, rain-fed torrents from June through September during the monsoon

season, making them impassable by foot. The Khasi tribe used to construct bamboo bridges over swift-moving streams. But the strong monsoons were too much for the buildings to handle. They would decay and crumble, trapping the residents. The Khasi elders came up with an alternative approach some 180 years ago. The hollow canes of the Areca nut palm were used to assist the roots of the rubber tree in meeting halfway across the stream. Years of attentive care and meticulous nurturing allowed the roots to gently reach the opposing bank and build the skeleton of a bridge strong enough to support a person's weight. In the matrilineal society of the Khasis, after marriage, the husband relocates to the village of the wife, and the children take their mother's last name. The bizarre, robust network of entwined root bridges can take 15 to 20 years to connect the two banks. In contrast to conventional buildings, Meghalaya's root bridges never need substantial maintenance or reconstruction; the oldest and sturdiest of these bridges is over a century old. Building these living bridges, however, has become less common during the last 25 years. Today's builders span the streams and rivers of Meghalaya using steel rope and contemporary construction techniques rather than spending years making living walkways.

Dabbawallahs - Maharashtra

In his paper "Culture as the Designer," Prof. Lalit Kumar Das tells us about the culture of "dabbawallahs." The "dabbawallahs" are only found in Mumbai and have been providing delivery services for over a century. Five thousand delivery personnel transport roughly 175,000 dabbas (lunches) in tiffins (segmented tin boxes) from suburban homes to educational institutions, workplaces, and mills throughout the city and its environs. Their clients are middle-class people who depend on the "dabbawallahs" to serve a home-cooked lunch because of cost, hygiene, caste, dietary restrictions, or just

because they prefer healthful cuisine from their homes. Each lid of a tiffin carrier is coded using a sophisticated system: Each suburb and specific area of the downtown core is denoted by a different colour. The street, the building, and even the floor where the Dabba will be delivered and ultimately returned to its source are marked with dashes, crosses, and dots. The system is a fantastic combination of the end user's needs and the carrier's capabilities. Only ten to twenty tiffins, which he can quickly identify and organize at the origin station, will be chosen by one person to give to the owner. Additionally, the delivery team is aware of which floor in a specific building to deliver to. On the floor, individual owners can easily identify their own tiffins. There is often just one error made by the delivery staff every two months or one error for every sixteen million transactions. Therefore, according to Forbes Global, a global business journal, this performance is "6 Sigma." This one provides another illustration of how a low-cost, effective system can function. (Das, n.d., 49)

Manifestation of the driver in the biological world

It was widely believed that culture, or conduct picked up from others, was unique to humans until the early 20th century. However, evidence suggesting animals may learn and pass on behaviours has been accumulating at an ever-increasing rate, beginning with the identification of a few species. There is no denying that culture is present in many animal species, including terrestrial and marine vertebrates and invertebrates. Both social learning and the genetic transfer of habits contribute to the development of this culture. Animals use imitation to learn social behaviour. Even animals from different species imitate one another to accomplish a task. Teaching is another method. Killer whales have been observed to "deliberately beach" themselves so they can capture and consume seal pups that are laying eggs on the sand. By

forcing their calves onto the sand and urging them to attack and consume the prey, mother killer whales instruct their calves on how to catch pinnipeds. This is an example of teaching, and cultural learning since the mother killer whale is changing how she behaves to assist her young. Along with Primates, many sea creatures, rodents as well as birds tend to form a culture, especially when these animals stay or travel in a group. Such cases of cultural transmission of knowledge change the way these animals behave. These animals adapt to their changing environment and develop new habits.

Representation of Animals in Culture:

Every culture has a unique perspective on animals, birds, and sea creatures. People in India have viewed all animals as their friends and partners with whom they share the earth for millennia. They have been shown in artwork in lovely shapes as divine companions, symbols of strength and beauty, or just as ornamental accents. The Romans believed that for humans to survive, it was necessary to slaughter or subdue animals. The Greeks viewed them as powerful symbols which existed in a different world. However, ancient Indians perceived them as they ought to be perceived: kind, devoted, and graceful. Animals haven't changed significantly regarding their appearance or behaviour, but how people perceive them has evolved over time. Animals, birds, and sea creatures are used as religious symbols of strength, elegance, beauty, dignity, luxury, and wisdom. They are shown in sculptures, paintings, dance, fabric printing, and other arts, as well as in architecture. (Patil, n.d. https://www.esamskriti.com/e/Culture/Indian-Culture/Animals-in-Indian-Culture-create-an--colon-inclusive-universe-colon--1.aspx)

The plethora of findings about animal cultures in recent times offers an intriguing starting point for more in-depth investigations. Do animal civilizations develop over time in the same way as human cultures have over the previous aeons? How significantly does the impact of culture across an animal's lifetime alter our perception of behavioural ecology and the underlying principles of evolution in general? How similar do people today think that animal and human cultures are, and where are the biggest gaps still present? (Whiten 2021, https://www.science.org/doi/10.1126/science.abe6514)

How could the driver impact design in extended space and time?

Cultural Evolution

Cultural evolution is essentially just the change in culture over time if we define culture as "knowledge capable of changing individuals' behavior that they learn from other members of their species through teaching, imitation, and other types of social transmission." The essential tenet of cultural evolution is that cultural development is an evolutionary process that, while fundamentally similar to genetic evolution, also differs from it in important ways. As a result, both genetic and cultural evolution have influenced human behavior. The same may be stated for a wide variety of other animal species, such as chimpanzee tool use, Caledonian crow tool use, or the intricate social structure of ant, bee, termite, and wasp hives. ("What is Cultural Evolution", n.d. https://culturalevolutionsociety.org/story/What_is_Cultural_Evolution)

Richard Dawkins' 1976 book The Selfish Gene proposed the concept of the "meme", which is analogous to that of the gene. A meme is an idea replicator that can reproduce itself by jumping from mind to mind via the process of one human learning from another via

imitation. Along with the "virus of the mind" image, the meme might be thought of as a "unit of culture" (an idea, belief, pattern of behavior, etc.), which spreads among the individuals of a population. The variation and selection in the copying process enable Darwinian evolution among memeplexes and therefore is a candidate for a mechanism of cultural evolution. As memes are "selfish" in that they are "interested" only in their own success, they could well be in conflict with their biological host's genetic interests. Consequently, a "meme's eye" view might account for certain evolved cultural traits, such as suicide terrorism, that are successful at spreading memes of martyrdom but fatal to their hosts and often other people. (Fontanive, n.d. https://en.wikipedia.org/wiki/Memetics)

Cultural particularism dominated popular thought for the first half of the 20th century before American anthropologists, including Leslie A. White, Julian H. Steward, Marshall D. Sahlins, and Elman R. Service, revived the debate on cultural evolution. These theorists were the first to introduce the idea of multilinear cultural evolution. Under the multilinear theory, there are no fixed stages (as in the unilinear theory) towards cultural development. Instead, there are several stages of differing lengths and forms. Although individual cultures develop differently and cultural evolution occurs differently, multilinear theory acknowledges that cultures and societies do tend to develop and move forward. Leslie A. White focused on the idea that different cultures had differing amounts of 'energy'; White argued that with greater energy, societies could possess greater levels of social differentiation. He rejected the separation of modern societies from primitive societies. In contrast, Steward argued, much like Darwin's theory of evolution, that culture adapts to its surroundings. 'Evolution and Culture' by Sahlins and Service is an attempt to condense the views of White

and Steward into a universal theory of multilinear evolution. ("Cultural evolution", n.d.https://en.wikipedia.org/wiki/Cultural_evolution)

Smart Cities & Cultural Heritage

The Kingdom of Saudi Arabia is creating the smart city of NEOM along the Red Sea coast as part of Vision 2030. This ground-breaking initiative aims to diversify the Kingdom's economy, welcome a million people from the Kingdom and abroad, establish itself as the new benchmark for urban sustainability and put residents' livability, health, and well-being first. Although NEOM is still under development, the blueprint thus far suggests it can address some of the issues that hampered earlier smart cities. The villages along "The Line," a belt of live-work communities that don't rely on conventional roads or automobiles, will be connected by cutting-edge housing and mobility systems. The city's economic and industrial engine, the massive floating structure known as Oxagon, will draw in top talent from around the world to help NEOM develop into an incredibly efficient port city with an abundance of cultural attractions. Oxagon is powered entirely by clean energy. Plans by NEOM include previously unheard-of advances in the utilization of big data. In addition to networked infrastructure and mobility systems, biometric and health data may be used to protect inhabitants' safety and health as well as provide real-time access to the services they require. If it works, NEOM's integration of large-scale data functions with environmentally friendly urban planning might usher in a new era of smart cities.

Risks linked with sociocultural diversity, such as how the culture of newcomers from abroad affects the local population or the other way around, are present in cities with a diverse population. An observation was made that there isn't much literature on the

dangers of developing new cities. However, research has revealed risk variables that relate to urban infrastructure and other sub-projects that can be connected to the dangers of creating new megaprojects, like NEOM. Most current cities, like Silicon Valley in the United States, took years of effort from the government, investors, businesses, entrepreneurs, and the populace to develop a metropolis with a varied range of cultures driven by entrepreneurship and innovation in order to accomplish such a difficult goal. Since Saudi culture differs from other countries in the West and South, integrating a million people from various backgrounds, social classes, and socioeconomic status is a significant challenge. It calls for significant easing of societal norms and rules. (Algumzi, Areej. 2022. Risks and Challenges Associated with NEOM Project in Saudi Arabia: A Marketing Perspective. Journal of Risk and Financial Management 15: 381. https://doi.org/10.3390/jrfm15090381, n.d., #)

As time progresses, Human society would develop to fade its Cultural boundaries in small areas, which would again tend to grow bigger to form a culture as a planet as the Technologies develop. And people start commuting/migrating at a faster rate. The societies would start merging their cultures to form a new one, keeping elements of the old and developing new traits. The restrictions present in old cultures of societies would become insignificant, and designers would have to tend to a larger group of users.

If humans migrate to other planets, the environment tends to create a separate culture from that of Earth. This society would have different needs and requirements. There would be elements of culture from the earth that would need to shift to a different planet to keep the connection alive. Although the Designs made for Earth would not be used as is on other planets, Products Designed for

other planets should be inspired by the original culture on Earth at the start. As Human society Progressed to more and more planets, the culture restricted to local areas or land would be changed to the culture of the planet as a whole.

CONCLUSION

Consideration of Sociocultural Needs

When utilizing the human-centred design method in brand-new emerging economies, the majority of designers tend to neglect the users' sociocultural needs. Any new product or service must consider user culture because it affects how well the target market receives them. Additionally, it is asserted that designs developed from a sociocultural perspective may give users cultural significance that aids adoption. Product responses frequently result in a blend of inner and external meanings. Products, services, or Sustainable Design: An Introduction Systems are no longer only functional objects; rather, they are now understood for the meaning, associations, and contributions they provide to the development of a user's self-image. As a result, it is important to consider the user's sociocultural demands in the early phases, when the design is still evolving. This allows for a deeper understanding and analysis of the user's culture. This kind of design is anticipated to result in the development of high-calibre user experiences that enhance the symbolic worth of goods, services, or systems as well as the lives of their users. This can help designers build or design value and think of culture as a resource for their work. In order to include social and cultural issues, as well as individual requirements, desires, and aesthetic reactions, the study of human factors should go beyond the conventional physical and cognitive fit between products, services, or systems and consumers.

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LAWS OF SCIENCE AS A DESIGN DRIVER

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Abstract

This research paper delves into the concept of "laws of science as design drivers" and explores its significance in both the man-made and natural world. By examining the fundamental principles that govern the universe, we can uncover how these laws have shaped and influenced the design of objects, structures, and systems in human civilization. Moreover, we investigate the manifestation of these laws in the natural world, where they have led to the development of complex ecosystems, geological formations, and celestial phenomena.

Furthermore, this paper analyzes the impact of laws of science in extended time and space. By examining the evolution of the universe, geological processes, and the long-term behavior of ecological systems, we gain insights into how these laws have shaped the world over vast temporal and spatial scales. The findings highlight the inherent relationship between scientific principles and design, shedding light on the interconnectedness between scientific understanding, natural phenomena, and human creativity.

Key Words: ***Science Law, Design driver, Nature, Human Creativity, Future.***

Introduction

In 1665, a young Isaac Newton observed an apple fall from a tree. That made him question why the apple fell straight down, instead of sideways or upwards. He observed the moon as a point of reference, and how the moon doesn't fall similarly to the apple. These observations, along with a point of reference, the moon, helped him deduce the theory of gravitational force. After deducing the theory, it was subjected to experimentation. The results convincingly proved his explanation and assumptions, and thus, it became a law, and gravity was discovered.

Hence, the law is a summary of theory after experimentation. The laws of science are what define the basic principle, manufacturing and functioning of every single product or daily object that we interact with. If these laws aren't considered, several products designed to make our everyday life easier will fail to work. Laws of science govern the creation, sustenance and destruction of all matter in the known universe. Many laws that we use today have existed in nature for the past millions of years. The evolution and adaptation of each and every organism on this planet are based around the laws of science.

Meaning of the design driver

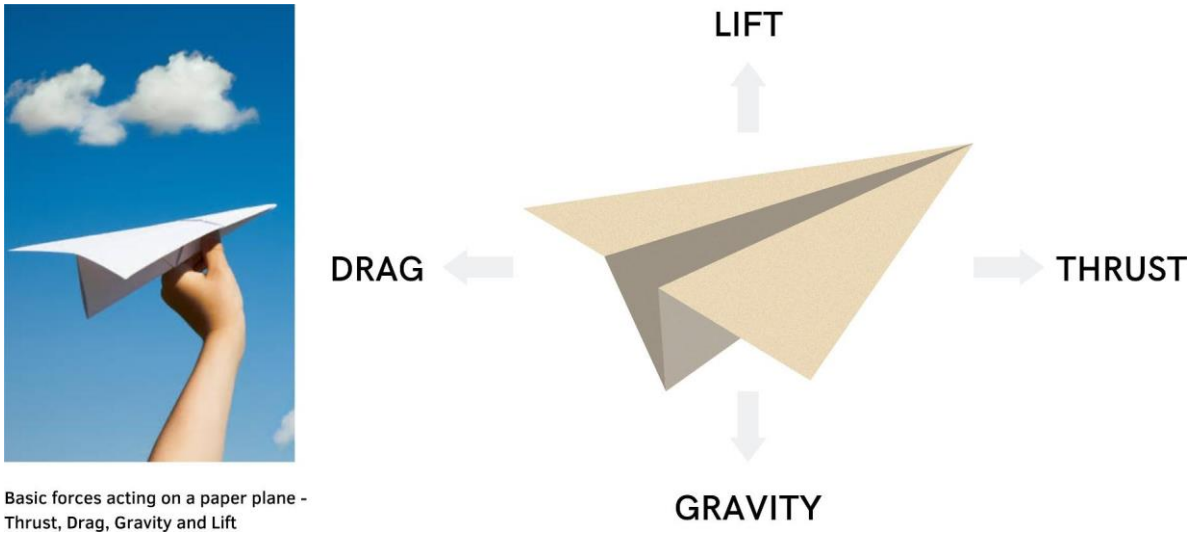
> ***'Scientific laws or laws of science are statements, based on repeated experiments or observations that describe or predict a range of natural phenomena.'***

Laws of science embody themselves in the simplest of products or activities that we perform in our day-to-day lives. Even a simple paper plane, a simple construct past time in our childhood, works

on complex scientific laws of gravity and aerodynamics to function as intended. Even with our layman's knowledge and understanding of scientific laws, we, as children, attempted to create farther-flying and faster iterations of paper planes. As our understanding of these scientific laws gains more depth, we apply these to create better and better products and break further thresholds. Along with their manifestation in the man-made world, these scientific laws have manifested themselves in the natural world ever since its creation. These laws have dictated the transformation and evolution of all matter and species as we know it. We shall discuss this manifestation through four different forces and scientific laws acting on a paper plane, namely - Gravity, lift, thrust and drag.

Manifestation in the man-made world

Laws of science are visible all around us. Over the past centuries,



Basic forces acting on a paper plane - Thrust, Drag, Gravity and Lift

these laws have influenced the design of objects and products that we see and use in our day-to-day lives. Not only have they helped us invent newer technologies, but it has also helped mankind in developing further and raising the bar to achieve newer possibilities.

Since automobiles were developed, manufacturers have pushed the boundaries of material science and manufacturing capabilities to pack the maximum safety, technologies and performance in the most efficient and lightest chassis/frame possible. From using materials like stainless steel, we have progressed to aluminium, magnesium alloys and carbon fibre. The shape of automobiles has also seen a drastic transition based on weight-distribution, momentum and aerodynamics, all in the chase of performance and efficiency. Similarly, Newton's laws of motion have been instrumental in developing several safety technologies. The seat belt was designed to absorb the momentum of the human body in the event of a crash.

Taking this concept one step further, airbags provide a cushion for a slow deceleration and transfer of momentum to prevent any shocks or injuries to the human body. Combined, these provide a vital safety net. Our greater understanding of the laws of lift and aerodynamics has also helped us manipulate these factors and forces to create greater functionality, as seen in the F-14 Tomcat combat aircraft.

Change in vehicle form to reduce drag

Manipulation of aero and lift

Earlier aeroplanes relied on thrust from rotors and a hefty, bulky build to transport humans from one place to another. When we built

upon the concepts and laws of motion and aerodynamics, planes became more and more streamlined, and efficient, and rotor-propulsion was replaced with a much more powerful and efficient jet propulsion. These concepts have been fine-tuned to reach the pinnacle of air travel in the form of fighter planes and the Blackbird, a jet plane capable of reaching speeds of up to Mach 10. Our understanding of gravitational laws, along with material/weight saving, has helped us develop innovative and efficient housing/roofing methods. The fuller geodesic dome utilizes hexagonal elements to distribute weight evenly among all its members to provide unrivalled material and weight saving as compared to concrete roofing methods.

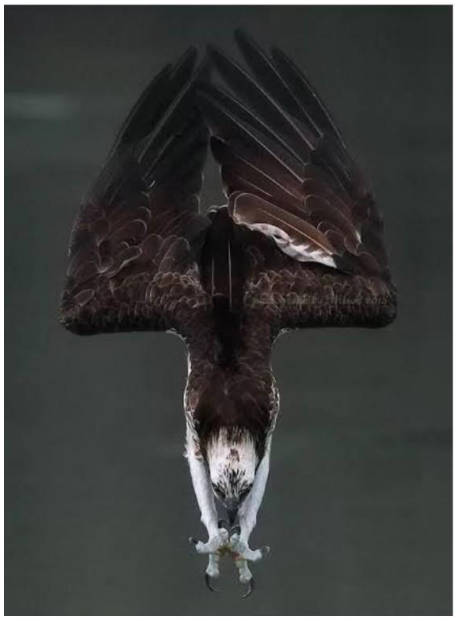
Development and transition to cleaner, more efficient propulsion methods

Fuller geodesic dome - A material and weight efficient roofing method

Manifestation in the natural world

In the natural world, laws and concepts of science can be identified in how animals have evolved over millions of years. Several species have developed body features and mannerisms that help them survive or adapt better to their habitat. The concepts of thermodynamics and insulation are seen very frequently in nature, especially in mammals. Several animals make use of several layers of thick fur to trap body heat and prevent themselves from cold surroundings. Birds and other species with the ability to fly are

some of the most complex and scientifically evolved species. Birds use a combination of thrust and Bernoulli's principle through the flapping motion of their wings, which helps them generate flight. In addition to this, their hollow bones allow significant weight saving, and aerodynamics/streamlined shape only enhances their capabilities. Birds like sea hawks can transform into extremely aerodynamic shapes to enhance their hunting abilities.



A sea hawk hunting for prey

Manipulation of aero and lift

Efficient methods of propulsion can be seen in various forms of aquatic life. Propeller-like motion is observed in fishes, the only difference being that the flexibility and curvature of their fins provide much more efficient propulsion than achieved by mankind. Examples of jet propulsion are seen in some squids, which use a jet of water to propel themselves forward.

Examples of material saving and efficient construction are seen in the case of honeycombs. These examples indicate that a significant part of our understanding and discovery of scientific laws comes from the observation of their application in nature.

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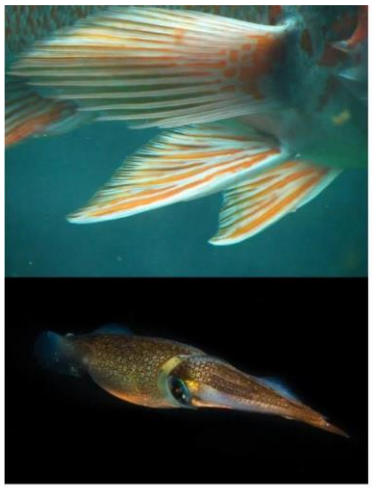


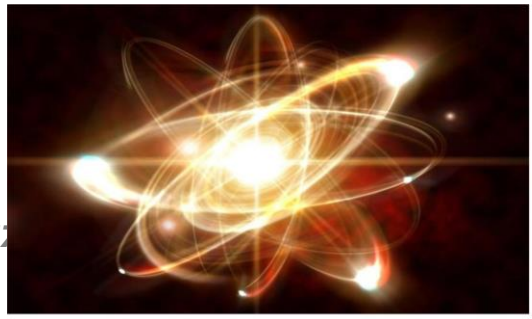
Propulsion in aquatic life

Weight distribution and material saving in nature

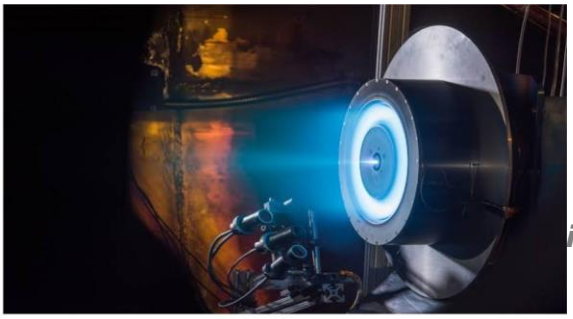
Impact in extended space and time - Future scenarios and conclusion

While the advancements made by scientists and mankind in the field of science are noteworthy and have changed the course of human history, there are still a lot of unknowns out there. For years scientists and astronomers have been trying to figure out what lies beyond the event horizon, the existence of life beyond Earth, the very creation of our universe as we know it, and even the theory of multiverses. As science moves forward and we discover and unearth more and more laws and secrets of our universe, we might use energy and our resources in a much more efficient manner. The constant work being done on achieving nuclear fusion and NASA's

SEP can provide us with means of ultra-efficient, unlimited sources of energy.



