

12 HUMAN CONSCIOUSNESS; facts , fiction and medical perspectives

Dr. Janardan Bhatt

MD Medicine, MD, Ph.D. Physiology ,prof of Physiology, Dr. N D Desai faculties medical science and Research, Dharmsinh Desai University, Nadiad Gujarat .email appiguj@gmail.com

Abstract:

Background and objectives: On one hand recent developments in knowledge of artificial intelligence, machine learning, and robotics have created fear that the Internet and the Internet of Things may become conscious. On the other hand with the development of technology in digitalization human brain-mind and copying of mind have raised the possibilities of downloading the brain and mind and uploading it to digitized computer supporting devices. The article tried to answer this potential fear of machine consciousness from a physiological and medical point of view. Method; Thorough review of human consciousness, its spiritual, psychological, and physiological mechanisms, and knowledge of possible implications and correlation with the development of information technology. **Results:** Human consciousness is considered mysterious since the millenniums in philosophy and spirituality, medical sciences consider consciousness as a vital function of the body/brain. Though the origin of consciousness was also a puzzle in physiology the discovery of reticular formation, the reticular activating system, and their connection with various parts of the central nervous system has significantly helped to solve the mechanism of consciousness and sleep. **conclusion:** The technologies of digitalization of the human brain-mind including; copying and transferring the copied scanned digitized brain-mind to other supporting digitized devices including computers and robots evolved significantly higher enough to be a reality in this or next century though is scientific fiction today. But the current computers have still a limited capacity to hold the brain data and execute in a computer. Though future quantum computers may give the solution. Even though the quantum computer can solve this fiction it will be the partial one because the definition of consciousness includes there must be consciousness of self the body and brain . . . so without the brain and body the consciousness will be limited to rudimentary stored memories, experiences, sensations and emotional information without bodily consciousness. so the real fear is remote one unless the technology of immortality human body has come true. Meanwhile, brain-computer interphases and associated innovative devices in the health industry are going to give blessings to patients suffering from paralysis, paraplegia, or hemiplegia including patients suffering from speech and language problems. The devices based on this concept of brain-computer interphases are going to be a great blessing to humankind as these devices sense mere thinking or thought or EEG waves force our body parts and other equipment to respond to the need of patients. Some such devices have already received FDA approval and continue to improve and continue to bless human beings. And the brain-mind and human consciousness uploading will remain fiction till quantum computing in reality but again without consciousness of body the self.

Key words: Reticular formation. Brain computer interphase, scientific fiction of uploading and downloading of brain & its possibilities & ethical consequences, innovative thought and EEG controlled devices and their clinical applications

Introduction:

History and definition: defining consciousness:

Consciousness is considered a mysterious subject in philosophy and spirituality. We the medical fraternity usually define Consciousness as an awareness of thoughts, feelings, sensations, environments, memories, and our own body and mind the SELF. Consciousness is a subjective experience. Both Eastern and Western scriptures are full of defining and trying to understand the phenomenon of consciousness in their way. Both philosophy and psychology have worked a lot on the topics of consciousness and self-awareness. In this context, it is worth remembering a great historical statement by René Descartes "I think, therefore I am". Considering the quantum-like features of the characteristics of thoughts and thinking i.e. randomness and unpredictability, Physicists also have contributed to understanding consciousness. From an evolutionary point of view, like every aspect of the biological kingdom consciousness is also evolving. So to understand and universally define consciousness objectively is like Miraj. I have tried in this article to review our understanding of consciousness in context with the medical and physiological point of view and its clinical implications and futurological consequences in computer industries.

Consciousness is defined as awareness of our internal and external environment. From an evolutionary point of view, the question rises whether consciousness evolved to perceive sensations, emotions, and OR thoughts and emotions developed as a byproduct of consciousness is debated. But it appears that all have developed parallel hand-to-hand. For example to feel pain one must be conscious. vice a verse pain will create consciousness. Thus consciousness is essential for perceiving pain.

Indian scriptures & Upanishads state that the universe's fundamental infinitive energy is consciousness. This energy exists in every living and non-living material in varying degrees. The great sage Maharshi Shree Aurobindo in his book "Synthesis of Yoga" expanded the knowledge of consciousness further that this energy is dynamic and creative. Consciousness is Chit or Chit Shakti, awareness and conscious force. consciousness is connecting the link between Purusha and Prakriti, between the Soul and Nature. (Sankhya yoga Geeta). In Western philosophy study of consciousness extends beyond scientific realms, making it a topic of philosophical contemplation. Philosophers have pondered questions regarding the nature of consciousness, its relation to the physical world, and its potential spiritual or metaphysical dimensions. Renowned philosopher Descartes has proposed the existence of a dualistic mind-body relationship, suggesting that consciousness is immaterial and separate from the physical body. Indian philosophical scripture has a rather more infinitive concept and mentioned the whole universe is generated by Cosmic consciousness.

