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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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