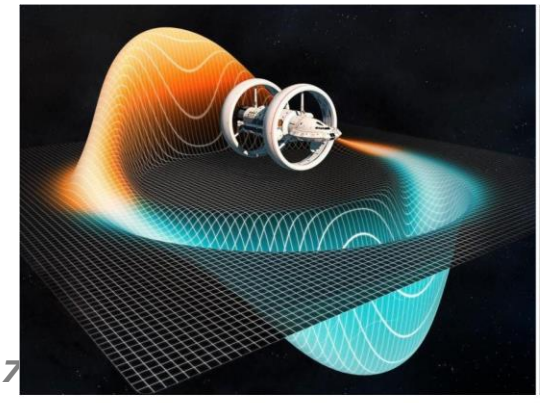
Nuclear Fusion



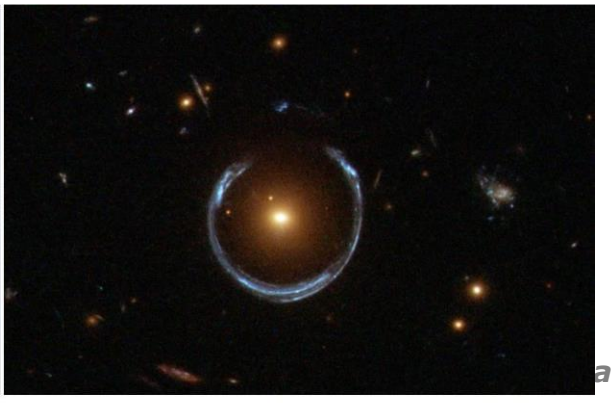
NASA's SEP - Solar electric propulsion

Advancements in the artificial creation of nuclear fusion will solve the world's energy crisis. Newton's laws of motion state that every action has an equal and opposite reaction. We might develop a new, more efficient way of burning fuel that creates greater amounts of thrust, hence propelling us to supersonic or even light speed. As we develop science in higher dimensions, we might be able to harness time and gravity and utilize them to create wormholes for intergalactic and interstellar travel. Matter and our reality as we know it makes up only 5% of our universe. 'Dark energy' and 'Dark matter' make up about 68.3% and 26% of our universe, respectively, and are conceptualized as the 5th fundamental force. Dark energy and dark matter have the strength to drive the universe apart and bring it closer and, if harnessed, can help us achieve intergalactic travel with ease. As dark matter interacts with gravity to cause various phenomena

like gravitational lensing, harnessing dark matter will lead to the harnessing of gravity itself. This might help us develop anti-gravity, which can be another propulsion for future human races. Anti-gravity can help us develop moveable settlements and inter-galactic modes of travel like warp drive, which can help mankind to live in favourable conditions all year round, instead of staying stationary in one region and experiencing the entire seasonal cycle.



Warp Drive



Dark Matter - Gravitational Lensing

A significant amount of our understanding of the future and expectations of scientific advancements comes from science fiction. Visionaries such as the creators of sci-fi genres like Total Recall (1990), Star Trek (1966), and Star Wars (!977) have given us several ideas like the first flip phone, AI/self-driven vehicles, Holographic technologies etc. Similarly, science fiction and conspiracy theories of today, like UFOs, warp drive, and extraterrestrial settlements, give us an idea and a sense of direction where scientific laws and design can lead us to.

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DESIGN TOOLS AS A DRIVER

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Abstract

The role of design tools in the creative process is paramount, aiding designers in expressing their ideas effectively. This article explores the historical progression of design tools and their impact on human evolution, from primitive tools to modern computational systems. While traditional tangible mediums such as paper and pencil have been supplemented by computer-aided design software, new tools like virtual reality (VR) and rapid prototyping offer enhanced design capabilities. Visualization and storytelling techniques, along with design thinking methodologies, further enrich the design process. Looking ahead, generative design powered by artificial intelligence (AI) holds immense potential, enabling high-performance iterations and addressing complex challenges. The emergence of the metaverse introduces new opportunities for designers, with AI-based programs and 3D modeling tools shaping immersive virtual experiences. As design tools continue to evolve, they empower creators to conceive and craft objects beyond previous limitations. The future of design is characterized by human augmentation, where

tools enhance our cognitive abilities and unlock boundless innovation and creativity.

Key Words: ***Design Tools, Design Driver, Artificial Intelligence, Prototyping,3d Modelling, Future.***

Introduction

In the realm of design, tools and techniques play a crucial role in driving the design cycle. Skilled designers recognize the immense value of appropriate tools, as they amplify their capabilities and enable them to express their creativity more effectively. These tools become an integral extension of their imagination, aiding in the generation of ideas, concepts, and themes. While numerous computational tools exist to assist designers in the later stages of the design process, only a limited number of tools, both physical and computer-based, support the initial ideation phase through freehand sketches, which remains an art mastered by proficient designers.

DEFINING DESIGN TOOLS

Design tools encompass various objects and mediums used to manifest design ideas, thoughts, scenarios, and bring a designer's imagination to life. Throughout history, design and its tools have

evolved in response to available materials, continuously adapting to enhance output quality. We can observe four distinct historical eras in terms of our work methods: the Hunter-gatherer age, lasting millions of years; the Agricultural Age, spanning thousands of years; the Industrial Age, encompassing a couple of centuries; and the current Information Age, which has persisted for a few decades. Today, as we enter the augmented age, computational systems augment our natural human capabilities by facilitating thinking processes, aiding in manufacturing, and connecting us to a digital network beyond our natural senses.

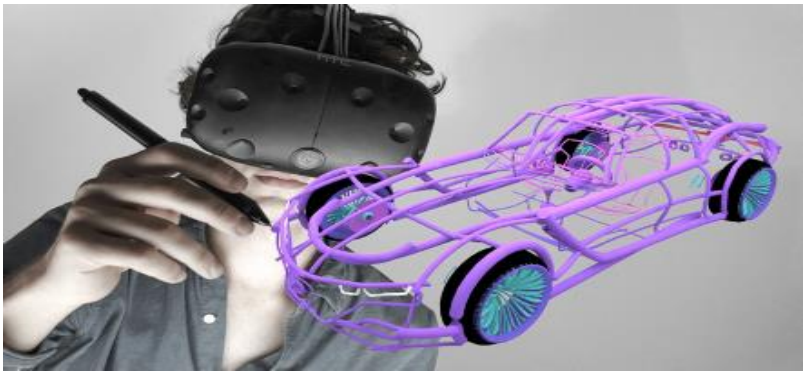
For millions of years, our tools were entirely passive, merely executing the actions we commanded them to perform. Even our most advanced tools remain obedient, carrying out explicit instructions. The earliest tools, like the chisel, were only carved when directed by the artist's hand. However, we are now witnessing a shift from passive to generative tools. Generative design tools utilize computer algorithms to synthesize geometry, generating new designs independently.

MANIFESTATION OF DESIGN TOOLS IN THE MAN-MADE WORLD

Design tools have played a significant role in human evolution throughout history. From the invention of the wheel during the Stone Age, which likely stemmed from imaginative wall paintings and was carved using primitive tools, to the design of tools used in hunting and gathering, human beings have consistently employed design principles based on user experience. This practice has persisted over the ages and continues to revolutionize design as new materials, techniques, and tools are discovered and embraced worldwide.

Design tools now extend beyond traditional tangible mediums like paper and pencil, encompassing computer-aided design software that enables efficient and precise designs. Prototyping and scale models are utilized to enhance understanding and analysis. Additionally, design thinking methodologies, including visualization, journey mapping, mind mapping, rapid prototyping, and storytelling, serve as valuable tools. These tools have the potential to shape design in broader spatial and temporal contexts.

Visualization, including virtual reality (VR), can enable the creation of environments beyond the realm of human experience. For instance, VR simulations can facilitate the design of water bottles suitable for extraterrestrial environments like Venus or Mars. Furthermore, rapid prototyping, such as the use of 3D pens, holds the potential to transform the design process, allowing designers to sketch three-dimensional models effortlessly.



Source: ***https://www.dezeen.com/2017/01/13/gravity-sketch-virtual-reality-vr-software-creative-professionals-launches-beta-testing-platform-design-technology/***

While design tools remain crucial for designers to express themselves through various mediums, adapting and mastering new tools can be challenging. However, it is essential to remember that design drives tools, and not the other way around.

IMPACT OF DESIGN TOOLS IN THE FUTURE OF DESIGN

The evolution of design tools is poised to bring about unexpected changes in the future. Generative design, powered by artificial intelligence (AI), represents the next frontier in computer-aided design for engineers across manufacturing industries. This approach harnesses the potential of AI to develop high-performance design iterations, addressing complex challenges, reducing component weights and manufacturing costs, enabling customization at scale, and optimizing performance. Generative design has already found practical applications, such as the creation of aerial drone chassis, where the computer explores countless design possibilities based on given criteria.

Source: DALL.E 2 from Open AI can turn your thoughts into images using only text
Source: https://www.qblocks.cloud/blog/openai-dall-e-2-generate-images-from-text

Computers have transitioned from being purely logical machines to intuitive entities capable of analyzing and providing feedback on human-designed creations. This development holds immense potential, not only for artistic endeavors but also for addressing significant global challenges like climate change. By leveraging technology to augment our cognitive abilities, we can imagine and design solutions that were previously beyond our reach as unaugmented humans. This era of human augmentation encompasses not only the physical world but also the realm of intellectual and virtual experiences.

DESIGN TOOLS IN THE METAVERSE

AI-based programs like DALL.E 2 have the potential to revolutionize art generation, particularly in the context of emerging trends like NFTs and the metaverse. As we enter the metaverse, a 3D extension of the internet, designers across various sectors, from education and healthcare to marketing and retail, seek appropriate tools to craft

metaverse experiences. Tools such as Nvidia Omniverse, a real-time 3D design collaboration and virtual world simulation platform, and Oculus Horizon Words, enabling the creation of personalized virtual worlds facilitate this process.

Source: https://developer.nvidia.com/nvidia-omniverse-platform

In the metaverse, realism is key to user immersion. Therefore, metaverse designers must master 3D modelling tools like Blender, Cinema 4D, and Houdini. Designing realistic avatars and designing interactions within the metaverse require tested methods, emphasizing the importance of building upon existing knowledge. The metaverse not only provides a virtual world for designers to shape but also serves as a tool for enhancing intuitive design experiences as we progress into the future.

CONCLUSION

Design tools continue to evolve, opening up endless possibilities for the future. Our tools have always shaped the things we create, from simple reeds and letterpresses to virtual canvases and beyond. Technology amplifies our cognitive abilities, enabling us to conceive

and design objects that were previously unimaginable. The era of human augmentation encompasses both the physical and virtual realms, as new tools contribute to increased productivity and creativity. The potential for innovation and creation is boundless, and we must equip ourselves with the tools necessary to shape our future.

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DURABILITY, RELIABILITY AND AVAILABILITY AS DESIGN DRIVERS

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Abstract

This paper explores the essential role of design drivers in the design process, particularly durability, reliability, and availability. Design drivers are influential factors that guide and motivate design decisions, fostering creativity and problem-solving. Durability refers to the ability of a physical product to withstand challenges and remain functional over its intended lifespan. Reliability is consistent performance and trustworthiness, while availability signifies accessibility and usability. By examining the interplay of these design drivers in human biology and nature, designers can draw inspiration to create sustainable, efficient, and resilient solutions.

Key Words: ***Durability, Reliability, Design driver, Nature, Human Creativity, Future.***

Introduction

Design drivers play a pivotal role in the planning, arrangement, and interactivity of creating various objects and systems. These drivers

act as catalysts, stimulating divergent thinking and directing the design process toward specific goals. Durability, reliability, and availability emerge as prominent design drivers, shaping a design's form, function, and overall success.

Durability, Reliability, and Availability:

Durability is a crucial design driver, referring to the capacity of a physical product to endure regular operation without significant deterioration. It can withstand wear, pressure, damage, and other stresses, ensuring longevity and reduced maintenance needs. In human biology, durability is evident in the skeletal system, which provides structural support and protects vital organs. Bones exhibit remarkable durability by withstanding daily stresses, while the availability of essential minerals sustains their strength and regeneration.

Reliability emerges as an essential design driver, signifying consistent performance and trustworthiness. A reliable design or system operates consistently well and meets expectations. The immune system exemplifies reliability in the human realm by mounting effective responses to pathogens and defending the body against infections. Similarly, the circulatory system showcases reliability through the heart's consistent contractions, maintaining blood flow and delivering oxygen and nutrients throughout the body. In renewable energy, sources like solar and wind power demonstrate reliability by consistently providing sustainable energy without depletion.

Availability plays a vital role as a design driver, representing the usability and accessibility of a product or system. It reflects the

degree to which something can be obtained or utilized. In human biology, availability is observed in the respiratory system's ability to supply oxygen to tissues throughout the body. Oxygen is made available to cells for optimal functioning by coordinating various organs, such as the lungs, heart, and blood vessels. Similarly, the availability of resources in natural ecosystems enables the sustenance of diverse species and ecological processes.

Subtopics

Human:

Human biology offers compelling examples of durability, reliability, and availability within various physiological systems:

- ***Nervous System:*** ***The nervous system exemplifies reliability by efficiently transmitting electrical signals and facilitating communication within the body. Availability is observed through neurotransmitters, enabling proper functioning and synaptic connections.***

- ***Immune System:*** ***The immune system showcases reliability through its consistent defense against pathogens, protecting the body from infections. The availability of immune cells and molecules ensures the body's readiness to mount responses when needed.***

- ***Musculoskeletal System:*** ***The musculoskeletal system provides durability by allowing for physical movement and maintaining posture. It relies on the reliable coordination of muscles, tendons, and bones, ensuring stability and functionality. The availability of nutrients and minerals supports these structures' growth, repair, and maintenance.***

- ***Endocrine System**: The endocrine system exhibits reliability by regulating various bodily functions through hormone secretion. The availability of hormones ensures their timely release, influencing physiological processes and maintaining homeostasis.*

Nature:

The natural world offers profound examples of durability, reliability, and availability, demonstrating sustainable design principles:

- ***Ecosystems:** Natural ecosystems exhibit remarkable durability and reliability through their ability to maintain ecological processes. Biodiversity and species' interdependence ensure resource availability, promoting stability and resilience.*

- ***Migration Patterns**: Animal migration patterns highlight the durability and reliability of species in navigating vast distances. The availability of suitable habitats and food sources along migration routes enables the survival and reproduction of migratory species.*

- ***Plant Adaptations**: Plants demonstrate durability by adapting to diverse environmental conditions, such as extreme temperatures or limited water availability. Reliability is observed in their ability to withstand these challenges and continue to grow and reproduce.*

- ***Natural Resilience**: Natural disasters and disturbances provide opportunities to witness ecosystems' durability, reliability, and availability. Through regeneration and*

recolonization, ecosystems exhibit resilience and adaptability, maintaining their functions and biodiversity.

Future:

Considering the future, incorporating durability, reliability, and availability becomes crucial in designing sustainable solutions. Here are examples of how these design drivers can be applied:

- ***Intelligent Infrastructure**: Building resilient and durable infrastructure systems that can withstand natural disasters, cyber-attacks, and changing environmental conditions ensures the reliability and availability of critical services. This includes developing smart grids, advanced transportation networks, and resilient buildings that adapt to future challenges.*

- ***Circular Economy**: Embracing a circular economy model focuses on designing products for durability, ease of repair, and materials recyclability. This approach promotes resource availability and reduces waste, creating a more sustainable and efficient future.*

- ***Healthcare Innovations**: Advancements in healthcare technologies aim to improve the durability, reliability, and availability of medical treatments and interventions. These innovations, from durable prosthetics to reliable telemedicine platforms, enhance healthcare accessibility and quality.*

- ***Sustainable Agriculture**: Designing agricultural systems prioritizing soil health, water efficiency, and crop resilience promotes durability, reliability, and availability of food resources. Implementing sustainable farming practices and*

utilizing precision agriculture technologies contribute to a resilient and secure food supply.

Conclusion:

Durability, reliability, and availability are integral design drivers that can be observed in both human biology and the natural world. By recognizing and implementing these principles, designers can create sustainable and efficient solutions that align with the fundamental principles of durability, reliability, and availability. Drawing inspiration from nature's designs and understanding the interconnectedness of human systems can lead to innovative and resilient structures that meet present and future needs.

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GEOGRAPHY AS A DESIGN DRIVER

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Abstract

The influence of geography on design is a significant factor that shapes various aspects of our lives. This paper explores the impact of geography on design, including its influence on the environment, evolution, culture, socio-economic development, and architecture. Geography, as the study of places and their relationships with people and the environment, explains the diversity and uniqueness found worldwide. It affects the evolution of species and cultures through varying environmental conditions created by geographical separations. Furthermore, geography plays a role in shaping human traits such as race and ethnicity. Socio-economic development is influenced by geography, with factors like landlocked locations affecting trade, coastal areas benefiting from higher incomes, and topography impacting state formation. In architecture, geography influences materials, design decisions, and climate adaptation. Moreover, the future colonization of other planets, such as Mars, will require innovative designs driven by the unique geographic conditions of these celestial bodies. Overall, geography is a crucial

determinant of design, influencing form, function, and cultural expression.

Key Words: ***Geography, Design driver, Nature, Human Creativity, Future.***

Introduction

Design is a broad concept, and its meaning can vary from situation to situation, person to person. Every designer will have their perception of what drives it. Many things can drive designs, and one of those important things is geography. This paper aims to look at what geography is and how influential it is in shaping things around us, whether natural or man-made.

According to National Geographic, Geography is the study of places and the relationships between people and their environments. To most people, Geography means where places are and what they are like, but if we take a closer look, Geography explains why certain things are as they are, and where they are. (What is Geography? n.d.). It explains why there is so much diversity all around the world in everything from the appearance of people to the food they eat. Geography influences everything from our food, health, safety, and climate to our social and economic systems. Imagine a world there are no geographical differences, no deserts in Sahara, or ice caps on the poles, it would result in everywhere everything looking and feeling the same, and everyone would be experiencing similar environmental conditions and having access to similar resources. Most importantly, this would completely alter the course of the origin and evolution of species and cultures.

Geography is a field of study that deals with the description, distribution, and interaction of the diverse physical, biological, and cultural features of a planet's surface. Geography can also improve our understanding of places and the relationship between people and their environment, it includes physical features, their atmosphere, human activity, distribution of population, resources, and economic activities. Our understanding of social and physical

processes within the context of place defines geography. Even though the term means to graph physical places, geography is also about spatial aspects of human existence and its shared relations, how humans occupy and alter the physical landscape, and the relationship between the environment and human society.

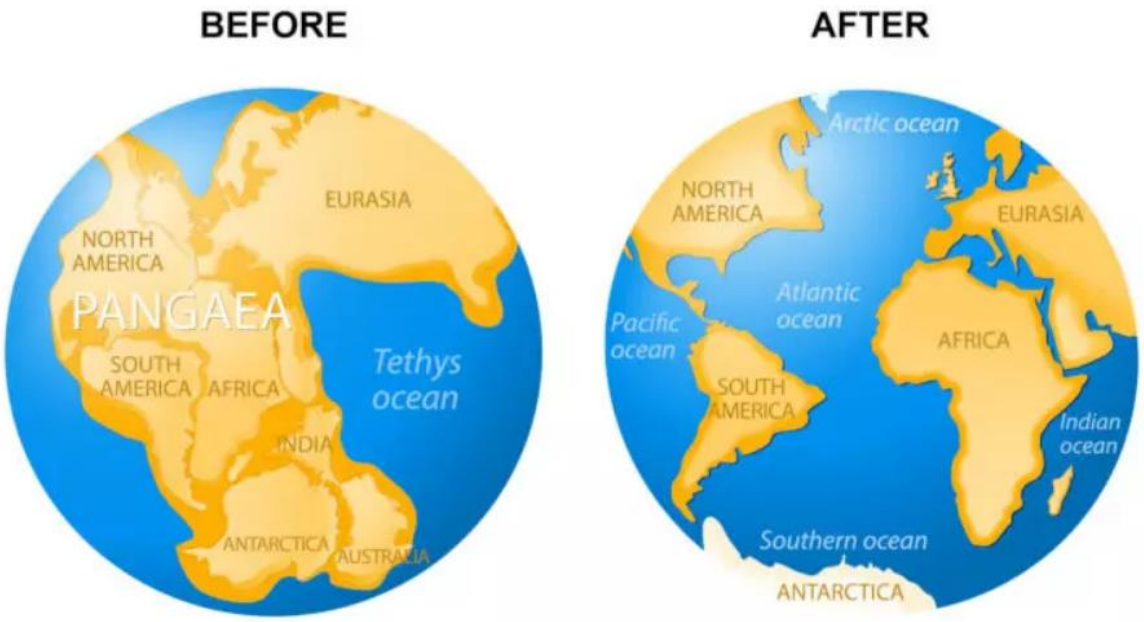


Figure 2 Earth before and after separation of Plate Tectonics. Source: https://worldinmaps.com/tectonic-plates

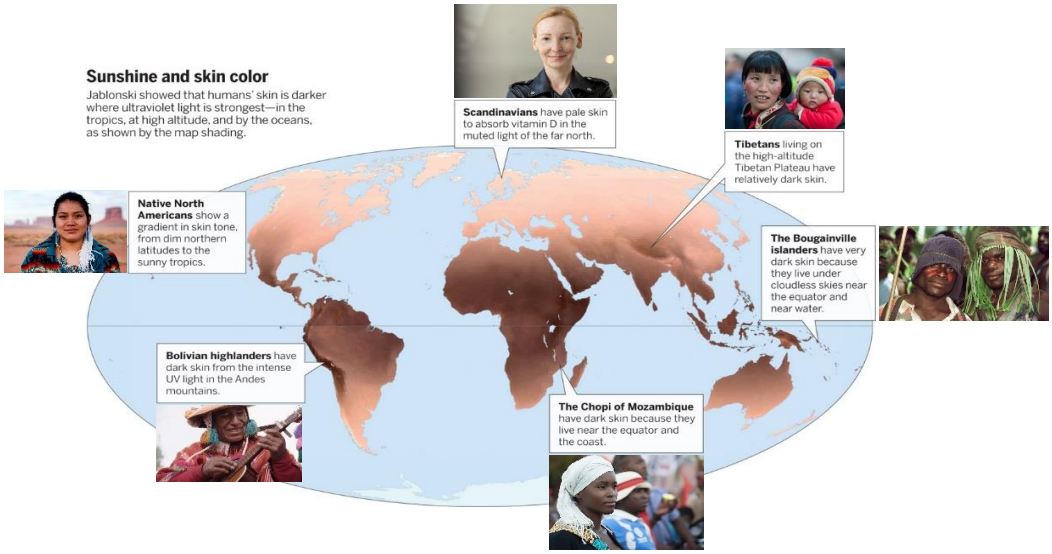
Influence on Geography in Nurturing Life

We all have learned about the theory of evolution. At a very basic level, organism undergoes evolution to adapt to their change's environmental conditions; it's a survival mechanism, now what drives these environmental conditions are primarily their geographical location. Climate, resources, flora, and fauna all change due to varying geography. Geological studies show that the earth's geography was in a very different state than what we see now. There was only one single land mass continent called Pangea and one single huge ocean called Panthalassa; the continents and oceans we have now are the results of the movement of plate tectonics and the subsequent breakdown and separation of land mass that sits above it. These geographic separations caused the formation of very diverse geographic conditions all over the globe. Hot, cold, dry,

humid, etc. This also caused species to evolve differently to adapt to their changing conditions. These eventually led to minor and major biological differences in life forms. Human differences in cultures, way of life, faith, food, shelter, clothing, etc., all of these things began to take unique shapes and forms in different parts of the world.