while Shaping our understanding of who we are or answering the fundamental question "WHO AM I?" -"Consciousness is a fundamental thing in existence". In reality, consciousness continues to evolve in human beings. Spiritually speaking consciousness itself wants to liberate itself. It is said that in Matter living or non-living, the consciousness exists in still in the form. It emerges as a life - force in animals including human beings. It is present in various degrees in an animal as well as in a human being. The true purpose of the human being or human life is "the further evolution of consciousness to supramental consciousness. In this context Shree spiritual master of Integral Yoga "Sri Maharshi Shree Aurobindo" once stated that the human consciousness still to evolve to reach a

state called supramental consciousness . This is a divine state and merge with infinitive consciousness the "sat chit anand". and achieving the state of "sat chit anand" is the purpose of life.

Physiological perspectives

Evolutionary biologists have categorized animals in various ways depending on their consciousness from 0 (zero) consciousness i.e. ameba and sponges to grade 2 (two) like mammals and humans. A large number of scales, grades, maps ...developed to explore the scale of consciousness in evolutionary schemata. But the fundamental fact is that everything is depending upon the development of the nervous system especially the development of the brain. The human being is in the highest position in this context because of the development of parts of the brain called the neocortex and prefrontal lobe. Though consciousness has subjective and abstract properties, consciousness is made complicated in philosophy but to make simple consciousness refers to our capacity to be aware, aware to experience thoughts, emotions, and actions awareness of our body and mind the self. Consciousness also encompasses our self-awareness, our ability to perceive, think, and make decisions. We experience consciousness as the ebb and flow of our thoughts, emotions, and experiences, essential to our understanding of reality.

Human Consciousness is a multi-headed giant to understand because of diversity in expression both subjective and objective and making Consciousness understanding complex. For an individual consciousness is not only qualitative but quantitative also. Let us take an example of subjective perceptions, such as the perception of pain, the taste of sweetness, or colors. These experiences are unique to every individual, making consciousness a deeply personal phenomenon. What my sweetness of taste may be different from for others. What I perceive as beautiful may be ugly to others. consciousness also explores in terms of our working memory and executive function. Our working memory i.e. the ability to hold information in our minds, and make conscious decisions from available information from stored memory is also a function of consciousness. Thus consciousness has a vital role in our cognitive abilities, attention, concentration, and problem-solving leading to conscious decisions. Our conscious experiences are perceived i .e. sensations, emotions, or thoughts due to an interconnected neuronal network in the brain in a very similar way to augmented virtual reality, where the projector is the brain and the screen is the universe. In the conscious decision, selective attention is a function of consciousness. In such function reward and punishment centers of the limbic system play a very significant role.

An Italian neurophysiologist Moruzzi with Magoun was the scientist who concluded that wakefulness is a function of a structure in the brain called Reticular formation and their connection with the cerebrum called [the reticular activating system](#) (RAS). The reticular formation is the structure in the core of the brain stem especially the pontine, medullary, and midbrain part of the brain stem is responsible for sleep, and consciousness. Dr. Moruzzi with Dr. Magoun concluded after doing their experiments on brain stem structures in cats. Their work also concluded that sleep is an active process in the brain rather than a passive one. They discover the huge network of neurons and interneurons is called reticular formation. The unique feature of this structure is there are millions and millions of neurons including interneurons that make interconnecting synaptic networks. These synaptic interconnections are both axon-dendritic and dendro-dendritic types. Further the reticular formation forms connections with the spinal cord and the cerebrum. This vastness of connectivity is understood by the fact that reticular formation receives millions of nervous impulses every single second from ascending and descending tracts of the spinal cord.