There is a strong relationship between man and the natural environment, After the publication of Charles Darwin's Origin of Species (1859), the concept of defining geography concerning the relationship between man and the environment began to take shape. Darwin's geological findings and theories all pointed toward the idea that things in nature evolve with time and their changing conditions or said as evolution. Some places contain more species than others. For example, Sahara has fewer species than a temperate rainforest like Amazon. Life thrives in one, and in the other, only very selected lifeforms that have undergone evolution can survive. The Amazon is the most biodiverse terrestrial place on the planet. This amazing rainforest is home to more species of birds, plants, and mammals than anywhere else. Around 30% of the world's species, and 10% of the world's biodiversity, can be found there. Factors that influence the species richness include are size and position of continents and islands, the height, position, and location of mountains, and

temperature and exposure to energy from the sun. (Lobo, n.d.). These three factors in different combinations can cause very different environmental conditions cold, hot, dry, tropic, etc., On the poles, it is very cold due absence of direct sunlight. The high position of the sun causes extreme heat in deserts. Many of the patterns we observe around us are the result of the historical movement of tectonic plates, and uplift and degradation of mountains and the accompanying effect on climate and the persistence and distribution of flora and fauna. The geographic distribution of organisms in the various locations follows patterns that can be explained by evolution concerning the movement of tectonic plates slowly over time.



Race and Ethnicity are other important Human traits influenced by physical geography. Further, the distance between the two places and differences in people's physical traits like skin, color, height, and hair will be more and more. a person's racial character can be traced down to where in the world their ancestors originated from. People whose ancestors have been living in the same geographic location

for a long time seem to show similar visible traits. Further, the distance between the two places and differences in people's physical traits like skin, color, height, and hair will be more and more. a person's racial character can be traced down to where in the world their ancestors originated from. People whose ancestors have been living in the same geographic location for a long time seem to show similar visible traits. Fig 4 shows that human skin is darker where ultraviolet light is strongest. In the tropics, at high altitudes, and by the oceans. (Gibbons, 2014). The environment they evolved in favours certain characteristics, causing the development of populations that are, on average taller, darker, or more rugged than other populations from other geographic areas around the world.

Geography and Socio-Economic Development.

Geography is often a key affecting the design and character of various things around us, it can influence choices like form, colour, or material. A house in a rainy suburb of Kerala may look nothing like a shelter in a desert-like Thar, likewise clothes, foods, products, and vehicles all change in form and function based on geographical differences. However, the current reality is that with globalization at its peak, most products are being designed for a global audience. The concept of 'one-design-fits-all' is becoming more popular, evident in several fields like Architecture, Automobiles, Products, Films, etc.

The physical features of a place can influence the human culture and social development of that place. This means that the landforms, ecology, and climate of a specific region are the most important factors influencing how culture develops in that place. There is a field of science called Environmental Determinism which studies

physical geographic features such as climate and terrain and their influence on human culture. Friedrich Ratzel, A well-known German geographer in his book first pointed out the influence of the physical environment on history, culture, way of life, and the geographical distribution of humans around the world. (KROSOFSKY, 2020) He considered a nation similar to a living thing and argued that a country's search for territorial expansion is similar to a growing organism's need for space and resources; this particular concept was used Nazi regime to justify their program of territorial expansion, which led to the World Wars. Almost all the landlocked countries have poor economies or are underdeveloped, except for the few in Western and Central Europe, which are well connected to the regional European market. It is because landlocked countries are completely dependent on their neighbouring countries to access overseas markets. Kazakhstan has the longest distance from the sea, followed by Afghanistan, Chad, Niger, Zambia, and Zimbabwe, with distances from the closest coastline of more than 2,000 km. Transit time for goods in these countries is very long because of their landlocked location, difficult terrain conditions, road and rail conditions, and inefficiency of transport networks. On the opposite, Britain's geography allowed it to become a superpower. In the past, it made foreign invasion difficult, which protected its resources so that it could develop relatively uninterrupted. It eventually focused on trade and naval power. The unique geographical position of Britain also helped in tremendous trade opportunities all over the world, Britain held a highly strategically important position on the global map. It links America with Europe. It sits in the middle of the world. It controlled the English Channel, one of the busiest shipping

routes in the world, and all of these eventually helped Britain to become a world power.

Historians have also noted that the density of population seems to concentrate on coastal areas and that regions with large coastlines benefit from higher average incomes per capita when compared to those in landlocked countries. It has been proven that coastal living has huge advantages as coastal civilizations relied on the coastline and waterways for trade, irrigation, and, very importantly, as a food source. On the contrary, landlocked countries and countries without navigable waterways are often less developed and have less growth potential because of the slow movement of knowledge, innovations, and goods. In addition, landlocked regions tend to have both lower population densities and low labour productivity levels. However, other factors, including land fertility, connected rivers, and ecological conditions suited for rice or wheat cultivation, can lead to dense populations and further development of civilization. (John Luke Gallup, 2009)

A study by Economists Nathan Nunn and Diego Puga explained that the terrain had positive effects on some African communities by protecting them from the slave trade. Some communities that were located in areas with rugged terrain were able to conceal themselves from slave traders and protect their place from being invaded. The study found that in these areas, rugged topography produced long-term economic benefits and aided post-colonial state formation. Economic historians have found that societies in the Northern Hemisphere experience higher standards of living and that as latitude increases north or south from the equator, levels of real GDP per capita also increase.

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Design driven by Geography

Architecture is the art and science of designing and creating buildings, the influence of geography on architecture is different in places around the world. In North Africa, they use rammed earth that is made of chalk, lime, and gravel and in West Africa, they use mud for adobes. Because of the geography, the materials available locally are different. Japan is located in the highly seismically active area of The Ring of Fire in the basic Pacific Ocean, where a lot of tsunamis and earthquakes occur, causing frequent destructions. Japan has come up with an interesting design solution called a levitation system to protect from earthquakes; this technique which

sulates the building from the effects of seismic waves by lifting off its foundation for the duration of the earthquake.

Today what we call now as vernacular architecture is an architectural style that is built to meet the present needs, keeping in mind the local climate, culture, and materials. But its presence appeared a long time back when the need for "a shelter" came up, which pushed humans to use indigenous techniques and materials to come up with an optimum solution for themselves. This gave birth to a "tent" that now has unique designs in different geographic locations. It is also evolving because the local conditions proportionally evolve and are dispersed because it is purely regional. Its diverse nature makes it difficult to be termed into a singular style with a single name. (Jindal, n.d.). There are more ways in which geography can dictate architectural designs. Building something on a flat piece of land and a sloping terrain is different. There are design different approaches you can take in this case; the best would be designing the spaces with carefully planned levels that follow the contours of the site in a way that the disturbance and displacement to the land are as minimal as possible. The result would be a design that is unique to that particular site's conditions.

Different geographic conditions can drive people to make the same product in different shapes and forms. In Fig 7, These are both small boats with similar use cases. The shorter one is from Varanasi, and the longer is from Kerala backwaters. It is very evident that the boats are docked differently, in Varanasi boats are docked perpendicular to the shore; this is because Varanasi experiences a tidal variation of up to 4m in a single day; the boats will roll over during low tide if docked parallelly since they are docked perpendicular ingress and egress from the boats will be easier if they have this flat portion on both ends. Secondly, If we look at

boats in Kerala, they don't have to worry much about the tidal variation since it is less than 1 meter, so boats can be longer and can be docked sideways, also easier to enter and exit. In both cases, we can see how geography has played an important role in deciding the form and shape of boats with similar functions.

We, humans, are not naturally designed to live in extreme conditions so, we have come up with solutions or products that can assist in extreme conditions like very cold, hot, or outer space. When we started going out to space, we realized that a simple thing like a pen wouldn't work in space, it needs gravity, so we needed to design a new pen that doesn't require gravity. That's how fisher space pens were invented. it works in zero gravity because of pressurized nitrogen pushing the ink. Similarly, we have specially designed gadgets like laptops that are designed to be used in extreme climatic conditions like the pole, because our conventional when we started going out to space, we realized that a simple thing like a pen wouldn't work in space, it needs gravity, so we needed to design a new pen that doesn't require gravity. That's how fisher space pens were invented. it works in zero gravity because pressurized nitrogen pushes the ink.

Fig 9 shows a motorcycle, designed for the moon, we can see how the tires are, and how the mechanics are shielded from radiation, and overall, it has a spacecraft theme to it, all purely based on functional requirements. this design is completely driven by the geographic characteristics of the Moon.

Looking beyond, Planets like Mars do not have anything in common with earth's geography, we are forced to come up with innovations and designs if we were to inhabit Mars. All the conceptual buildings or habitat designs (fig 10) for Mars can be seen as round bubble shapes. Because circular shapes hold the air pressure most effectively, also huge vehicles as shown in (fig 10) can be more effective on mars than on earth due to low gravity, mars have only one-third of the earth's gravity so things would only weigh one-third.

A lot of organizations are conducting several outer space design competitions for the public to encourage innovations and techniques to solve challenges put forward by these very different geographic conditions. Just like how we thought of building dams on a river, surely these new geographic conditions will enable us to come up with similar solutions that will enable future generations.

Conclusion

We, humans, are wonderful creatures, we can create languages, conventions, and customs and are incredibly diverse. The rules governing human progression are not built into our genes; each new generation has to learn to live according to the surroundings they are introduced to. We continue what previous generations have started. We move forward as a species not as an individual. Maybe sometimes in the future, we may not even be earthbound, but we have that extraordinary ability to make the best out of what we are given. We might evolve, but we will always be Humans and we have to take care of our environment for the betterment of all life.

We saw how geographic conditions can drive innovations and development in different ways. It very strong driving factor in

deciding how things are and where they are. But now we have started to overcome geographic limitations through technology to expand our footprint to places that were thought to be impossible earlier, so it is right to say that geographic limitation is the new driving force behind a lot of innovative designs and technologies. In the design and technological field, now there is a lot of design competition concerning outer space habitation, all of these are to generate new thought processes and innovations to enable us to sustain ourselves in an environment that we are naturally not suited to live in. With the development of technology, humans have been able to improve their quality of life by connecting and having access to information and overcoming the limitations of unfavorable geography.

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PAST AND PRESENT AS A DESIGN DRIVER

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Abstract:

Design is a dynamic field that constantly evolves to meet the changing needs and aspirations of society. The past and the present serve as important drivers in the design process, providing valuable insights, inspiration, and foundations for innovation. This paper explores the significance of the past and the present as design drivers, examining their influence on design thinking, aesthetics, technology, and sustainability. By understanding and leveraging the lessons of history and the opportunities of the present, designers can create solutions that not only address current challenges but also pave the way for a better future.

Key Words: ***Past, Present, Design driver, Nature, Human Creativity, Future.***

Introduction:

Design is a multidimensional discipline that encompasses various aspects, including aesthetics, functionality, usability, and

sustainability. The past and the present play crucial roles in shaping design practices and outcomes. This paper aims to explore the interconnectedness of the past and the present as design drivers and their implications for future-oriented design.Design is a dynamic and ever-evolving field that draws inspiration and guidance from the past while responding to the needs and opportunities of the present. The past and the present serve as powerful design drivers, influencing design thinking, aesthetics, technology, and sustainability. By understanding and leveraging the lessons of history and the possibilities of the present, designers can shape a future that is both visionary and rooted in practicality.

The past offers a vast repository of knowledge, experience, and inspiration. Historical design movements, cultural contexts, and technological advancements provide valuable insights into successful design solutions, enduring aesthetics, and lessons learned from past failures. By studying and appreciating the evolution of design, designers can build upon past achievements, avoid repeating mistakes, and incorporate timeless elements into their work.

On the other hand, the present is a reflection of the current socio-cultural, economic, and technological landscape. Designers must immerse themselves in the contemporary context to create relevant and meaningful solutions. The present moment presents opportunities to explore emerging technologies, materials, and social dynamics that shape design decisions. It requires designers to be adaptable, innovative, and empathetic to meet the evolving needs and aspirations of society.

The integration of technology into design practices is a key aspect of the present and future of design. Technological advancements, from the invention of the printing press to the rise of digital technologies, have revolutionized design possibilities. Emerging technologies such as artificial intelligence, augmented reality, and advanced manufacturing techniques are transforming how designers approach their work. By embracing and harnessing these technologies responsibly, designers can unlock new avenues for innovation, customization, and sustainability.

Furthermore, the urgency of environmental concerns calls for a design approach that prioritizes sustainability and the circular economy. Designers are increasingly tasked with creating solutions that minimize waste, conserve resources, and promote a regenerative mindset. Learning from traditional practices, utilizing renewable materials, and embracing sustainable manufacturing processes are essential for designing a future that is environmentally responsible and socially equitable.

In this paper, we will explore the interconnectedness of the past and the present as design drivers and delve into their implications for future-oriented design. We will examine how historical influences continue to shape contemporary design approaches and how the current context inspires innovative design thinking. Furthermore, we will explore the role of technology in shaping design possibilities and how sustainability considerations are becoming central to the design process.

By understanding the significance of the past and the present as design drivers, designers can navigate the complexities of the modern world and create solutions that not only address current

challenges but also shape a future that is sustainable, inclusive, and visionary.

Learning from the Past:

The past serves as a rich source of inspiration and knowledge for designers. By studying historical design movements, cultural contexts, and technological advancements, designers can gain insights into successful solutions, enduring aesthetics, and lessons from failures. Understanding the evolution of design helps designers build upon past achievements and avoid repeating mistakes. Examples of design movements like Art Nouveau, Bauhaus, and mid-century modernism illustrate how historical influences continue to shape contemporary design approaches.

The past serves as a rich source of inspiration and knowledge for designers, offering a treasure trove of ideas, concepts, and aesthetics that have stood the test of time. By delving into history, designers can gain valuable insights and draw upon the successes and failures of their predecessors to inform their own creative process. Here are some key reasons why the past is an essential resource for designers:

1. ***Historical Design Movements: Throughout history, various design movements have emerged, each with its unique characteristics and philosophies. Movements such as Art Nouveau, Bauhaus, Art Deco, and Mid-Century Modern have left an indelible mark on design history. By studying these movements, designers can understand the principles that underpin successful design and apply them in innovative ways. They can learn about the use of materials, proportions, colors,***

and forms that have resonated with people across different eras.

2. ***Timeless Aesthetics:*** *Many design elements and aesthetics from the past have endured and continue to captivate audiences today. Whether it's the graceful curves of the Art Nouveau era or the clean lines of the Bauhaus movement, certain design styles have transcended time. By incorporating these timeless aesthetics into their work, designers can create visually appealing and enduring designs that resonate with people's sensibilities.*

3. ***Lessons from History:*** *History offers valuable lessons and insights into design successes and failures. By examining past designs and their impact, designers can gain a deeper understanding of what works and what doesn't. They can learn from design mistakes, understand the societal and cultural contexts in which designs thrived or faltered, and apply those lessons to their own projects. History provides a wealth of case studies that designers can draw upon to inform their decision-making and avoid repeating past errors.*

4. ***Cultural Context:*** *The past is intertwined with different cultural contexts, each offering unique perspectives on design. By studying the design traditions of different cultures and civilizations, designers can broaden their understanding of aesthetics, symbolism, and functional considerations. This cross-cultural exploration allows designers to infuse their work with diverse influences, resulting in richer and more inclusive design solutions.*

5. ***Craftsmanship and Traditional Techniques:*** ***Throughout history, artisans and craftspeople have developed sophisticated techniques and craftsmanship that have been passed down through generations. By learning from traditional practices, designers can integrate age-old techniques into their work, fostering a sense of heritage and cultural continuity. Incorporating these techniques can add a level of craftsmanship and authenticity to contemporary designs.***

6. ***Revival and Reinterpretation: Designers often draw inspiration from the past by reviving or reinterpreting historical styles. This can involve taking elements from a specific era and infusing them with a modern twist or incorporating vintage-inspired details into contemporary designs. By referencing the past, designers can create designs that evoke nostalgia, evoke emotions, or establish a connection with a particular time period.***

The past serves as a wellspring of inspiration and knowledge for designers. By studying historical design movements, timeless aesthetics, learning from past mistakes, exploring cultural contexts, embracing traditional craftsmanship, and reviving or reinterpreting historical styles, designers can tap into the vast resources that history offers. The lessons and inspirations from the past can fuel innovation and enable designers to create meaningful and impactful designs in the present and future.

Embracing the Present:

Design is a response to the needs and desires of the present moment. Designers must be attuned to the current socio-cultural,

economic, and technological contexts to create relevant and meaningful solutions. The present provides opportunities to explore emerging technologies, materials, and social dynamics that can shape design decisions. Concepts such as user-centered design, co-creation, and sustainability have gained prominence due to the demands of the present, reflecting the importance of designing with empathy and a focus on long-term impact.

Design is indeed a response to the needs and desires of the present moment. As society evolves, so do our needs, aspirations, and challenges. Designers play a crucial role in addressing these evolving dynamics by creating solutions that are relevant, functional, and meaningful. Here are some key points elaborating on how design responds to the present:

1. ***Understanding User Needs:*** ***Designers immerse themselves in understanding the needs, desires, and behaviors of the users or target audience. They conduct research, engage in user-centered design methodologies, and gather insights to gain a deep understanding of the present-day context. By empathizing with users and stakeholders, designers can identify gaps, pain points, and opportunities to develop solutions that directly address the specific needs and challenges of the present.***

2. ***Social and Cultural Influences:*** ***Design is intrinsically connected to the social and cultural fabric of a society. It reflects the values, beliefs, and norms that shape our present moment. Designers are keen observers of societal shifts, cultural trends, and emerging behaviors. They analyze the***

changing landscape and use this understanding to create designs that resonate with people, promote inclusivity, and reflect the diverse perspectives and identities of the present society.

3. ***Technological Advancements****: The rapid pace of technological advancement greatly influences design. New technologies provide designers with innovative tools, materials, and possibilities to meet the demands of the present. From the integration of artificial intelligence and machine learning to the development of sustainable materials and smart devices, designers leverage these advancements to create solutions that align with the present technological landscape.*

4. ***Environmental Sustainability****: In the face of pressing environmental challenges, design has a critical role in promoting sustainability. Designers are increasingly aware of the ecological impact of their work and are embracing eco-friendly practices. They respond to the present need for sustainable solutions by incorporating principles of sustainable design, utilizing recyclable materials, minimizing waste, and designing for longevity. Responding to the present need for environmental stewardship, designers contribute to a greener and more sustainable future.*

5. ***Emotional Connection and Experience****: Design is not only about functionality; it also focuses on creating meaningful experiences and emotional connections. In the present moment, people seek products, services, and environments that resonate with their emotions, aspirations,*

and values. Designers respond by creating designs that evoke emotions, tell compelling stories, and provide immersive experiences. They consider the present-day desires for personalization, authenticity, and a sense of belonging, crafting designs that engage users on a deeper level.

6. Economic Considerations: The economic landscape greatly influences design. Designers respond to the present economic conditions, market demands, and consumer behaviors. They consider factors such as cost-effectiveness, scalability, and market viability when developing their designs. By understanding the economic realities of the present, designers create solutions that are not only desirable and functional but also economically viable and sustainable in the long run.

Design is a dynamic discipline that responds to the needs and desires of the present moment. Designers actively engage with the present context, understanding user needs, societal shifts, technological advancements, sustainability concerns, emotional connections, and economic considerations. By being attentive to the present landscape, designers can create solutions that are relevant, meaningful, and impactful, improving the lives of individuals and shaping a better future.

Technology as a Catalyst for Change:

Technological advancements have a profound influence on design. From the invention of the printing press to the rise of digital technologies, each era's technological breakthroughs have revolutionized design practices and possibilities. The integration of

emerging technologies, such as artificial intelligence, augmented reality, and 3D printing, into the design process opens up new avenues for innovation, customization, and sustainability. Designers must embrace and harness these technologies responsibly to shape a future that balances efficiency, aesthetics, and ethical considerations.

Technological advancements have indeed had a profound influence on design, transforming the way we conceive, create, and experience products, services, and environments. Here are several key ways in which technology has shaped and continues to shape design:

1. ***Design Tools and Software****: Technological advancements have provided designers with a wide range of powerful tools and software that enhance their creativity, efficiency, and precision. Computer-aided design (CAD) software, 3D modeling tools, virtual reality (VR) and augmented reality (AR) platforms, and prototyping technologies have revolutionized the design process. These tools enable designers to visualize concepts, iterate designs more rapidly, simulate real-world scenarios, and gather user feedback early in the design phase.*

2. ***Digital Transformation****: The proliferation of digital technologies has fundamentally transformed various design domains, such as graphic design, web design, and user interface (UI) and user experience (UX) design. Designers leverage digital platforms, interactive interfaces, and multimedia elements to create engaging and interactive*

experiences. The digital realm also offers new avenues for personalization, customization, and dynamic content, enabling designers to tailor experiences to individual users and adapt to their evolving needs.

3. ***Internet of Things** (IoT): The advent of IoT has opened up new possibilities for connected and smart designs. IoT allows physical objects and devices to be interconnected and communicate with each other, enabling designers to create intelligent and interactive systems. From smart homes and wearable devices to industrial automation and smart cities, IoT has influenced the design of products and environments to be more responsive, efficient, and adaptive to users' needs.*

4. ***Sustainable Design**: Technology plays a crucial role in advancing sustainable design practices. With growing environmental concerns, designers are leveraging technology to create eco-friendly solutions. This includes the use of renewable energy sources, energy-efficient materials, smart sensors for monitoring and optimizing resource usage, and data-driven design strategies to reduce waste and carbon footprint. Technology enables designers to create innovative solutions that minimize environmental impact and promote a more sustainable future.*

5. ***Manufacturing and Production**: Technological advancements have revolutionized manufacturing and production processes, allowing for greater efficiency, precision, and customization. Technologies such as additive manufacturing (3D printing), robotics, automation, and*

advanced materials have transformed the way products are manufactured. Designers can now create complex and intricate designs that were previously difficult or impossible to produce, leading to greater design freedom and novel aesthetic possibilities.

6. ***Human-Machine Interaction****: As technology becomes more integrated into our daily lives, designers are tasked with creating seamless and intuitive interfaces for human-machine interaction. Designers focus on creating user-friendly interfaces, considering factors such as usability, accessibility, and learnability. They design interfaces that cater to various user contexts, devices, and interaction modes, ensuring a smooth and engaging user experience.*

7. ***Data-Driven Design****: The availability of vast amounts of data has enabled designers to make informed design decisions. Through data analytics and user research, designers can gain valuable insights into user behavior, preferences, and needs. They use this data to inform design choices, tailor experiences, and create personalized solutions that better meet users' requirements.*

Technological advancements have significantly influenced the field of design, shaping the way designers conceive, create, and deliver solutions. The availability of advanced design tools, digital transformation, IoT, sustainable design practices, advanced manufacturing techniques, human-machine interaction, and data-driven design are just a few examples of how technology has impacted design. Embracing and leveraging these advancements

allows designers to push the boundaries of creativity, enhance user experiences, and create innovative solutions that address the evolving needs of society.

Sustainability and the Circular Economy:

The urgent need for sustainable design has become increasingly evident in the face of environmental challenges. Designers today are tasked with creating solutions that minimize waste, conserve resources, and promote a circular economy. By learning from traditional practices, utilizing renewable materials, and embracing sustainable manufacturing processes, designers can address pressing environmental concerns. Moreover, the present moment calls for inclusive and regenerative design approaches that prioritize social equity, diversity, and community engagement.

The urgent need for sustainable design has indeed become increasingly evident in the face of numerous environmental challenges that we face today. These challenges include climate change, resource depletion, pollution, habitat destruction, and loss of biodiversity. Sustainable design aims to address these issues by integrating environmental, social, and economic considerations into the design process, with the goal of creating products, services, and environments that minimize negative impacts and promote a more sustainable future. Here are some key points elaborating on the importance of sustainable design:

1. ***Climate Change Mitigation: Design plays a crucial role in mitigating climate change. Sustainable design practices focus on reducing greenhouse gas emissions, increasing energy efficiency, and promoting the use of renewable energy***

sources. Designers can integrate energy-efficient technologies, passive design strategies, and sustainable materials into their creations. By designing energy-efficient buildings, eco-friendly transportation systems, and renewable energy solutions, sustainable design helps to reduce carbon footprints and mitigate the effects of climate change.

2. ***Resource Conservation:*** *Sustainable design aims to conserve natural resources and minimize waste. Designers can employ strategies such as life cycle assessment, material selection, and waste reduction techniques to optimize resource usage. They can promote the use of recycled and upcycled materials, design for disassembly and recyclability, and adopt circular economy principles to minimize resource depletion and promote a more sustainable and regenerative approach to production and consumption.*

3. ***Environmental Impact Reduction:*** *Sustainable design seeks to minimize the negative environmental impacts associated with the entire life cycle of a product or service. This includes reducing emissions, water consumption, and pollution during manufacturing, transportation, use, and disposal stages. Designers can consider the environmental impact of their creations by incorporating eco-friendly materials, reducing packaging, and designing for durability, repairability, and recyclability. By minimizing environmental harm, sustainable design contributes to the preservation of ecosystems and the protection of natural habitats.*

4. ***Social Equity and Well-being:*** *Sustainable design also*

takes into account social equity and well-being considerations. It focuses on creating inclusive, accessible, and healthy environments that enhance the quality of life for all individuals. Designers can incorporate universal design principles to ensure that their creations are accessible to people of diverse abilities and ages. They can also promote community engagement, social cohesion, and equitable access to resources, amenities, and services through their designs.

5. ***Long-Term Economic Viability****: Sustainable design is not only environmentally and socially responsible but also economically viable. By integrating sustainability principles into the design process, designers can optimize resource usage, reduce operational costs, and create products and services with longer lifespans. Additionally, sustainable design can foster innovation, create new markets, and drive economic growth in sectors such as renewable energy, green building, and sustainable transportation.*

6. ***Education and Awareness****: Sustainable design also plays a critical role in raising awareness and educating individuals about environmental challenges and sustainable practices. Designers can use their creations as a means to educate and inspire people to make more sustainable choices. Sustainable design can serve as a powerful tool to communicate complex environmental issues, instigate behavior change, and encourage sustainable lifestyles.*

The urgent need for sustainable design arises from the pressing environmental challenges we face today. By integrating

environmental, social, and economic considerations into the design process, sustainable design aims to mitigate climate change, conserve resources, reduce environmental impacts, promote social equity and well-being, and ensure long-term economic viability. Embracing sustainable design principles allows us to create a more sustainable and resilient future, where the needs of present and future generations are met in harmony with the natural environment.

Conclusion:

In conclusion, the interplay between the past, present, and future is crucial in driving and shaping the field of design. By acknowledging and learning from history, designers gain valuable insights, lessons, and inspiration that can inform their work. Understanding the present context is equally important, as it allows designers to grasp the current needs, challenges, and aspirations of society.

Furthermore, embracing technological advancements opens up new possibilities and tools for designers to explore and create innovative solutions. Technology has the potential to revolutionize design processes, materials, and functionality, enabling designers to push boundaries and bring about transformative changes.

However, it is essential for designers to approach their work with a sense of responsibility and awareness of the ethical, cultural, and environmental implications. Designers have a significant role to play in shaping the world around us, and it is crucial that their designs contribute positively to society, while being considerate of diverse cultures, promoting inclusivity, and minimizing negative environmental impacts.

As we move forward, the dialogue between the past, present, and future will continue to guide designers in their quest for meaningful and impactful design solutions. By integrating historical knowledge, current context, and emerging technologies, designers can create solutions that are relevant, innovative, and sustainable. By considering the broader implications of their work, designers can help shape a future that is not only aesthetically pleasing but also socially responsible and environmentally conscious.

In this way, the past and present become valuable sources of inspiration and insight, providing a solid foundation from which designers can envision and create a better future. By continuously learning, adapting, and evolving, designers can contribute to the advancement of society and make a positive difference in the world through their thoughtful and impactful designs.

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REALIZATION AS A DRIVER FOR DESIGN

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ABSTRACT:

This paper focuses on the topic of 'realization' and its importance in the world of design. Design is a vast term and it has many facades, but in every segment, truly understanding the purposes and requirements is absolutely necessary. This true understanding is called realization. When we truly realize, we tend to do things in a way that leads to optimal and fruitful results. And these results or outcomes are long-lasting. They do not harm or cause discomfort to their surroundings. Realization happens at different levels. One can realize the change by looking into the various steps of their endeavor. This will help them is exactly pinpointing the area of alteration/ change. The moment we realize the layer in which the change has occurred, we immediately realize the cause of it. This enables us to act immediately and effectively. If that change is desirable then we move along, or else we try to do the necessary modifications that will rectify it and lead to the improvement of the overall result. Then there are various types of realization, broadly

these are categorized based on the way realization is implied. The categories are namely self-realization, collective realization and ideation to realization. The idea of how the manmade world and the natural world are different in terms of problem-solving is also addressed in this paper, where I found that the manmade world is solely driven by the idea of fulfilling the demand without careful and logical thought about the practical consequences, it is only now that we have realized that how consequences are shaping a future that we will find difficult to live in. On the other hand, the natural world or mother earth/ the provider has designed everything that is interconnected and optimal by nature. This has resulted in the creation of a pure, self-sustaining and self-fulfilling world that is also self-healing and self-providing. As designers, we must abide by these wonderful ideals when we design because it will lead to the creation of outcomes that will be the best and most favourable.

Key Words: ***Realiztion, Design driver, Nature, Human Creativity, Future.***

INTRODUCTION

Realization can indeed be a powerful driver for design. In the context of design, realization refers to gaining a deep understanding or insight into a problem or a need, which then informs the design process and the resulting solutions.

When designers have a strong realization of the problem they are trying to solve, it fuels their creativity and motivates them to develop innovative and user-centred solutions. Realization helps designers move beyond surface-level observations and uncover the

underlying challenges and opportunities inherent in a design problem.

Realization also helps designers identify constraints and limitations that may impact the design process. By understanding the practical aspects and contextual factors surrounding a design challenge, designers can develop more feasible and viable solutions. Realization can lead to practical design decisions that consider factors such as budget, resources, technology, and user preferences.

Furthermore, realization enables designers to envision the desired outcomes of their designs. It allows them to imagine how their solutions will positively impact the users, the environment, or the overall experience. Realization helps designers create a clear vision of what they aim to achieve, which provides direction and focus throughout the design process.

To harness the power of realization in design, designers can employ various research methods, such as user interviews, observations, surveys, and data analysis. These methods help designers gain insights into user behaviours, preferences, and pain points, allowing them to form a comprehensive understanding of the design problem.

In conclusion, realization plays a vital role in the design process by providing designers with a deep understanding of the problem at hand. It fuels creativity, guides decision-making, and enables designers to develop innovative, user-centred, and impactful solutions. By embracing realization, designers can create designs that truly address user needs and deliver meaningful experiences. The topic of this paper is 'realization as a means for design'. Now

there are three major words in this sentence, a. realization, b. means and c. design.

Realization – ***the word REALIZE means to convert a concept or an idea into something real, a proposal into something tangible. REALIZE also means to become conscious/ aware, to have the knowledge or understanding, of and about.***

Means – ***the word means MEANS stand for a tool(s). without a proper tool, a task cannot be accomplished. This on the other hand is a precursor to realization. It encircles the experiences, ways, or steps that lead to realizing.***

Design – ***this is the biggest word. The word 'design or designing' here has a much deeper meaning, purpose and perspective than it sounds. It is the entire journey of creation, an entire timeline, a process.***

So, together these three words form the basis for the most powerful requirement of any design process, which is understanding the need and purpose and building the solution accordingly.

In design, if the need/ goal/ purpose is not realized then it can steer the direction of the entire idea, which in turn might lead to catastrophic results. Because not being mindful or not being conscious about the idea or the next step can lead to nowhere causing complete failure.

Again, on the other hand, if an idea or an abstract is not realized then it will not see the light of day, there will not be anything tangible to interact with. So, it is very important to realize the

vitality of a product/ concept to take it through to a fruitful outcome.

A very critical example in the field of mobility is 'the study of the target group and creating a suitable persona'. As designers, if we fail to interpret and realize what the customer desires then the design will not be accepted and the entire project will end up as an experiment. So, it's better to realize the needs and demands of the customer at a very early stage when there is time to correct any mistake and react accordingly.

METHOD:

This is not a typical paper in the sense that this does not focus on any outcome based on some technical research. This is more about understanding the concept of realization. What does it mean to realize? What does it take to realize? And most importantly, where does it lead when we realize? these were the three questions that I wanted to explore through this study.

So, there is no typical method that I have followed. Instead, this is a collection of secondary and partly primary research that I have done. In the section on self-realization, I asked my colleagues to close their eyes for 30 seconds and think of nothing. This is a very tricky statement that I made on purpose. Because it suggests two things, 1. think of nothing – when there is absolutely nothing in the mind (truly empty mind), and 2. think of nothing – when the participant is thinking about the statement 'think of nothing. In the first case, the mind is truly blank whereas in the second case it is not. This was a very exciting experiment because it made us

understand the psychological efforts that we need to realize the very basic difference between these two types.

Apart from this no strict method of research was employed and used, except for secondary research.

RESULT:

Just like the method, there was no result in the typical sense, meaning, that there was no technical conclusion based on which a derivation can be done. The result is majorly learning and understanding the importance of realization, its types and its characteristics. It was also about how realization works in the automotive world. I learned about the various aspects of realization and how they function. The various factors that affect realization, and their consequences.

This was more of an exploratory study than a purely technical experiment.

DISCUSSION

Type of realization:

1. Self-realization

It is a great tool for achieving goals and performing any task as it gives the confidence to not only plan in a proper way but to execute flawlessly. In the world of design, this tool can be exploited in a creative way.

Design evolves with time, which means that there is an opportunity for new design direction at every moment, the only catch is that it

has to be viewed through different lenses which shows a different perspective.

Viewing/ addressing a problem is done by designers (people), who can have various characteristics and can employ them as and when needed.

a. *Touch of success* – *These people know how to turn lead into gold.*

b. Flow – These people follow the plans of the universe (flexibility and lack of attachment to results)

c. Enterprising – Go-getters. They are fluent in their actions. They are either disciplined or are taught life lessons.

d. Cooperating – These people are good at teamwork, as they know what to pull from each team member.

e. Intuitive – They rely on their sixth sense and can easily and quickly access it.

f. Waiting – They are patient, which is their greatest weapon.

2. Collective realization

Collective realization refers to the shared understanding or insight that emerges within a group or community of individuals. It is the result of collective thinking, collaboration, and the exchange of ideas and perspectives among group members. In the context of design, collective realization occurs when a group of designers, stakeholders, or users collectively gains a deep understanding of a problem or design challenge. Collective realization often arises through collaborative activities such as brainstorming sessions,

workshops, design critiques, or participatory design approaches. These activities encourage diverse perspectives and foster open dialogue, allowing participants to share their knowledge, experiences, and insights. Through this collaborative process, the group members collectively develop a deeper understanding of the problem, uncover new possibilities, and generate innovative ideas. The benefit of collective realization is that it leverages the collective intelligence and expertise of a group, leading to richer and more holistic design solutions. It allows for the integration of diverse perspectives, which can lead to more inclusive and user-centred designs. By engaging in collective realization, designers can tap into the collective creativity and problem-solving capabilities of the group, resulting in more robust and effective design outcomes.

In addition, collective realization promotes a sense of ownership and buy-in among the group members. When individuals actively contribute to the realization process, they become more invested in the final design solutions. This collective ownership fosters a sense of shared responsibility and commitment to the success of the design project.

To facilitate collective realization, it is important to create an environment that encourages open communication, active participation, and respectful collaboration. Designers can use various facilitation techniques, such as structured brainstorming, design thinking methodologies, or collaborative design exercises, to stimulate collective realization and harness the collective wisdom of the group.

Overall, collective realization is a powerful approach to design that leverages the collective intelligence, insights, and creativity of a

group. By fostering collaboration and shared understanding, it enables designers to develop more comprehensive, inclusive, and effective design solutions.

Like ants thinks in a group and their collective goal is to feed the queen ant. This leads to collective growth and finally collective achievement.

3. From experimentation to realization

Moving from experimentation to realization in the design process involves transitioning from the exploration and ideation phase to the implementation and execution of a design solution. It signifies the shift from the idea/ concept to a tangible/ virtual product through prototyping, user testing and modification. The final outcome is proof that the experiment has been realized (turned into a tangible reality or a usable virtual service). Here's a breakdown of the key steps and considerations involved in this transition:

1. ***Evaluation and refinement**: After conducting experiments and generating multiple design concepts or prototypes, it is essential to evaluate and refine them. This evaluation can involve user testing, feedback collection, and analysis to identify the most promising ideas or concepts. By gathering insights from these evaluations, designers can make informed decisions about which design direction to pursue further.*

2. ***Feasibility assessment**: Once a particular design concept is selected, it is crucial to assess its feasibility. Consider factors such as technical constraints, available resources, budget limitations, and time constraints. Evaluate whether the chosen concept is realistic*

and achievable within the given constraints. This assessment ensures that the design solution can be effectively implemented.

3. ***Design iteration**: Based on the evaluation and feasibility assessment, the design may undergo further iteration and refinement. Feedback from users, stakeholders, and team members is valuable in identifying areas that need improvement or adjustment. Iteration allows designers to fine-tune the design solution to better meet user needs and align with project goals.*

4. ***Prototyping and testing**: As the design concept becomes more refined, it is important to create high-fidelity prototypes or functional models that closely resemble the final product. These prototypes can be used for testing and validation. Conduct usability tests, user interviews, and gather feedback to ensure that the design solution addresses user needs and provides a satisfactory experience.*

5. ***Design documentation and specifications**: As the design matures, it is essential to create comprehensive documentation and specifications that outline the details of the design solution. This documentation serves as a guide for implementation and helps communicate the design vision to stakeholders, developers, or manufacturers. It includes design specifications, technical requirements, materials, dimensions, and any other relevant information.*

6. ***Implementation and production**: With the design solution defined and documented, the focus shifts to the implementation phase. This may involve working closely with developers, engineers, or manufacturers to transform the design into a functional product*

or system. Collaboration and effective communication are crucial during this stage to ensure that the design is accurately realized according to the intended vision.

7. Real-world deployment and user feedback: Once the design solution is implemented and deployed in the real world, it is important to gather feedback and monitor its performance. User feedback and data analysis can provide valuable insights into the success and effectiveness of the design in meeting its objectives. This feedback can then be used to inform future improvements and iterations.

The transition from experimentation to realization in the design process is a critical phase that requires careful consideration, collaboration, and iterative refinement. By following these steps, designers can successfully transform their ideas and prototypes into tangible and effective design solutions.

Realization for the future:

Realization for the future in the context of design refers to designing and creating solutions that anticipate and address the emerging needs, challenges, and opportunities that may arise in the future. It involves envisioning and shaping designs that are forward-thinking, sustainable, adaptable, and responsive to the evolving landscape.

Here are some key considerations and approaches for realization for the future in design:

1. *Future-oriented research: Designers need to engage in comprehensive research to understand the trends, technological advancements, societal changes, and environmental factors that are*

likely to shape the future. This research helps identify potential future needs, emerging user behaviours, and new design possibilities.

2. ***Anticipating user needs****: Designers must anticipate and envision the future needs and desires of users. This requires considering how people's lifestyles, values, and preferences might evolve and how technology and other factors may influence their behaviours. By understanding and empathizing with the future user, designers can create solutions that are relevant and meaningful.*

3. ***Design for sustainability****: Realization for the future involves integrating sustainability principles into design practices. This includes considering the environmental impact of designs, promoting circular economy approaches, minimizing waste, and maximizing energy efficiency. Designers can explore eco-friendly materials, renewable energy sources, and sustainable production methods to create designs that contribute positively to the future.*

4. ***Flexibility and adaptability****: Designs for the future should be flexible and adaptable to accommodate changing needs and contexts. Consider designing modular systems that can be easily reconfigured or upgraded, or products that can be personalized or customized by users. Flexibility enables designs to remain relevant and useful over time.*

5. ***Embrace emerging technologies****: Realization for the future often requires embracing and leveraging emerging technologies. Designers can explore the potential of technologies like artificial intelligence, internet of things (IoT), virtual reality, and augmented reality to create innovative and transformative experiences. By*

understanding and harnessing these technologies, designers can create solutions that are cutting-edge and future-ready.

6. Co-creation and collaboration: Realizing designs for the future often necessitates collaboration with stakeholders, experts, and users. Engaging in co-creation processes can help capture diverse perspectives, insights, and expertise, resulting in more comprehensive and future-proof designs. Collaboration also fosters collective ownership and fosters a shared vision for the future.

7. Continuous learning and adaptation: Designers should embrace a mindset of continuous learning and adaptation to stay abreast of evolving trends and technologies. The future is dynamic and unpredictable, so designers need to be open to new ideas, feedback, and iterative processes. By continually refining and adapting their designs, designers can ensure their solutions remain relevant and effective.

Realization for the future requires a proactive and forward-thinking approach. By considering future scenarios, user needs, sustainability, emerging technologies, collaboration, and adaptability, designers can create designs that not only address the present but also prepare us for the challenges and opportunities of the future. We have not seen the future, because it is literally after, and we live in the present which is now. So, to realize what will come after is crucial and takes a lot of effort and knowledge. Because only by observing and analysing the past and planning the present can we achieve a tomorrow that is future-ready.

Eg. How the market will accept a new vehicle segment? This can be understood only by analysing the present market condition and the demand for it.

Different stages of realization based on the level of civilization

The video named 'Alien Civilization from level 1 to 7' shows various levels of civilization ranging from type zero to type seven and how their energy needs increase over time and how they meet that requirement by venturing into new unexplored directions. Each of them has their own way of living and skill set. Starting from the most basic to the most advanced each civilization has its own unique character that has become the turning point for that civilization. These turning points can be in different areas. One can be the energy needs and demands, the other can be the level of consciousness. Thirdly it can be about the level of realization both mentally and physically. To realize beforehand when is the correct time to move on is the most critical aspect here. This can be done only if we have a wholesome understanding of humankind. The level of realization can be categorized in the following way.

***Level 0** – Realizing the most basic needs (have to survive)*

***Level 1** – Realizing the ways to survive. There are many reasons for it, such as the*

***Level 2** – Realizing the need to survive*

***Level 3** – Realizing that only the fittest will survive*

***Level 4** – Realizing the factors of being the fittest because it is not only about the daily needs and desires, it's truly about being in the present and living the expected life and practising the fittest habits.*

***Level 5** – Realizing the need to control desires and wants. Only then humans will truly be practising sustainability and healthy living.*

***Level 6** – The next step will be to realize that just because our brain is more mature than other life forms does not give us the capacity to exercise command.*

This level of realization has been/ will be the guiding factor because they have/ will occur to humankind eventually that without being consciously aware nothing could possibly be achieved.

Realizing as a feeling:

When we feel something, we tend to find both the good and bad aspects of a situation. The good aspect makes us feel relieved and the bad aspect keeps us reserved and closed. Because when we keep something to ourselves it builds a burden and if we don't let it out our level of performance is reduced and restricted. This is a realization that will affect our productivity and outcome.

- **Factors affecting realization:**

1. ***Ignorance** – when we choose to ignore any aspect of an entity, we deliberately make a decision, not to deep dive into that topic. This is undesirable because it is a lack of full dedication towards that topic. Hence the realization is incomplete.*
eg. If we choose to ignore the real-world effects of global warming then it will lead us to bigger problems which would be irreversible.

***2. Lack of information** – this can or cannot be under our control. But it will have a lasting effect on any endeavour. eg. In the automotive world we build concepts and ideas that might be relevant for the projected time, but it is impossible to know for sure if that concept will flawlessly fit. This is because we lack practical information about the needs and desires of the potential users of that vehicle and their needs and preferences.*

***3. Time (the earlier the better)** - the faster we realize the better it is. Because with time conditions, needs, preferences, and capability changes. In the 19th and 20th centuries the focus was all on coming up with new vehicle concepts, but now in the 21st century, it is about the experience of travelling in a vehicle. So, with time companies and brands have realized that people's (customers') need has shifted from owning a vehicle to enjoying the journey. The companies have realized it over time.*

***4. Influence** – the factors that direct decision-making. eg. In the automotive world the structure of a car is defined by safety regulations. Such as the thickness of A, B, and C pillars are defined by their load-bearing capacity in the case where the car is overturned upside down in an accident, such that they should be able to hold the weight of the entire car and not crumple under the load.*

Observation + contemplation + conclusion

Observation is looking + analysing + understanding. Contemplation on the other hand is deep thinking + analysis and understanding in all aspects. Realizing this basic difference is very crucial as it might make or break a situation because what appears on the top might

not be the underlying case and if not contemplated then it might cause repercussions while concluding.

Eg. The grave event of 9/11 which we all remember to this day is a good example. We all know who was responsible for the attack and after several years that responsible person was framed and killed by the US army. This seems to be the ideal situation where a crime is committed, a suspect is caught who also happens to have taken responsibility for the attack, and a coordinated counter-attack is conducted using two so-called stealth attack helicopters which were under development, and then he gets killed. The entire situation seems too scripted because 1st using two under-development helicopters indicated a foolish move to demonstrate tech. supremacy. 2nd there is just a claim that the perpetrator was killed and there was no evidence, in-fact the demand was denied by saying that the video is too brutal. 3rd the role of global politics is immense because US income is majorly dependent on arms export, and other countries don't need arms if there is no need for them. So just to boost their sales they needed a context. Again, the attack on the world trade centre is in itself suspicious because on that day along with the twin tower there were other buildings that were either demolished or damaged because of the attack and which were several locks away. So, was it a pre-planned attack with a framed culprit who would be accused after the incident? Or was it a genuine attack in the name of protecting Islam?

IMPLEMENTATION

1. *Man-made world – A man-made world is an artificial and biological world. We build and we reproduce. The machines we build,*

the life we create, and the technologies we develop are all human-made. They are in a way very rudimentary and basic. Because we strive to achieve the best outcome ignoring its harmful side effects of it. We are driven by the idea of gain no matter the outcome, and this leads to unsustainable practices.

Eg. mycologist Paul Stamets says that if we stop emitting carbon, the mycelium would clean the atmosphere in five years. Humankind should and must reach this level of realization where they consciously choose to let self-gain go for the better of the universe. Another example is the automotive world we build vehicles and we contribute to pollution.

2. ***Natural world*** *– Nature on the other hand employs the rule of optimal. It creates a life that is not always the best but is definitely optimal and supportive. For example, trees. Created by the nature are life-giving. Everything in nature works as a system. And every component in that system is a vital and critical part of it. And every process is cyclic. For example, mycologist Paul Stamets says that if we stop emitting carbon, the mycelium would clean the atmosphere in five years. So, here a clear atmosphere will lead to better thinking and a functioning mind, a better functional mind leads to clear ideas, clear ideas lead to better societies, better societies lead to great nations and great nations represent great practices. Great practices lead to a clean atmosphere. The earlier we realize this cyclic process the better is it for us. Another example is what nature creates but it decomposed and decays and helps another life form to survive.*

3. ***Extended time and space*** *– Spacetime are a scientific model that combines 3d space with time (the fourth dimension). It's a*

common scientific idea that we live in a world with four dimensions because of which we are able to see and live in 3 dimensions such as length, width, and height. Other than this the fourth dimension is time. our mind is programmed to perceive things in a quantifiable manner, which means that our mind accepts tangible concepts and anything abstract is difficult to accept and understand. It is a complex idea that time can be a dimension because we cannot see it, we can only experience it. But the relevance of time is immense as it is the most important because every day is another step towards our last day. There is also the aspect of change when we consider time. Everything in this universe is changing. Change is the law of life and the universe. Nothing is without change. Any action is impossible unless there is a feeling in itself of a deficiency that can be filled up by an active endeavour to possess the missing part that would contribute to the completion.

- **Aware of oneself in the context of harmony**

(This concept was introduced by prof. Lalit Kumar Das as an observation of the previous discussion)

Being aware is what we strive for in this material world, because, mostly we try to attain peace of mind through the material possessions that we hold so dearly close to us. But most of us fail to understand that actual peace happens when we realize and understand. Understand how short life is, and understand that the real inner self is the consciousness in us. Because it leads to the path of selflessness and harmony.

Harmony is about being in sync with every aspect that is part of life. And a harmonious life leads to balanced, congeniality (best

personality), and relaxation. A life where one is in tune with oneself, surrounded by people with whom one has reciprocal love and respect, a life that is marked by tranquillity and contentment, and where one feels appreciated, valued, and understood.

Most realizations are about harmony. Harmony in life, harmony at work, harmony in the environment. In our life, we tend to live harmoniously with nature. Because nature is the ultimate, the epitome, the pinnacle of design, and anything that is well-designed attracts us naturally and gives us peace of mind.

Eg. When we see a green paddy field, we feel fresh. It is soothing to the eye. This happens because all the paddy shoots appear to be of the same height which gives a sense of uniformity and peace. In the back of our minds, we subconsciously have an idea about the beauty of nature. About the proportions and ratios (the golden mean).

Eg. We realize using resources in our environment. We harmonize with the environment in a way such that when the sun rises, we wake. When the sun sets, we sleep. In long winters animals hibernate because food supplies become scarce, so this is again trying to sync with nature as if trying to harmonize with nature.

Eg. In the automotive world we find many vehicles to be naturally beautiful and are attracted to them without consciously knowing why. Such a brand is Rolls Royce and its vehicles

Imagination vs realization

Imagination and realization are two important aspects of the design process, and they play distinct but interconnected roles.

Imagination refers to the ability to conceive and generate new ideas, possibilities, and visions. It involves the creative and exploratory process of envisioning something that does not yet exist. Imagination is a powerful tool for designers as it allows them to think beyond current limitations, challenge conventions, and generate innovative concepts. It involves the ability to visualize, ideate, and imagine potential solutions.

Realization, on the other hand, involves the practical implementation and actualization of ideas. It is the process of turning conceptual designs into tangible and functional outcomes. Realization brings imagined ideas into the physical or digital realm, making them concrete and accessible to users. It encompasses the technical aspects, production considerations, feasibility, and execution of the design solution.

While imagination sparks creativity and drives innovation, realization ensures that the ideas are transformed into practical and usable designs. The interplay between imagination and realization is crucial in the design process. Here's how they relate to each other:

1. ***Inspiring ideation****: Imagination fuels the ideation phase of the design process. It allows designers to explore a wide range of possibilities, envision alternative approaches, and think beyond traditional boundaries. Imagination helps generate a pool of creative ideas that can be further refined and evaluated.*

2. Guiding realization*: Imagination provides a guiding vision for realization. It sets the direction and goals for the design process, shaping the decisions and actions taken during the realization phase. The imaginative ideas serve as a reference point for*

designers as they work towards implementing and bringing the design to life.

3. Iterative process: The design process often involves an iterative cycle between imagination and realization. Imagination generates ideas and concepts, which are then tested, refined, and realized through prototyping, user feedback, and iteration. The feedback and insights gathered during the realization phase can inspire new imaginative ideas, leading to further refinement and iteration.

4. Collaboration: Imagination and realization often benefit from collaboration and multidisciplinary teamwork. The imaginative ideas can inspire and guide the realization efforts of engineers, manufacturers, and other stakeholders involved in the production process. Collaborative processes allow different perspectives to contribute to both the imaginative and realization aspects of design.

Ultimately, successful design requires a balance between imagination and realization. Imagination sparks innovation and helps push the boundaries of what is possible, while realization ensures that those imaginative ideas are transformed into practical and impactful designs. By effectively harnessing both imagination and realization, designers can create innovative, functional, and meaningful solutions.

Imagination can also be something that generates in our minds to counter the boredom we might be feeling at that time.

Realization is knowing that any imagination/ idea is possible to build. Maybe not now, maybe five or ten years later. To believe that this imagination can or cannot be brought to life by the existing

technology is a realization. Without realization, we cannot put our imagination to life.

Eg. Once a certain someone imagined that if only, we could have gone to the moon how great would it be, then the next stage would probably have been let's try to cover the distance and reach the outermost layer of earth's atmosphere, then the next stage must have been to cover the distance and rotate around the moon, then it would have been let's try to land a probe on the moon's surface followed by let's put human beings on the moon. These would have been the possible broad levels of realization. Along with these, there must have been other factual considerations such as the aspect of atmospheric re-entry, heat generated during re-entry, the surface coating needed to protect the shuttle from getting damaged, the payload capacity of the rockets that can be delivered, the speed the shuttle has to gain to leave the gravitational pull of the earth, etc. these factual considerations are also realizations in the sense that they are scientific aspects which must be taken into consideration.

Someone had dared to imagine all these in the first place and realize that gaining knowledge about the world and universe around us is the first step to understanding life.

Eg. The first car is believed to be the three-wheeled cart vehicle built by Karl Benz. He dared to imagine a self-propelled version of then-used horse-pulled karts. It was both a realization that led to the imagination and innovation changing our lives forever.

It's moments like this when we as human beings recognize our potential and believe in the impossible until it's no more impossible.

It's this driving force that has manifested creativity in us and produced miracles.

- **Realization is always in layers**

(This concept was introduced by prof. Sugandh Malhotra as an observation of the previous discussion)

Realization can also happen in steps/ layers.

Eg. Arka is in the Mobility and Vehicle design discipline of IDC of IIT in Powai in Maharashtra in India in Asia. Now if Arka encounters any problem in his life during his stay in Mumbai, then it is quite logical and reasonable to consider that something at the aforementioned layers must have changed which is not in accord with him, and therefore the problem (uncomfortable situation).

Eg. At present vehicle manufacturers don't use the term 'new vehicle' whenever there is a new launch, instead they talk about the experience of the new product. How the customer will feel when they are in the vehicle? They talk about the experience that the product will give because they realized that a car is no longer a commute to take the passengers from point A to point B instead it is about the duration of the journey and how pleasant and comfortable it can be made.

Just within the time

At first, the idea might look like not being good enough, because just within the time sounds like not making enough effort towards any situation. Because similar to just in time (not the management philosophy) it invokes not being responsible enough to perform wholeheartedly. But it conveys a message of performing at the last

moment. But, on the other hand, it might also be that just-in-time is a saviour.

Eg. The patient was brought to the hospital for the surgery just in time.

There are many similar incidents where realizing the idea of just in time may help us understand the importance of the event. `Just-in-time' is a management philosophy

It originally referred to the production of goods to meet customer demand exactly, in time, quality and quantity, whether the `customer' is the final purchaser of the product or another process further along the production line.

It has now come to mean producing with minimum waste. "Waste" is taken in its most general sense and includes time and resources as well as materials. Elements of JIT include.

- **We can move in space but not in time**

(This concept was introduced by prof. Lalit Kumar Das as an observation of the previous discussion)

As human beings, we move in space as in real 3d space, the landmasses, the roads, mountains, etc. Moving in time is not a concept that we are able to grasp easily because time travel is still majorly fictional and not a reality, and that is because figuring out how to send tangible mass through an intangible path is not possible with the available technology. Because time is not physically visible it's the moment that we live in. So, traversing at the moment is not physically travelling or covering a distance it is about covering a time span where one can live the moment faster than others. So, to

realize that we can travel in time was the first stage, the next might be why do we need to travel in time? And followed by how it could be done. So, then ideas generate as to how mass can be transported over time and how will it be if the transport is made possible.

Eg. If it is a human, is to be timeported (time transported), will that person's age change? if she/ he is sent 5 years ahead or will the age not change? Then the next stage can be to realize how much quantity at a time one can send or transport through time.

We all think that to make time travel possible we need to go faster than the speed of light. But is it really true? Can time travel also be going the slowest? We consider light because we cannot imagine going beyond the speed of light or for that matter not even close to the speed of light.

Then the next realization will be to think that are there any parallel species who travel in time in general but the idea of moving in space is completely new to them. How will they react? How will they think of this new concept? How will they approach it? These are some of the questions that are fascinating.

· Realizing time as a dimension

We live in a 4-dimensional world and so we are able to observe the 3 dimensions which are length, width, and height. We are able to see the three dimensions because they are physical in nature and not intangible concepts. But Time is a moment and it is intangible. So, it is difficult to accept time as a dimension because we cannot see it or

measure it in the way we measure spans/ lengths. Instead, time can be measured in terms of moments.

eg. Let us consider a case where a person is sitting on a chair at a particular location, and let's imagine the same person sitting on the same chair in the same location, ten years from now. Are these two different events? Or the same event even though it's the same person and the same chair in the same place. These will be two different events in which one dimension is changing, which is time. Here we realize that time is a span but not a length in a typical sense that can be measured with a measuring tape. The length here is the number of hours or weeks or years covered.

Maybe it can be measured with a measuring tape, but then the tape has to run for 24 hours, 7 days a week, 365 days a year for 10 years directionless. And what about how fast the measuring tape is travelling? Because the faster it travels the longer will it be. Maybe then we can write that a person was sitting on a chair at 24^{o}E, 45^{o} W and she was sitting on a chair at 24^{o}E, 45^{o} W, 35,00,56kmh away. Here the thing to notice is that,

1. ***The unit is not km/h but kmh which is the distance in hours.***
2. ***The distance covered depends on the speed at which the measuring tape is drawn***
3. ***There is no specific direction in which the measuring tape is to be drawn because it would then be one of the three axes. But it cannot be in any of the known axes.***

So, it is evident, that time cannot be measured in units of length but it is a dimension that is part of every occurrence. It is the only dimension that is not constant.

Another way to understand this is to visualize time in a clock. The hour's hand completes one rotation in one hour and then the rotation is repeated again. It's a constant loop. Now, what if we extrude this rotation of 24 loops in a day? What if we pull it out of the clock in front of the clock? We will get a spring-like structure in the known 3D world, which is a span, but it is not a length that can have a unit of kilometres or meters, but a unit of kilometer-hour.

This is why time is a dimension. And we live in a 4D world.

Eg. Similarly in the automotive world, we have facelift versions of various models which is essentially the same model with a fresh exterior design that is launched after several years the initial version was launched. Here two things have changed, the look of the vehicle and the time during which it has been launched. So, there is a change in the 4^{th} dimension

- **Realizing time as unidirectional but is recorded in bidirectional**

(This concept was introduced by prof. Sugandh Malhotra as an observation to the previous discussion)

Time is unidirectional, it only flows in the forward direction. When a moment is gone, it is lost forever. It will never come back. But it can be recorded bidirectionally, such as the past which we call history. It is a testament to how why when and who.

Conclusion

From this study, it is completely evident that realization is the primary means/ tool for design. Because if we do not realize the

above-discussed aspects then in time the design concept will become irrelevant and lost.

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LIMITATIONS AND POTENTIALS AS DESIGN DRIVERS

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Abstract

This study explores the significance of limitations in human existence, emphasizing their role in driving progress and fostering innovation. It highlights how limitations spark creativity and resilience in various contexts, such as sports and language, leading to groundbreaking solutions. The research acknowledges the abundance of information and advancements in technology but argues that new limitations will inevitably arise. It discusses the potential of technology, like Neuralink, to surpass physical limitations. Ultimately, the essay asserts that limitations are not only inevitable but also necessary, providing structure and purpose to the creative process. It encourages individuals to embrace limitations as catalysts for growth and urges them to push beyond constraints to discover their true abilities. By recognizing and understanding limitations, people can find purpose and depth in their experiences, ultimately unleashing their full potential upon the world.

Key Words: ***Realization, Design driver, Nature, Human Creativity, Future.***

Introduction

Since the dawn of human existence over 300,000 years ago, our journey has been defined by evolution and adaptation. While genetic variations played a crucial role in our development, it is the limitations we faced that truly spurred our progress. Unlike the strongest or fastest creatures, we were initially weak and constrained by limited resources. These circumstances forced us to innovate and transform our way of life, leading to remarkable advancements.

Limitations persist throughout our existence, taking various forms. Physically, our perception of the world is restricted to the visible spectrum of light, excluding ultraviolet and infrared wavelengths. However, our ingenuity has allowed us to surpass these limitations through the creation of tools that extend our senses, enabling us to explore the once-invisible realms. Moreover, psychological limitations, such as those experienced by individuals with autism, showcase the extraordinary potential hidden within diverse minds. While they may struggle to focus on certain topics, their unwavering dedication and exceptional abilities in other areas demonstrate the power of embracing our differences.

As Albert Einstein eloquently stated, "Once we accept our limits, we go beyond them." This encapsulates the essence of human potential—a capacity to continually improve, surpass boundaries, and shatter preconceived notions of what is possible. A prime

example of this lies in the realm of sports. For years, the 10-second barrier was believed to represent the pinnacle of human sprinting capabilities. However, in the late 1990s, a new era dawned as athletes began transcending these limits and obliterating previously insurmountable barriers.

But why should we learn about limitations? What do they teach us as individuals and as creators? Firstly, limitations ignite our creativity and drive innovation. When faced with constraints, we must think beyond conventional boundaries, leading to groundbreaking solutions and designs. From architectural marvels adapted to challenging environments to technological breakthroughs born out of necessity, limitations breed ingenuity.

Furthermore, limitations instill within us resilience and perseverance. By encountering and overcoming obstacles, we learn invaluable lessons in patience, determination, and adaptability. Our experiences with limitations shape us into individuals capable of embracing challenges, turning setbacks into opportunities, and realizing our true potential.

Limitations in the Human context

Are limitations interesting? To truly grasp the fascinating nature of limits, we must delve into what makes them intriguing and why obstacles or restrictions have the power to captivate our attention. This concept lies at the very heart of sports—an arena where challenges abound, and barriers serve to heighten the experience. Consider the game of soccer, for instance. Why do we find joy in attempting to score a goal despite defenders standing in our way? Removing those obstacles may seem like a way to maximize scoring,

but it actually diminishes the excitement, thrill, and overall interest. People willingly pay to witness a group of individuals relentlessly pursuing a ball, eagerly anticipating the moment they can skillfully kick it away from their opponents.

Languages, too, play a significant role in shaping our interactions and expanding the bounds of knowledge. They serve as vessels for our thoughts, emotions, and ideas. Yet, every language is inherently limited by the boundaries of its origin. Each linguistic framework carries unique nuances of emotion and communication, making the process of translation a complex endeavor. Sometimes, when content is transferred from one language to another, certain subtleties and layers of information can be lost in the process, diminishing the richness of the original message.

However, it is essential to note that words are not always essential for conveying emotions. In certain instances, emotions can transcend linguistic barriers, communicating on a level that surpasses mere verbal exchange. Consider the profound impact of silent films, with the legendary Charlie Chaplin at their forefront. Through his masterful storytelling, Chaplin was able to convey complex narratives, evoke profound emotions, and touch the hearts of audiences without uttering a single word. His artistry transcended language barriers, captivating and resonating with people across cultures and generations. Despite the technological limitations of his time, Chaplin's talent for visual storytelling remained unhindered, reminding us that true communication goes beyond the confines of spoken language.

Human limitations extend far beyond our physical capabilities. The natural world itself imposes a set of boundaries that shape our

understanding and potential. Gravity, for instance, is an inherent limitation we encounter on Earth. To venture beyond our planet's atmosphere and explore the vastness of space, we must design spacecraft capable of surpassing the escape velocity. While humans can continually strive to break the limits of their own capabilities, surpassing the limitations imposed by nature is an immensely challenging endeavor. While we may set new records for speed, agility, and endurance, there exists an ultimate limit to how fast an object can travel—the cosmic speed limit known as the speed of light.

Let us journey back to the 1800s, a pivotal period in the exploration of light and its properties. It was during this time that William Herschel conducted a groundbreaking experiment to examine whether different colors of light emitted varying temperatures. Placing a series of thermometers under each color and an eighth thermometer at room temperature, he meticulously observed the results. To his astonishment, the thermometer shielded from any light source registered a higher temperature than the others. Herschel concluded that there existed something preceding the visible spectrum of light—a realm beyond human perception. He named this newly discovered region "infrared." A few years later, another scientist made an equally remarkable revelation by discovering "ultraviolet" radiation. These discoveries expanded our understanding of the electromagnetic spectrum, revealing a world of light that lies outside the boundaries of our naked eye's perception. Infrared, ultraviolet, and the entire spectrum of electromagnetic radiation, previously hidden from us, have since revolutionized

countless fields of science and technology, forever transforming our lives.

Limitations and nature

The interdependence within an ecosystem is a marvel to behold, where the survival of every organism is intricately linked. Even among the realm of unicellular organisms, some thrive in colonies, though without specialized cells as found in multicellular organisms. These solitary creatures must autonomously carry out all their life processes, lacking the reliance on other cells seen in their multicellular counterparts. Consequently, they bear the brunt of the consequences when injury befalls a single cell, often leading to the demise of the entire organism. However, amidst this vulnerability, extraordinary examples of resilience emerge, such as the renowned tardigrades—commonly referred to as water bears. These minuscule creatures exhibit astonishing abilities to survive in extreme conditions. They can endure freezing temperatures, withstand boiling water, and even endure the harsh conditions of outer space without the need for oxygen. Tardigrades possess an exceptional tolerance for radiation, surpassing that of a typical human by up to 1000 times. The remarkable characteristics of tardigrades hold potential for applications in radiation protection for humans and safeguarding crops during droughts, as we tap into their unique survival mechanisms.

The evolutionary origins of the eye trace back to the earliest life forms that inhabited underwater environments. These rudimentary eyes, which emerged millions of years ago, provided organisms with a basic sense of vision, allowing them to discern light from darkness.

The development of eyes through the process of natural selection has captivated philosophers and scientists alike. In his influential work "Natural Theology," William Paley marveled at the complexity of eye evolution, initially finding the concept absurd but ultimately acknowledging its feasibility. Paley recognized that, despite the difficulty in imagining it, the evolution of the eye was perfectly plausible. The limitations on creatures' visual capabilities served as the impetus for the evolution of more advanced visual organs. The intricate and awe-inspiring design of eyes stands as a testament to the remarkable adaptive power of nature.

Consider the prospect of encountering an extraterrestrial civilization visiting our planet. In such a scenario, limitations would inevitably come to the fore. These alien beings might possess elements or compounds that naturally occur on their own planet, enabling them to achieve more efficient spacecraft propulsion and far superior methods of space travel compared to our own primitive methods of igniting fuels. Our planet may lack these resources or possess them in forms that are unsuitable for such technological advancements. Consequently, our limitations would become starkly apparent in the face of the advanced capabilities and knowledge possessed by an extraterrestrial civilization.

As we venture into the vastness of the universe, we are confronted with additional limitations. The universe itself is expanding at a rate faster than the speed of light, resulting in a diminishing ability to observe distant planets and stars. This phenomenon gives rise to what is known as the "known universe," which represents the boundaries of our observational reach. As the universe continues its expansion, the light emitted from distant celestial bodies struggles

to keep pace, gradually reducing our view of the cosmos and imposing inherent limitations on our understanding of the broader universe.

In the realm of space travel, we encounter novel limitations that challenge our knowledge and capabilities. Among the most significant limitations is our understanding of time and the associated challenges of time dilation. Time is not uniform; it varies depending on factors such as gravity and velocity. As we push the boundaries of space exploration, our comprehension of the complexities of time and our ability to overcome the problems of time dilation will undoubtedly shape the future of space travel. Additionally, life-support system constraints, including the availability of breathable air and sustainable food sources, will pose ongoing challenges even as we establish outposts on remote planets, necessitating innovative solutions to overcome these limitations.

Time itself imposes a profound limitation on our existence. Humans, like all living beings.

A world without limits

The concept of limitations is an intrinsic part of our existence. While it may be tempting to envision a world without any limits, a closer examination reveals that limitations serve as catalysts for growth, innovation, and meaningful progress. Looking back just a century ago, people were bound by various limitations. Technological advancements were limited, understanding of the world was limited, and access to information was constrained by the physical limitations of newspapers and other forms of media. However, in

today's world, it may appear that many things are limitless. The abundance of information, the availability of diverse food items, and the unprecedented ability to connect with anyone, anywhere, seem boundless. Yet, even amidst these advancements, limitations persist, albeit in different forms. It is conceivable that as we overcome current limitations, new ones will inevitably arise, and our understanding of what lies beyond may be limited by factors we cannot currently fathom.

Paradoxically, limitations can also serve as a guiding force, allowing for greater meaning and utility in the products and services we create. By acknowledging and understanding limitations, designers, and innovators can tailor their creations to address specific needs and cater to a broader spectrum of people. For instance, devices that offer screen calibration for colorblind individuals enhance their experiences by accommodating their limitations and enabling them to perceive the world more accurately. Recognizing limitations can help focus our knowledge and channel it toward solutions that truly make a difference.

Advancements in technology have also allowed humans to surpass their physical limitations, essentially pushing the boundaries of what was once deemed possible. Projects like Neuralink, which aims to integrate technology with the human brain, represent a step towards creating cyborg-like capabilities. By leveraging such technologies, scientists hope to treat neurological disorders, restore sensory and motor functions, and ultimately enhance human interactions and experiences. These endeavors expand the limits of human potential and reshape what we are capable of achieving.

It is crucial to acknowledge that limitations are not only inevitable but, in some cases, necessary. Without limitations, the creative process can become aimless and unfocused. As a designer, understanding and imposing limitations can lend purpose and significance to the work being created. When unrestricted by constraints such as resources, manpower, or time, it becomes challenging to define the essence and purpose of a design. Limitations can serve as active guiding factors, providing the necessary structure and framework for meaningful and impactful creations.

Author Brandon Sanderson once remarked, "Flaws are more interesting than the powers themselves." This statement, though originally referring to magic systems in storytelling, can be extrapolated to the broader concept of limitations. Limitations and flaws add depth and intrigue to our experiences. They define our humanity and form the basis of compelling narratives. In storytelling, conflicts often arise from the boundaries and restrictions imposed by the magic system or the limitations of the characters themselves. Similarly, in life, our struggles and triumphs are often shaped by the limitations we face. It is through our flaws and limitations that our stories become worth telling, and our journeys become truly captivating.

What is the sky?

The sky, with its enigmatic allure, holds a metaphorical significance that resonates with the limitations we encounter in life. It can be perceived as a comforting blanket that encompasses our world, offering protection and kindling hope in our hearts. Yet, despite our yearning, it remains elusive, forever out of our grasp. In this

context, the sky symbolizes our dreams and aspirations, the aspirations that often seem just beyond our reach.

Limitations, those omnipresent obstacles, define the very essence of our human existence. They shape our identity, forging the unique individuals we become. Paradoxically, it is these very limits that ignite our curiosity and fuel our desire to transcend them. They spark the fire of interest within us, propelling us to explore the boundaries of our potential.

It is through grappling with limitations that we find ourselves standing where we are today. They challenge us, forcing us to confront our weaknesses and seek growth. Like the sky's vast expanse, the possibilities that lie before us are infinite, awaiting our bold pursuit.

To truly embark on a transformative journey, we must strive to outgrow our limitations. By pushing beyond the constraints of our own potential, we enter a vast and wondrous spacetime continuum, where our capabilities know no bounds. Just as the sky represents our dreams, becoming limitless, like the boundless sky, becomes our ultimate aim.

For it is in breaking free from the shackles of limitation that we discover the profound depths of our abilities, unleashing the full force of our potential upon the world. In this pursuit, we embrace the belief that the sky is not merely a dream, but an embodiment of the limitless possibilities that await those who dare to reach for the stars.

Conclusion

In a world defined by evolution and adaptation, limitations are catalysts for growth and innovation. They ignite creativity, instill resilience, and shape our understanding of what is possible. From sports to language, human context to nature, limitations captivate our attention and lead to groundbreaking solutions. Even in a seemingly limitless world, constraints persist, guiding innovation and tailoring creations to address specific needs. Advancements in technology allow us to surpass physical limitations and redefine human potential. By acknowledging and embracing limitations, we find purpose, significance, and depth that make our experiences and stories truly captivating.

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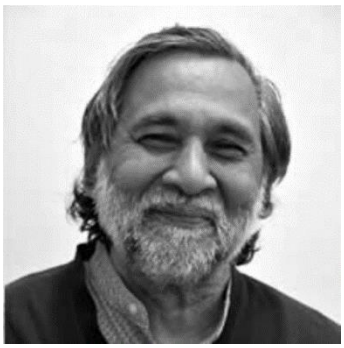

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His research interest areas include design research methods, future design possibilities, design forecasting and sustainable design.

Dr. Malhotra has been a recipient of several national and international awards. Most recently, he was awarded the prestigious Joseph Jaworski's Next gen Foresight Practitioner's Award in the Annual Convention that happened in October 2019 at Brussels, Belgium.

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Letter from the Chairman's Desk

By Sunil Bhatia PhD

One day I was reading a novel by famous authors Arthur Hailey and John 'Flight into Danger'. The plot of the story is very unusual, thrilling, and engaging. The pilot and co-pilot die for some unforeseen reason, and the plane carries the passengers flying mid-air without a pilot. There was an announcement from the ground "Anyone who can fly this plane". There was a repetitive and desperate call from the ground. Passengers of the plane feared death and started crying and looking for some means of safety. But all desperation proved in vain. An old passenger gets up from his seat and informs the female crew member' I may be little help to them." He enters the pilot cabin along with female crew members and speaks in front of the microphone "I am not competent for flying such a huge plane. Still, I did for small plane during second world war". Ground staff found he was the best bet, and there was no better option; the ground crew requested him to follow his instinct and our instructions carefully for a safe landing. It is the question of many lives. He did what he felt was correct in the circumstances according to his instinct, and everyone was over joyous with such success of safe landing. I realized from this reading that if you have common sense and a little bit of guidance that is not necessarily available all the time, but your instinct guide properly in taking out

from any crisis. Trust your basic instinct and if it is applied to a product that will be operational by anyone who has common sense. It is my request to the community of the designer while designing the product to follow the instinct as well as what users can do applying instincts for making it functional and operational.

Another incident in my life was when one of my friends living in a foreign country gifted me an item, and as I opened it, I found an operation manual in various languages, but my language was missing. Somehow I managed to make it operational, and I thank my basic instincts. My philosophy is that a product should have an inbuilt mechanism that should exploit the optimum level of the user's instincts in guiding it in making it functional after assembling and operational for what purpose it is designed.

Nature works with this principle for the propagation of future generations in its products. I visited the mango garden and found mangoes were not ripened and the colour of the skin was green, which helps in hiding among green leaves of the tree 'not to be noticed by others'. As the seed of the mango is mature and self-sustaining for new life its skin of the mango changes to attractive colour and makes its presence visible out of green leaves to attract those who can help in propagating by eating the sweet pulp of the fruits by throwing the seeds at a distance for turning into the process of making another tree. The entire process of avoiding clusters in close areas of the existing tree that will not allow the growth of the tree of the mango and the chances of damaging the other's growth of the seed is very high.

In the animal world, if there is one lion in the dense jungle and another lioness is not visible to him and separated to such a distance where the possibility of locating for mating for producing offspring for future generations appears dim. Nature works with the principle where products guide both for locating the spot for mating by using the smell instinct. Both products come closer by smelling the presence of urine in the area and what direction it is guiding both moves in the same direction. It is the inbuilt mechanism of the product that helps in guiding one another for locating for mating. No one has manual for intercourse but yet it is in practise and learned through their natural instincts from the days of birth of human beings in this planet.

There is debate among the design community 'What is the best design?' Some people are arguing good or bad design based on certain parameters that we consider standard in every product. I have a different opinion. 'Any product that can operational with the human's basic instinct is the best design for mankind.' For example, a comb does not have any manual literature in different languages, but every class of the society who has common sense can make it operational. Even a person who has never encountered comb and the moment handover to a person who lives in primitive areas or is not educated but makes it proper functional values for it is designed by following the invisible instruction inbuilt in the comb. This is the beauty of the comb there is nothing written external instruction to be followed by users, but the design itself guides you to follow. There are many steps before combing the hairs, and everyone has to follow sequential steps for combing hairs. First, hold the comb in such a manner teeth should be free from any obstruction , in this

case user's hands or fingers can work as obstruction, and it will not allow it to slide into the hair. Wherever the comb encounters obstruction due to entanglement of hair in some areas, users exert little high pressure on the comb to clear it for proper sliding . The level of pressure on the comb to detangle hairs is controlled by a level of pain by pulling his hair that is bearable . It is the design that does not allow the user to hold from the area of the teeth of the comb. Everyone holds the comb from where a user should. The second step is to use the movement of the arm that has restricted movement and allows using the comb to the management of hair by sliding from top to ground direction. Stylish hair design is not the work of combing but also supports in proper management. It means any design that has reached the status above language and religious or cultural influence but works on the basic instinct of humans is the ultimate goal of any designer for designing a product. Comb design has acquired the status of Nirvana or is perfectly useful for humanity in the design area. There is no scope for improvement in design, but the foundation of designing it is initiated with the basic principle of the universe; I called it Design Drivers. Reflection of light is used in designing the mirror, and that reflection attracts and generates curiosity in the user and makes him to stand in front of a mirror, not at the place where there is no reflection.

One of my friends told me what is new in it. It is the concept of user-friendly. I correct him that user-friendly is when the designer designs the product thinks about the limitations of the users, and tries to design under that parameters that should not tax him. Where I am discussing the next level of design, where the designer is designing the product in such a manner that the product itself

guides the users in using the natural inbuilt instincts to reach the goal the designer wishes.

I am reverting to the novel, where the plot was designed to solve the problem based on basic instincts. The design of flying a basic plane is still in use, but the introduction of safety, high speed, and better knowledge has made the modern time airplane complex yet based on simple operational transport principles. If you have 36 hours of flying experience, then you are capable of flying any type of plane. It is the design that should influence proper working rather user struggling to make it operational is not good design. Ikea Company's success story lies where it uses the basic instincts of users to assemble the products by using Do it yourself(DIY) to make it operational. If you use a nut or bolt that is not meant for that specific place, it will keep refusing and force the user to try some other place for proper functioning. They have taken design help avoid any confusion by not designing identical attaching device that can be use in two different function steps in assembling.

One day person purchased a dry battery for his device, and he did not ask for its manual for fixing. He took it from the shopkeeper with confidence as he knew how to use it. The battery has a simple mechanism of the sign of + (plus) and − (negative), and he will insert in the slot matching this sign as he hears the click sound that assures him that it is properly fixed and his device will be functional. It is my suggestion that signs can be eliminated with improved technology where cathode and anode can make interchangeable. If someone inserts the battery in a slot, it selects the positive and negative slot accordingly and maps for function. I have noticed in

electric vehicles where the sliding slot of the battery box guides the user in insertion, and there is no need for an operational manual and matching the negative and positive sign. A mechanical Lock and key is another area where the key will insert as a lock guide to allow it to open. It was designed for the safety of assets by locking, but it is a driver that can be used in other areas. Electronic devices have a locking mechanism, and using the password of the device turned operational.

The design of writing devices is made of reed pen or quill or feather after dipping into an inkpot over the pages. It has a basic concept of interface with users, and those who so are writing know how to hold for writing. The modern pen has a mechanism of supplying ink for writing from within the pen chamber, whereas dipping into an inkpot has an external mechanism. It is the control-guided surface tension of the ink used for proper writing over paper.

There are universal phenomena about cooking, and in every corner of the world, humans roll the kneaded flour with the help of a rolling pin or with the hand to give the round shape. Who has guided them for round shape bread? The reason is man is governed by his basic instinct, and nature has the best conservation of high volume in round shape. The man was guided by nature that gradually pushed to roll the bread in a round shape. It is the inbuilt shape of bread in mankind's minds. The only difference is some people cook with direct heat, and some sections of society in indirect heat with the help of an iron plate. The shape of the bread is universal. They later feel that bread should not be puffy. They make spots around the

rolled bread before cooking on heat. This is another driver used finely for making a variety of bread.

The entire concept of artificial intelligence devices is designed for how human intelligence performs any specific task. They begin the design of the product by using various technologies and know-how to eliminate the role of humans in that specific steps.

I am thankful to Prof Sugandh of Bombay IIT for accepting our invitation to be Guest Editor. It was short notice for him but he did proper justice with his role of Guest Editor.

Lambert Academic publication for celebration of the 150th special issue by publishing a book by compiling editorials "Design For All, Drivers of Design" was translated into eight different languages from ENGLISH to French, German, Italian, Russian, Dutch, and Portuguese. Kindly click the following link for the book. "Morebooks", one of the largest online bookstores. Here's the link to it:
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Enjoy reading, be happy, and work for the betterment of society.

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Forthcoming Issues

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October 2023 Vol-18 No-10

Dr Dolly Daou *has 23 years of academic and industry experience leading global academic programs and non-profit associations and initiating practice-based research projects for medium-large organisations in Australasia,*

Europe and the Middle East. Dr Daou's professional background is in interior architecture and urban design research, her career path led her to France where she became the Director of Food Design Lab at l'École de design, Nantes Atlantique. During her leadership to the lab Dr Daou developed and implemented system-based and food entrepreneurship education strategies. Combining her multidisciplinary and my international industry and academic experience Dr Daou developed workshops that transform theoretical research into impactful commercial outcomes and strategies with ecological benefits particularly in the food sector. Dr Daou is currently the co-founder and co-chair of Food Think Tank Research Working Group at Cumulus Association. Dr Daou established the Interior Architecture Program at Swinburne University of Technology and implemented its transition and rebranding, was the Director of the non-profit Association of Professional Interior designers/Architecture (MENA) in the Middle

East and North Africa, where Dr Daou was awarded the title AlSafeer Congress Ambassador by Dubai Business Events, a Community Manager for a team of start-ups at the European Innovation Council (EIC), European Commission and invited Quality Assurance reviewer for TEQSA and for international quality assurance agencies for higher education in Australia and in Bahrain.

ISSN: 2582-8304

November 2023 Vol-18 No-11

***Dr. Soumyajit Bhar** is currently an Assistant professor of environmental studies at Krea University, India, where he offers and coordinates a course on Design Thinking. Soumyajit straddles action and academic research with more than 14 years of experience (both volunteering and full-time) working with various environmental and sustainability issues. He holds a Ph.D. in Sustainability Studies (with a specialization in ecological economics) from Ashoka Trust for Research in Ecology and the Environment (ATREE) as part of a unique interdisciplinary Ph.D. program. His dissertation attempts to understand socio-psychological drivers and local and regional scale environmental impacts of conspicuous/luxury consumption basket in India. Soumyajit is furthering postdoctoral research at the intersection of rising consumerism, sustainability concerns, and inequality levels in the context of the Global South. He is also keen to explore how design education can broaden students' perspectives and help them delineate pathways to a better world. He has published in international journals and popular media. He is also interested in larger questions of philosophy and ethics, particularly pertaining to environmental issues.*

ISSN: 2582-8304

December 2023 Vol-18 No-12

Prof Manoj Majhi

With a Bachelor's Degree in Industrial and Production Engineering, a Master's Degree in Visual Communication along with a Doctoral Degree in Design added with 8 years of using it in the Broadcast medium of Satellite Television, with at least 15 multimedia promotional, published every week a probing question kept nagging the creative mind, why am I doing this, who benefits from this etc. and around over a decade in design education. A decision to impart the knowledge I had acquired from my professional career to equip the education system to bridge the lacuna .The feel we have not yet explored the Iceberg of the information that is available in the Media, we seem to be at the beginning tip of the iceberg . This does inspire a creative person to try out things that have not been explored yet. Instead of re-inventing the wheel, we designers should be inventing innovative utility of the

wheel for today's context. The research areas are primarily in Communication Design area (Graphic Design such as Animation), Interaction design and Product design.

Janvary 2024 Vol-19 No-1

***Dr Farnaz Nickpour** is an inclusive and human-centred design scholar and educator with 13+ years of experience in leading inclusive design research across healthcare and mobility sectors in the UK and Director of The [Inclusionaries Lab] for advanced design research at The University of Liverpool, United kingdom.*

Farnaz's research focuses on critical and contemporary dimensions of design for inclusion, aimed at advancing four strategic research themes i.e. Inclusive mobility; Psychosocial inclusion; Inclusive healthcare innovation; and Design for palliative and end-of-life care. Farnaz has an established track record of award-winning design research, education and knowledge transfer, with 40+ peer-reviewed design publications, External Examiner appointments at the Royal College of Art and University of

Brighton UK and various reviewer and scientific committee positions in international design journals and conferences.

As the Guest Editor of the inaugural edition of Design for All India, Farnaz will be introducing and outlining the theme of 'Critical Inclusive Design', building the case for critically engaging with Inclusion. With diverse contributions from the Inclusionaries Lab researchers, this edition will provide multiple perspectives, contexts and examples of dilemmas and existential crises inclusive design is facing and sets the scene for a new theoretically and empirically informed field of 'Critical Inclusive Design' - which Farnaz argues is urgently needed.

March 2024 Vol-19 No-3

Prof Dr. Ketna Mehta

She is Founder Trustee & Editor (One World), Nina Foundation, a 22 years young NGO for rehabilitation of people with spinal cord injuries in India. She is an Author of two books; 'Nano Thoughts on Management' & 'Narratives of Courage, Lives of Spinal cord injury survivors in India'.

As editor, 36 issues of 'One World - Voice of people with spinal cord injury' has published since 2001 (www.nina foundation.org)

She is a thought leader on social and inclusive development of persons with disabilities, transformational change and leadership. She was invited to contribute a chapter in the popular book 'Chicken Soup For the Indian Spiritual Soul' ! India's very first literary festival by the highest circulated newspaper group The Times of India on 'Disability is a state of Mind.' Her action oriented, innovative and bold opinions on disability has been published in over 100 research papers, articles, book chapters, columns, blogs and interviews in the media. She has been invited as a Guest Editor for Success& Ability's first and only thematic issue on Spinal Cord Injury in 2012, two issues of 'DesignForAll' international publication focusing on 'Improving Quality of life of people with spinal cord injuries' & 'FutureSpeak SCI Rehabilitation' in 2021 & 2019.

She has been a Regional Consultant for WHO's first Research Report IPSCI (International Perspective on Spinal Cord Injury'. For the very first Rehab Exhibition, Nina Foundation was invited as the NGO Partner where a demo workshop of how Scoop Stretchers during the Golden Hour prevents a devastating spinal cord injury. Several Public Forums on spinal cord injury have been curated by her for spreading awareness.Since 25th June 2009 Nina Foundation has initiated a spinal cord injury awareness day. Their grassroots free SCI OPD & multi disciplinary camps have successfully gifted equipments, medicines, hope and solutions for living a life of dignity. In April

2017 was invited by UC Berkeley, California as a faculty jury to evaluate international live student projects on Universal ReDesign from various countries. She was invited as an Expert Speaker for CIVIL20 (G20) by Rising Flame for 'Women with Disabilities' Panel on 17th June 2023, American Consulate, Mumbai. Nina Foundation is also a PAB Member for SPINE20 (G20) as Speaker & Observer 10-11 Aug 2023.

Ketna is a spinal cord injury survivor since 27 years and lives in Mumbai India.

New Books

it is available on www.morebooks.de one of the largest online bookstores. Here's the link to it: https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1

The Ultimate Resource for Aging in Place With Dignity and Grace!

Are you looking for housing options that are safer and more accommodating for independently aging in place? Do you want to enjoy comfort, accessibility, safety and peace of mind – despite your disabilities, limitations and health challenges? The help you need is available in the Universal Design Toolkit: Time-saving ideas, resources, solutions, and guidance for making homes accessible.

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Rosemarie Rossetti, Ph.D., teamed with her husband Mark Leder in creating this unique Toolkit. They bring ten years of research, design and building expertise by serving as the general contractors for their home, the Universal Design Living Laboratory– which is the highest rated universal design home in North America.

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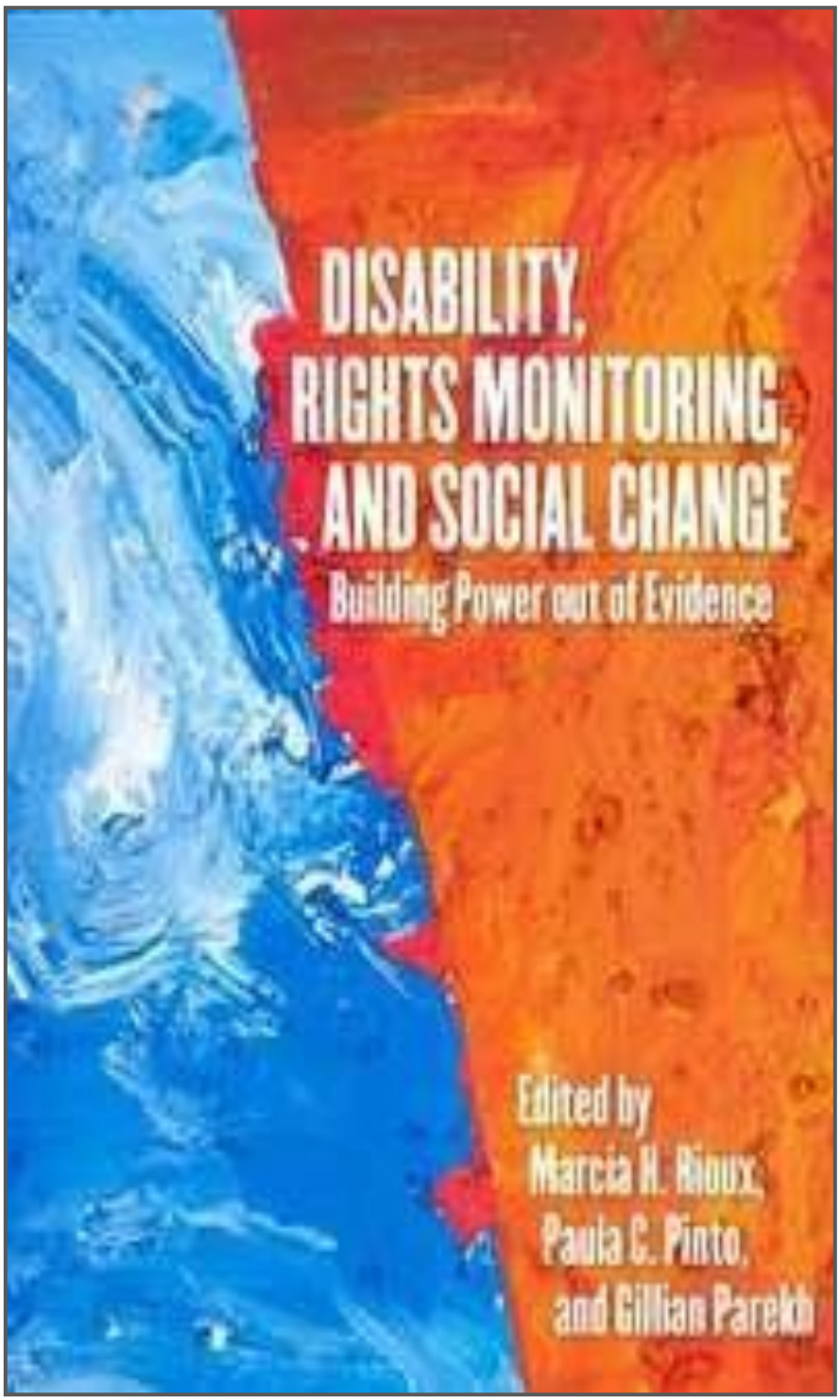
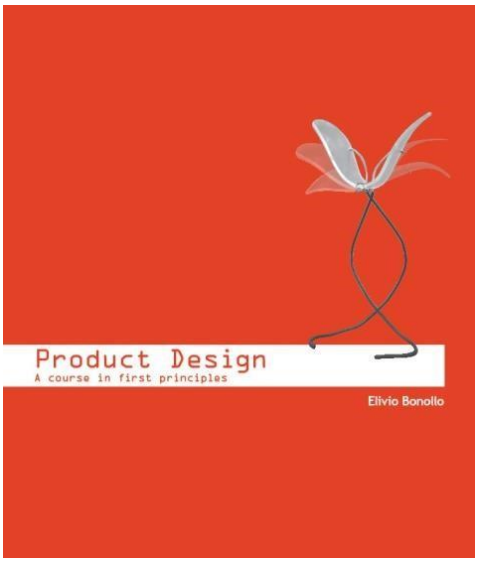
If you want useful, dependable advice and easy to implement ideas from respected experts who know the ropes, you'll love Rossetti and Leder's perspective. As a speaker, author and consultant who uses a wheelchair, Rossetti has helped hundreds of people design their ideal homes. Now her comprehensive Toolkit is available to help and support you! Get the Universal Design Toolkit now to start your project!

ISSN: 2582-8304

Disability, Rights Monitoring and Social Change:



New Update: ELIVIO BONOLLO (2015/16) PRODUCT DESIGN: A COURSE IN FIRST PRINCIPLES



Available as a paperback (320 pages), in black and white and full colour versions (book reviewed in Design and Technology Education: An International Journal
17.3, and on amazon.com).
The 2018, eBook edition is available in mobi (Kindle) and ePub (iBook) file versions on the amazonand other worldwide networks; includingon the following websites:
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eBook on PCs; Kobo readers can also be used to read ePub files on MacBook and iPad. All formats are very interactive with very good navigation.

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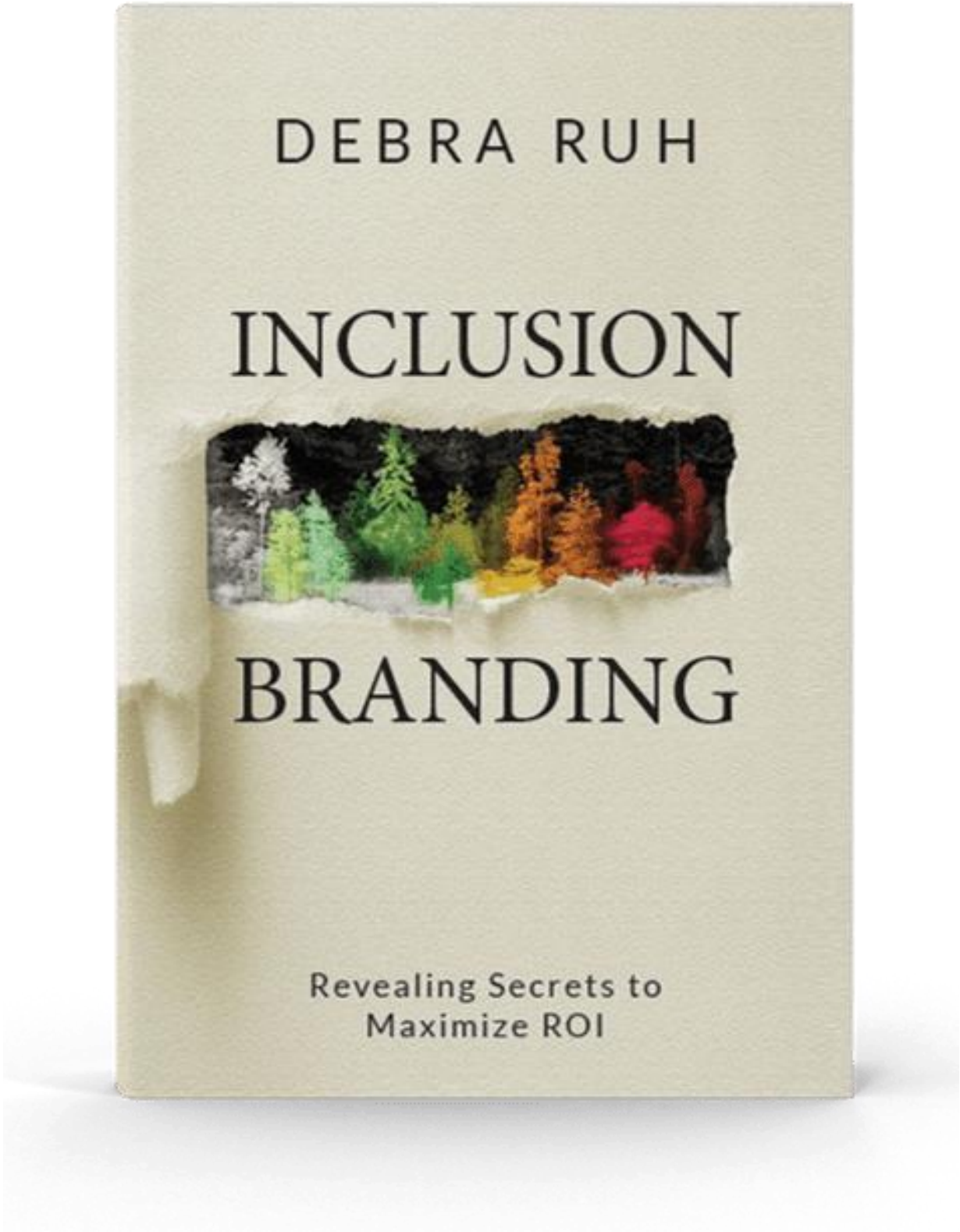

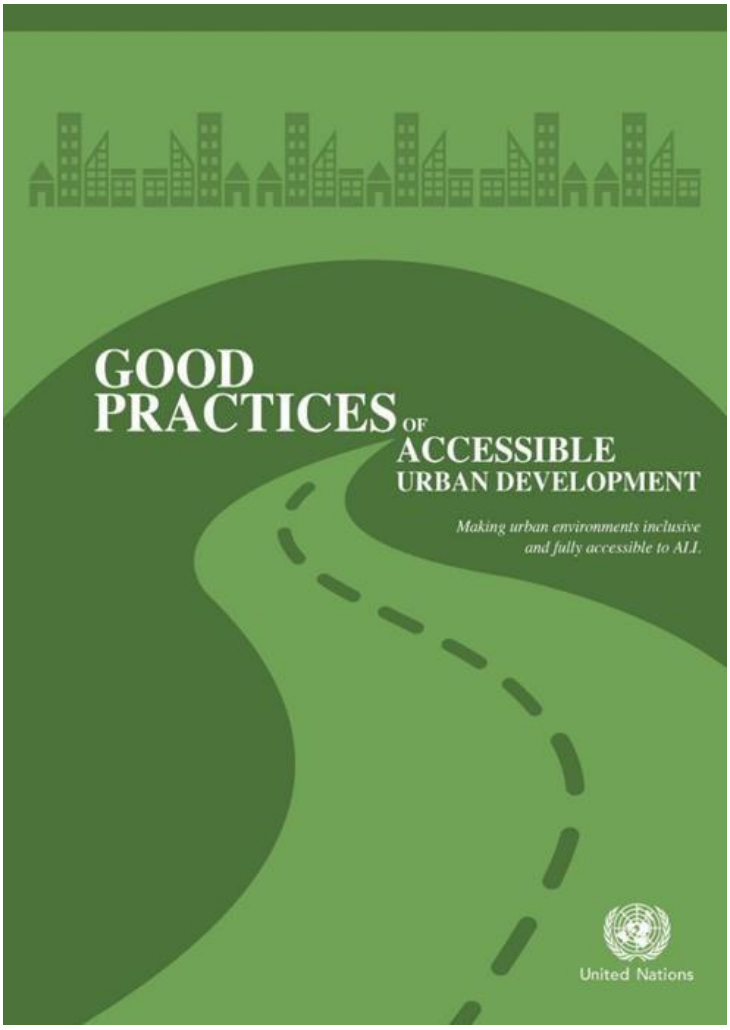

In light of the forthcoming United Nations Conference on Housing and Sustainable Urban Development (HABITAT III) and the imminent launch of the New Urban Agenda, DESA in collaboration with the Essl Foundation (Zero Project) and others have prepared a new publication entitled: "Good practices of accessible urban development".

The publication provides case studies of innovative practices and policies in housing and built environments, as well as transportation, public spaces and public services, including information and communication technology (ICT) based services.

The publication concludes with strategies and innovations for promoting accessible urban development. The advance unedited text is available at:http://www.un.org/disabilities/documents/desa/good_practices_urban_dev.pdf

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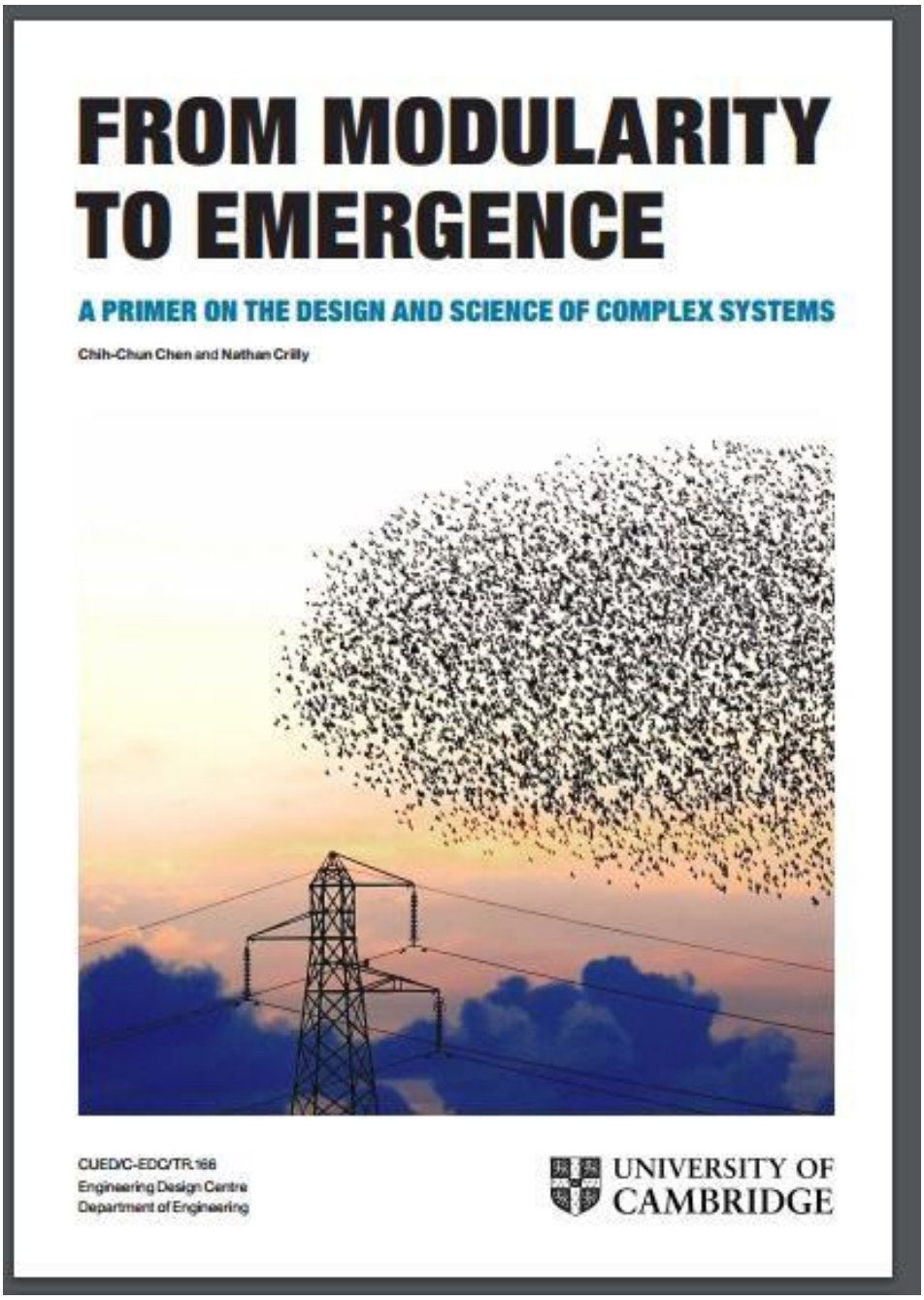


Dr Chih-Chun Chen and Dr Nathan Crilly of the Cambridge University Engineering Design Centre Design Practice Group have released a free, downloadable book, _A Primer on the Design and Science of Complex Systems_.

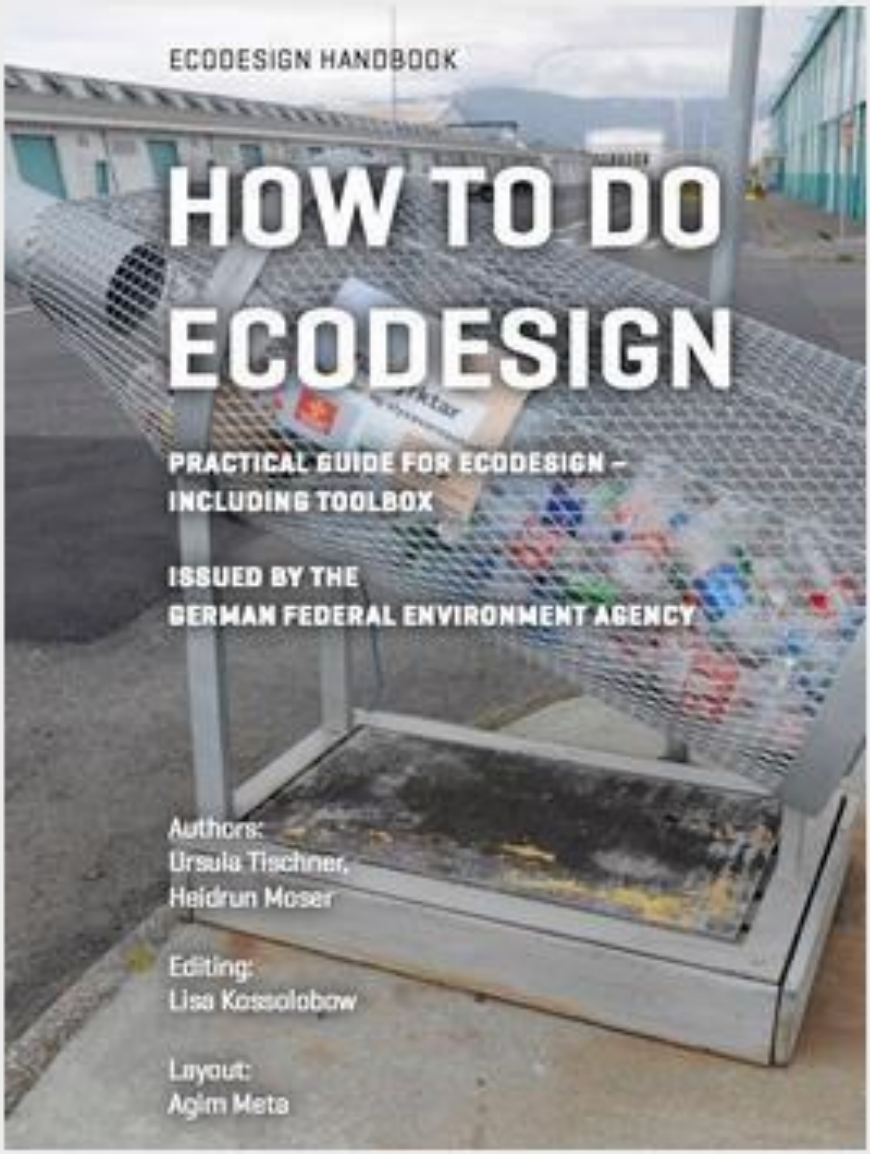
This project is funded by the UK Engineering and Physical Sciences Research Council (EP/K008196/1).

The book is available at URL: http://complexityprimer.eng.cam.ac.uk

Changing Paradigms: Designing for a Sustainable Future

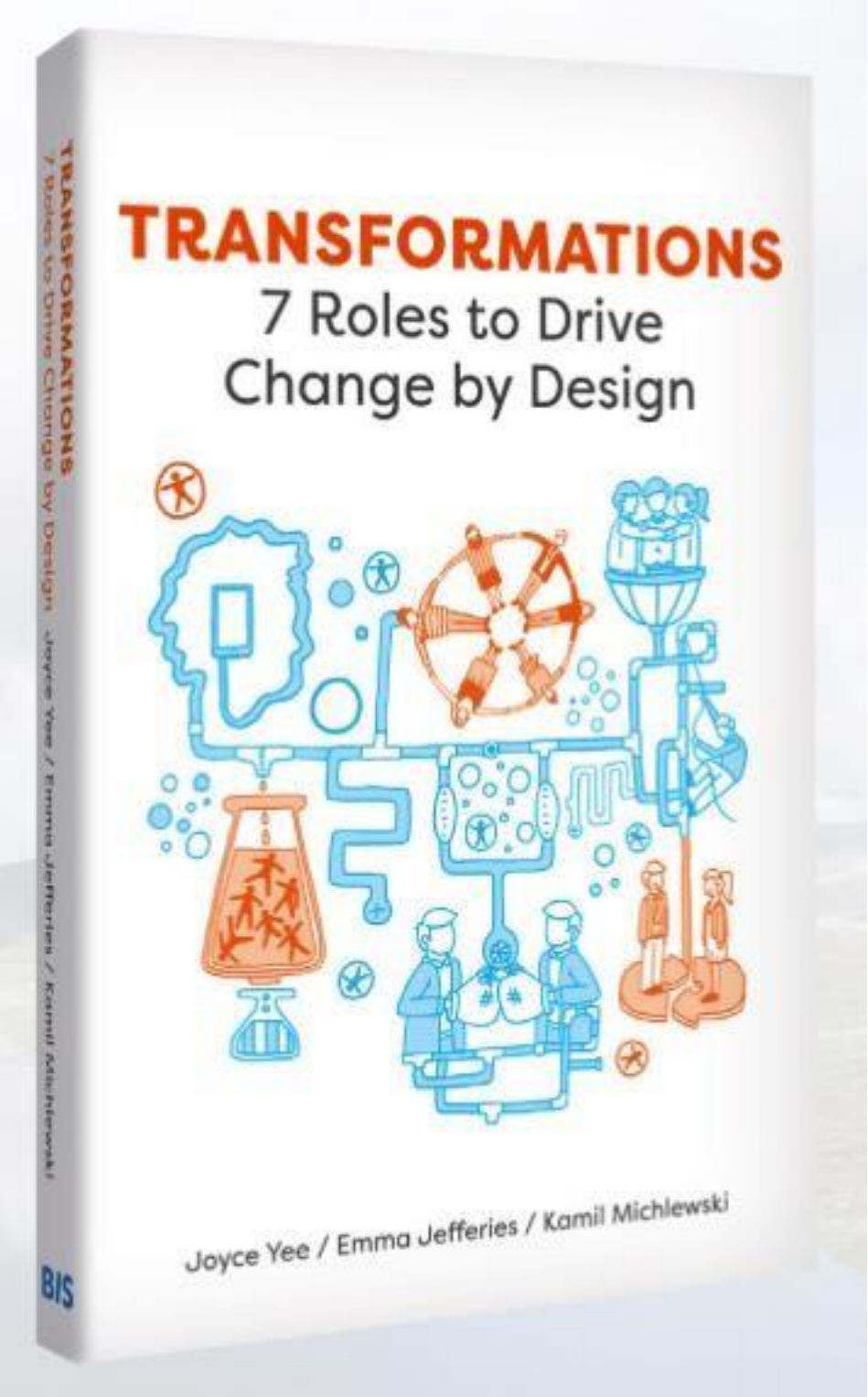
ISSN: 2582-8304

New iBook / ebook:
HOW TO DO ECODESIGN



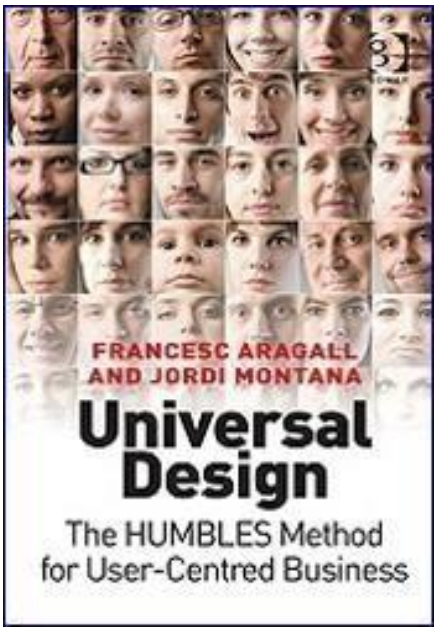
Practical Guide for Ecodesign – Including a Toolbox
Author: Ursula Tischner

ISSN: 2582-8304




Arnar Árnason and Sigurjón Baldur Hafsteinsson
DEATH AND GOVERNMENTALITY
Neo-liberalism, grief and the nation form

Universal Design: The HUMBLES Method for User-Centred Business



"Universal Design: The HUMBLES Method for User-Centred Business", written by Francesc Aragall and Jordi Montaña and published by Gower, provides an innovative method to support businesses wishing to increase the number of satisfied users and clients and enhance their reputation by adapting their products and services to the diversity of their actual and potential customers, taking into account their needs, wishes and expectations.

The HUMBLES method (© Aragall) consists of a progressive, seven-phase approach for implementing Design for All within a business. By incorporating the user's point of view, it enables companies to evaluate their business strategies in order to improve provide an improved, more customer-oriented experience, and there by gain a competitive advantage in the marketplace. As well as a comprehensive guide to the method, the book provides case studies of multinational business which have successfully incorporated Design for All into their working practices.

According to Sandro Rossell, President of FC Barcelona, who in company with other leading business professionals endorsed the publication, it is "required reading for those who wish to understand how universal design is the only way to connect a brand to the widest possible public, increasing client loyalty and enhancing company prestige". To purchase the book, visit either the Design for All Foundation website

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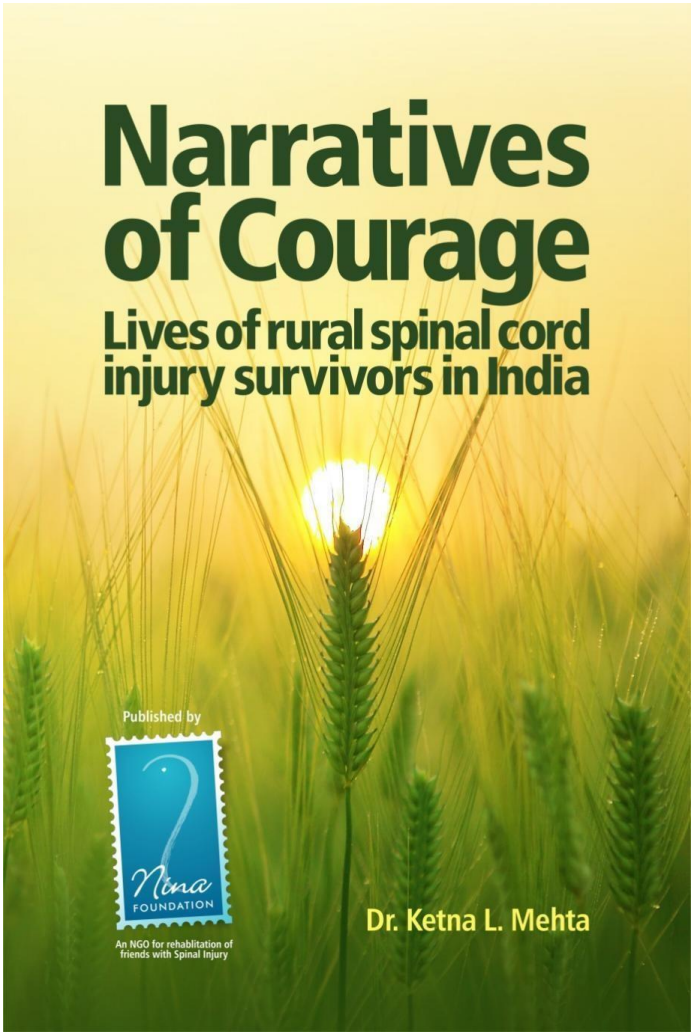


NOW AVAILABLE
Case Studies in Applied Behavior Analysis for Individuals with Disabilities (Second Edition)
Keith Storey, Ph.D., BCBA-D
Linda Haymes, Ph.D., BCBA-D
This book responds to a critical need for highly qualified personnel who will become exemplary professionals because of their advanced knowledge, skills, and experiences in working with students and adults that have varying disabilities, including Autism Spectrum Disorders (ASD). Since Board Certification for behavior analysts was introduced, there has been an expansion of training programs in Applied Behavior Analysis to meet the demands from school districts, health insurers, and families. In spite of these developments, a case studies book has not been available that uses the Behavior Analyst Certification Board Task List, Fifth Edition (BACB) guidelines for educating individuals receiving their BCBA, or for those in the field such as teachers, and service providers. The goal of this book is to fill that need. In this newly revised second edition, eighteen case studies are provided—case studies with complete analysis, case studies with partial analysis, and case studies without analysis. The format, readability, and detailed description of instructional methodology makes this text a valued resource for instructors and behavior analysts responsible for improving the skills of people with disabilities.
Charles C Thomas, Publishing is proud to announce the release of this second edition.
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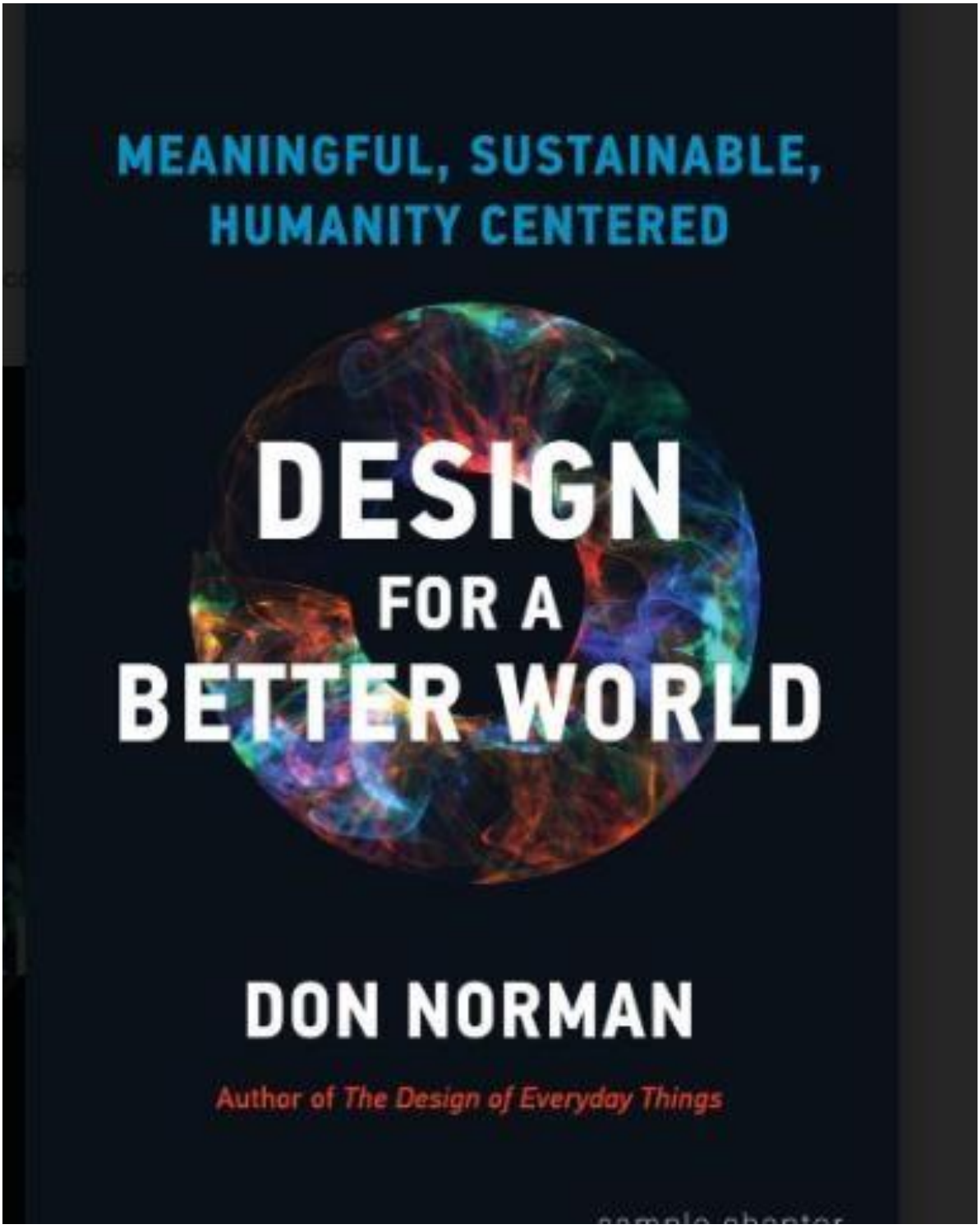

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News

1.

Surgical ergonomics in urology: A growing movement

"Data have shown among surgeons in multiple specialties that a good chunk of people have pain; probably around 60% of people have pain that they associate with operating," says Kristin Chrouser, MD, MPH.

Surgical ergonomics was the subject of multiple discussions at the American Urological Association 2023 Annual Meeting in Chicago, Illinois. In this conversation, Kristin Chrouser, MD, MPH, and Amy Park, MD, discuss the growing movement for incorporating ergonomics into surgical practice. Dr. Chrouser is the S Matthew Berge MD Research Professor and an associate professor of urology at the University of Michigan in Ann Arbor. Dr. Park is the Section Head of Female Pelvic Medicine & Reconstructive Surgery in the Obstetrics & Gynecology Institute at Cleveland Clinic in Cleveland, Ohio.

Kristin Chrouser, MD, MPH

Chrouser: There's the act of surgery itself, which is hard on people's bodies. And I think on top of that, you have the stress of a surgical lifestyle; as everyone knows, that can certainly also impact your tension. Those 2 together can be a little bit of a toxic soup. Data have shown among surgeons in multiple specialties that a good chunk of people have pain; probably around 60% of people have pain that they associate with operating. Most of that is back and neck. And then if you look at urologists, in particular, the AUA Census data from 2018, there were some questions about work-related discomfort, and about 46% of urologists have some work-related discomfort.1 In other surveys, people have complained that there's too much response bias. In other words, if you respond to an ergonomic survey, you're probably more likely to have ergonomics symptoms. So people always assumed it was a bit of an overestimation. What was nice about the AUA census is there's less of that bias, because it was not just an ergonomic survey. The piece of data I found kind of scary in that census was that the worst discomfort was actually in younger urologists who are women. I think that also tells us something about the risk factors of a surgical lifestyle and spending a lot of time in the operating room.

Amy Park, MD

Park: Dr. Chrouser is absolutely correct. It's up to 60% for 12-month pain estimates. In terms of cervical lumbar spine pathology, rotator cuff, it's about 20%. And then carpal tunnel is about 10%. The scariest thing is these numbers probably are an underestimate. In a *JAMA* meta-analysis,2 about 12% of physicians needed to either curtail their careers or modify their work activity due to disability related to work-related musculoskeletal disorders. So not only is it highly prevalent, you can incur a career-ending injury, or at least not be able to practice the way that you would normally practice. If you're a surgeon-urologist and you can't operate anymore or you can only do certain kinds of cases, it restricts your scope of practice. You can see quickly that it's not only a work force issue—and there are not enough urologists as it is—on the individual level, it's definitely a wellness issue.

Chrouser: Absolutely. And along those same lines, there's a question that's been in several surveys of other specialties. And I have some data on urologists that I never published, which also asked the same question, which is, do you worry that your pain or discomfort is going to affect your ability to do what you do in the future? And around 50% of vascular surgeons, micro surgeons, general surgeons, and, in these nonpublished data, urologists, are worried that pain or injury is going to affect their long-term ability to do what they do. That's terrifying. We might not talk about this stuff very much because of surgical culture and many other reasons, but I think that that really goes to the heart of it. People are worried that this is not a sustainable lifestyle.

Park: I think now that the door has been opened on the conversation, it's a generational shift in terms of openness of culture. I would say, now, if you start talking about it, everyone has a story. We wrote an article in *Obstetrics & Gynecology* on surgical ergonomics and work-related musculoskeletal disorders, and on social media, it had a lot of engagement.2 There were lots of letters to the editor, talking about their own personal experiences, with responses from generalists, maternal fetal medicine, urogynecologists, gyn-oncs. Unfortunately, it's a unifying experience and a universal experience among surgeons.

Dr. Chrouser and Dr. Park also touched on strategies for improving surgical ergonomics.

Chrouser: The way I think about it, there are several buckets. There's the bucket of things that you can do on your own—at home, even—like stay in shape, make sure that you've done strength training, as well as, in an ideal world, aerobic and flexibility training, but also that you're not doing things at home that exacerbate what you do at work. People garden, or they sit on their couch with their laptop, or on their phone with their head down. We do all these things at home that irritate those same cervical spine muscles that are a problem at work.

So there's that home bucket, and then there's the environmental bucket, which is when I walk into the operating room, I want the room set up in such a way that it facilitates my team's posture. This includes things like table height and screen height. There are also adjuncts that can help with back pain. There are standing mats that some people unfortunately call "princess pads." That's another example of old school culture.

Then there are things about the actual build of the room. If you ever have the opportunity to be involved in an OR renovation, request booms, so that screens can come from the ceiling and can be lower. A lot of people have their screens too high and it throws their neck back. We need the ability to bring screens down to a reasonable level so that you can align your body up as much as you can. And then there are environmental things outside the OR like a computer workstation at home or in your office, where the height of where you're typing is aligned correctly, and you have a good chair. For a lot of us, our feet will dangle, and so a lot of people need a footstool and don't even realize it. There are a lot of things that a regular office ergonomics consult can figure out. But if you spend your non OR day in an awkward position in the clinic, that's also contributing to this toxic soup.

The other thing I would say is that there are things that you can do yourself in the operating room or in the clinic that are helpful. [One example is taking] micro breaks in the middle of surgery. I do some micro surgery and I have my circulator set an alarm to remember to stop and stretch. Some people stretch between surgeries. If you have the option, you can alternate sitting and standing for your cases for those of us who do the types of cases where either position is a do-able position. And then there are the adjuncts that we use. You don't want to use super heavy loupes; you don't want to use a super heavy headlamp. Those of us who wear lead when we operate

should wear light lead. Some of these adjuncts that we use can really exacerbate these stresses and strains that we have.

Park: This is an example of when the job demands exceed the resources, injury and illness result. So what Dr. Chrouser's talking about—and I totally agree—are things like core work. It's like being an athlete. One of my mentors always said, "Get your head in the game." We just need to be mentally and physically conditioned to be doing this really intense, mentally and physically demanding job. That includes getting enough sleep, doing core work, making sure that we're strong.. It's also about positioning the table, the adjuncts. I don't wear loupes, but [those who do] have to make sure the angle is correct for them. Having your monitors in the correct place, going on step stools for conventional laparoscopy; I operate in the pelvis as a urogynecologist. We need to partner with industry regarding the ergonomics of laparoscopic instrument design because it's a huge strain, and the GI staplers and all of these things are not meant for a smaller hand size. When we're talking about the disproportionate impact on work-related musculoskeletal disorders based on gender, it's not just gender. It has to do with smaller stature, smaller hand and glove size. Disparities in stature is also an interesting thing that has been popping up lately. One of my partners was 6'5" and used to operate with a 5'2" surgeon. How do you even adjust for that? It would be nice if we had electronic platforms that you could go up or down on, although you probably would risk a fall. We're trying to reimagine what the operating room looks like in the future to really preserve our work force and our health because there are all these data showing that there's going to be a work force shortage. We're coming up on a demographic bulge, with the baby boomers now all squarely in the Medicare population, and a lot of people retiring. COVID-19 really pushed a lot of people out. Child care issues have pushed a lot of people out. It's smart thinking in the long run to invest in the future to pay attention to these issues.

Chrouser: Absolutely. I feel like there's always been this perception that we ought to be at loggerheads with industry. This is a situation where we really can align our goals with industry. There's a whole world of surgeons with less hand strength out there. Can we please design for a broader swath of the population? Some of the standards that are used now in terms of hand strength are from the 1980s. You can imagine the demographics in the 1980s for surgeons do not match what it is today. We're essentially putting people at risk, who

are actually the people in surgery that add the diverse perspectives that I think have changed the field for the better, and so to put them at extra risk, just because we have the wrong hand size or strength is unfortunate. So, I think, really partnering with industry about how we can do that better [would be great].

Park: **I agree. Having a seat at the table for design issues and feedback is extremely important. I hope that that stigma has changed. I think, with startup culture, that's getting a little bit better.**

Chrouser: **When I've talked to people in industry and asked them, why don't you just redesign this so it's not so hard to squeeze the stapler, maybe it's just an excuse, but I actually think there's something to it, they say that it's a big deal, regulatory wise, to go back to the FDA and make changes in terms of device design and things like that. So, maybe some of [the change] needs to happen at the regulatory level. Maybe that should get some more attention than it does. We'll see.**

Park: **Take Oxo kitchen gadgets. The whole concept behind them is universal design. Universal design means they're accessible for everybody. That concept can also be applied to surgical instrumentation. It's always been a balance between surgical innovation and safety guardrails and mechanisms. Obviously, we don't want to hamper either, but there should be a middle ground on trying to have something that is better.**

Chrouser: **I think one of the problems that has caused people not to be willing to ask for something better is that the perception is that that is whining. That's where we really need to normalize the fact that everybody has pain. Tolerating it and just sucking it up is not a sign of strength, it's actually stupid. Because you're going to either end your career, or you're going to be irritable and yell at your nurse, and go home unhappy, and that isn't helping anyone. It's not helping you. It's not helping your team. It's not helping your family. And so I think taking a bigger picture [view], and asking these questions about [with the mindset that,] this isn't just me being whiny and selfish. This is actually just part of what it means to be a well-adjusted surgeon and have a safe career.**

Park: **Absolutely. I think the mechanism for reporting and the culture around reporting doesn't capture what's going on. But it's**

just so highly prevalent. Everybody has it when you talk about it in small groups. Everybody says [something along the lines of], "I have tennis elbow." "I have a C spine issue. "I had lumbar disc disease and I had surgery for it." "I have a knee problem." "I have a hip replacement." Yes, it's probably from some other contributing factors too. But a lot of surgeons attribute [their issue] directly to the burden of surgery. A lot of people are using the robot, for example, because they cannot do conventional laparoscopic surgery. It's good to change positions; I do a lot of vaginal surgery, so I switch from side to side. And then I think also just having higher awareness and education and educating our trainees. It's hard to implement change when we get set in our ways. However, that's not just a "me" problem; everyone has that kind of thing. Because we're used to doing things a certain way, and you want to preserve what you associate with good outcomes. Just like in sports, having these little techniques and things that people do for superstition. I think that surgical culture prevents people from embracing the micro breaks. I have issues with that, too. I mean, there's a whole science on this. It's called implementation science.

Chrouser: We're actually in the middle of an implementation study right now at Michigan, trying to implement micro breaks. It's really hard. One of the last trials on that, which took place at the Mayo Clinic, found at the end of it that approximately 88% of surgeons planned to continue the breaks. But then anecdotally, when my colleague went back into the OR to do a different study, surgeons would see her and say, "Oh, yeah, I need to do the breaks." They had totally forgotten, even though the vast majority of people planned to do it. That's one of the things about implementation science, to me, that's so interesting, is we spent a lot of time trying to figure out, how can we help you remember, if the barrier isn't that you don't want to do it? Now, some people just don't want to do it. That's fine. But among those of us who actually think it's a good idea, why don't we do it? It's almost like exercise. I think it's a great idea. And then somehow it's 10 at night, I'm getting in my pajamas, and I realize I haven't done any exercise. It's not that I didn't want to; it just wasn't operationalized. And so how do we, in different hospital contexts and different sets of workflows, help people operationalize this in a way that they'll remember and they'll do it consistently? There's no one answer. It's a challenge, for sure. But I think a piece of it is understanding that change is painful. Habits are hard to start. There's a whole science to behavior change, and most

of us aren't experts in that. And so understanding the psychology is really important.

Park: **I also think the other thing that is super interesting, and this was presented at the Society of Surgical Ergonomics Symposium last year, is what are the work-related musculoskeletal disorders/issues for other members of the surgical team, which I think is fascinating. You have the circulator nurse, you have the scrub tech or scrub nurse, you have the anesthetist, you have the pathology person, and everybody has different positions and there are probably differences if it's open or vaginal, or what have you, but I'm just wondering, if you demonstrate that this is good for the whole team, it's easier for the whole team to realize that this is something we can do together and it can be team building and it can be preventive for all.**

Chrouser: **That's actually the tack that we took, because I didn't see any way that the surgeons were going to do it on their own. Adding one more thing to the circulator's list of stuff that she already has to do for the surgeon I knew wasn't going to go over well. And since Michigan already emphasizes [the importance of the team], that's how we've pushed it, and we actually surveyed everybody on our teams about their pain; the scrubs have more pain than we do. I think the surgeons found that to be interesting. I had a surgeon tell me, "You showed us that data, and it really got me thinking about the fact that if I choose not to have a micro break, I might be the reason that my scrub is at home at night, popping extra ibuprofen." And so I think for people, it was a little eye opening, just that there was so much pain around, but also just this understanding that we could really all come together on this thing. It's a work in progress, and every specialty is different. We're still in our pilot phase; we'll see how it turns out, but I think you're absolutely right that it can be leveraged as a real team-building exercise. And I think the team is key to it happening; otherwise, as surgeons, we're just not going to remember.**

Park: **I'm hoping as surgical culture gets less hierarchical that people will have the ability to speak up and advocate for themselves. Because when you're the trainee, it's hard to speak up and say, "Hey, do you want to do a microbreak?"**

Chrouser: **True; you need psychological safety in that room, even for the circulator to remind the team. We chose to roll it out within teams that were already really close; for example, liver teams that**

tend to work together and they know each other and the circulators are comfortable with the surgeons. But in teams where everybody's green or doesn't know each other well and there's a lot of turnover, that's a big issue. It must be psychologically safe. The other thing that's interesting, though, and I try and warn surgeons of this, is that they're not going to want to stop and stretch. It always seems like that alarm goes off, and you say, "Not now." And also, sometimes if you're really in the zone, it takes you out of the zone, it's like a pager going off. It's normal to feel that way, and if it's the critical portion of the case, absolutely don't stop. Most of the time, it's not, but you're going to have this sort of annoyance, because it's just an interruption. Then it's just learning to say to yourself, "That's okay. I'm just going to stop and stretch. Because otherwise, if I don't do it now, I will forget." Most of the time, people don't want to stop. Going into it knowing that you're probably going to feel somewhat resistant, at least in the moment, is helpful. What's interesting to me is to hear feedback now from some of the surgeons that I'm working with in this pilot who are doing these huge cases. They say they really appreciate the fact that it clears their mind, which I thought was fascinating. We just have to tap into what makes somebody want to do it and trying to figure that out is the whole challenge of implementation.

Park: **I would say micro breaks are probably one of the best studied interventions, but there's all sorts of stuff that was presented at the symposium like exoskeletons and AI-assisted ergonomic assessments. We're on the cusp of all this innovation, but just me and Dr. Chrouser [working on this] is not going to change things. It has to be a movement; it has to be everyone thinking it's an issue. That is something that I find really heartening because now I've given a couple talks on this, and people really respond to it. The younger folks are saying, "We should definitely be doing this. This is important." Quite honestly, if you're in that much educational debt, the idea of curtailing your career is very scary. I mean, it's scary for anybody, but I think especially for them, it's very scary. I'm crossing my fingers that this is the start of a sea change.**

Chrouser: **I would add that there's this downstream impact of our pain on our relationships with other people and our irritability level. And sometimes we're quite blind to that in the moment. So I think remembering that it's not just about, "We need to fix this so that we don't have injuries and we don't lose surgeons," that the way the work is done in the moment can be adversely impacted if I fly off the**

handle because my neck hurts. So I think just understanding that a lot of that we might not even notice, but it does influence how work is done and how surgery is taught, especially in an academic setting.

[It's also important to note that] where someone's pain locations are going to be really different if they're doing robotics vs pure laparoscopic surgery vs microsurgery vs open surgery. The tools that you use to decrease awkward postures might be a little different. Urologists, in particular, probably do the widest variety of surgeries. And so if you still do a lot of different modalities or types of surgery, that's probably good because you're stressing out different parts of your body. But if you become a super sub specialist, and all you do is one thing, you probably are at higher risk, and so then it's particularly important to make sure that that you pay attention to avoiding static posture, or being super still, and avoiding awkward postures.

[Another important concept is] postural resets, which mean, while you're operating, being conscious of where you are in space, and what might be awkward or tight. And that's not natural at all; for most surgeons, we get in the zone, we get super focused, and you can be in a really awkward position and you don't feel it, you don't think about it until you stop. And then you walk out of the room and the epinephrine settles out of your system, and you think, "Wow, something hurts." And so really learning in the moment to be more present and mindful of how long you've been holding positions and doing what people in the ergonomics literature call a postural reset, which is coming back to a neutral position where you're in an awkward or stiff posture. Those are general rules of thumb that people find helpful in the world of surgical ergonomics.

Park: If you're sitting, keep your hips and knees at a 90-degree angle. Adjust the robotic platform appropriately. Of course, we all like the stools with wheels in some contexts, but sometimes it makes you roll away, and then you start rolling away from the field. Make sure that you have lumbar support. It's our job and incumbent on us as trainers to help our trainees become more aware of it too.

Chrouser: When you're learning, inexperience is actually a risk factor for pain and injury. When you're learning, you really are not thinking about your body. That's where academic surgeons need to, as trainees get more and more comfortable with the steps of the procedure, really help them develop good ergonomic habits. When

you try and implement something like micro breaks or just even ergonomic adjustments in the operating room, some of the more senior surgeons will eyeroll you, and one way I've actually found to get them on board is to say, "This is the standard of practice for the next generation. And they are dealing with a lot more tech than we did when we were training. And they have to deal with it for a lot longer. And so it behooves us to train someone, so not only can they technically do a procedure, and do it well, but that they can do this for 40 years and do it safely and not end up in a neck brace or have to quit their career early." If they want to operate until they're 100, then they should be able to operate till they're 100. But I don't want them to quit because they hurt. I want them to quit because they found something else they like better than surgery.

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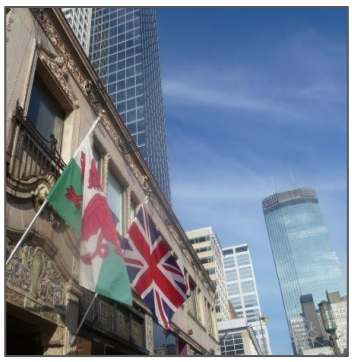
(Courtsey: Urology Times)



Programme and Events

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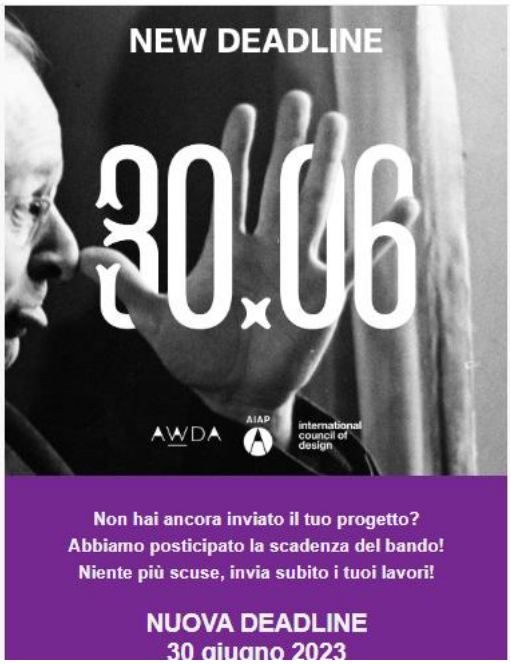

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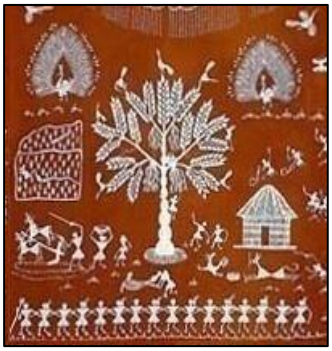

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