Though the vital importance of reticular formation is the vital centers i.e. respiratory and cardiac centers and their connections with respiratory muscle and heart. They play a significant role in vital functions in the heart and lungs. Thus reticular formation serves as a major integration and relay center for many vital brain systems to coordinate functions necessary for survival. But the function which makes reticular formation unique is that its subserves role is in " arousal - awakesness and sleep cycles " (sleep-wake cycles). Some other functions of the reticular formation perform are due to their connections with the Autonomic nervous system (Heightened awareness), sensory and motor system (regulation of pain perception and tone -posture), limbic system (Behavioural and emotional perceptions), including their connectedness with other parts of the cerebrum (cognitive functions thinking, memory....).The damage of the Reticular formation and reticular activating system lead to complete loss of consciousness and led a coma because of the disconnection of ascending and descending pathway connecting the cortex and spinal cord .so in brief reticular formation is concerned with arousal -consciousness & sleep. Any single afferent or efferent fibers to and from the reticular formation can arouse a sleeping individual and the awake state is heightened depending upon the strength and nature of stimuli. Any injury or pathology in Reticular formation leads to unconsciousness. Bilateral damage to the reticular formation leads to coma or death. Further experiments in the 1950s revealed more connections between Reticular formation to the thalamus and neocortical structures. The role of thalamo cortical discharges is a well-known mechanism in understanding the sleep-wake cycle and their role in the generation of electroencephalographic waves (EEG waves). The latest research in neurophysiology is with new methods i.e. functional magnetic resonance imaging and electroencephalography. These rather objective studies added further shreds of evidence for understanding the underlying mechanisms of consciousness. This method further supports the work of neurophysiologist Dr. Moruzzi. These newer methods have provided valuable insights into the neural correlates of consciousness (NCC). The method also emphasizes the role of other brain regions like the frontal-prefrontal- parietal cortex. These regions, in associated with reticular formation play a significant role to solve in the long puzzle of psychology and philosophy i.e. self-awareness, attention, and integrating sensory information to create our conscious experiences.

Physiologically human beings in day-to-day life perceive three levels of consciousness 1 arousal states: waking, 2 sleep (resting or slow-wave sleep), 3 sleep and dreaming (paradoxical, active, or rapid eye movement sleep). These three states occur predictably and periodically. These three periodic states are occurring periodically according to the firing properties of neurons of reticular formation based on their intrinsic membrane properties, their synaptic and neurochemical connectivity, and their responsiveness to sensory inputs.

The quantitative point of view of consciousness can vary from 1] Conscious (sensing, perceiving, and choosing), 2]Preconscious (memories that we can access), 3] Unconscious (memories that we can not access), 4] Non-conscious (bodily functions without sensation),5] Subconscious ("inner child," self-image formed in early childhood)...

THE QUALITATIVE POINT OF VIEW Consciousness IS HIGHLY SUBJECTIVE BUT MADE SIMPLIFIED IN THREE DEGREE I.E. 1]normal state awake and alertness 2] Heightened awake and alertness when the person is under stress or fearful or threatened condition or otherwise or as part of alarm reaction or the body's response to stress in the form of activation of the reticular activation system and sympathetic nervous system and secretion of adrenaline nor adrenaline and

glucocorticoid hormones by endocrine gland suprarenal gland. This reaction is known in physiology “fight or flight response. 3] Sleeping state

CRITICAL CARE CONSIDERATIONS:

Medical science has developed a scale called Glasgow Coma Scale to assess the level of consciousness as a marker of the vital function of the body in the following way

Depending upon

E spontaneous eye opening

V verbal response

M Motor response.

Best eye response (4)

1. No eye opening
2. Eye-opening to pain
3. Eye-opening to sound
4. Eyes open spontaneously

E1,E2,E3,E4

Best verbal response (5)

1. No verbal response
2. Incomprehensible sounds
3. Inappropriate words
4. Confused
5. Orientated

V1,V2,V3,V4,V6

Best motor response (6)

1. No motor response.
2. Abnormal extension to pain
3. Abnormal flexion to pain
4. Withdrawal from pain
5. Localizing pain
6. Obeys commands

M1,M2,M3,M4,M5,M6

We can now grade from 3 to 15 Glasgow Coma Scale (GCS)

This scale is very useful as a vital parameter and helps to assess the diagnosis, progress, and prognosis of neurological conditions including heading injury in General ward and intensive care units objectively without any complicated instrumentation in all medical, surgical, and intensive care wards.

Behavioural & Psychological Perspectives

consciousness can be considered from a Behavioral & Psychological perspective with its innate origin introspection. we are capable of perceiving and reflecting on our thoughts, emotions, sensations, psychological - parapsychological and spiritual experiences, analyze our mental states. This self-reflection allows us to have insights into our motivations, desires, and intentions.

Medical aspects: Complete loss of consciousness “COMA” is medical emergency and need immediate medical diagnostic and therapeutic attention . Significant number of medical conditions

including epilepsies and organic lesions of CNS affect consciousness. Many drugs and biochemical alteration in internal environments also affect consciousness including create vivid experiences. Majority of drugs used in anaesthesia and psychiatry are meant for altering consciousness including complete loss of consciousness. They do so by altering connections, function, and neuro transmitters at synaptic level of Reticular formation and/or their connection with other parts of central nervous system.

In this context it is worth wise to consider a special state of consciousness different from wakefulness and sleep Called hypnosis. Spiegel et al. define hypnosis as an **altered, focused, and receptive state of consciousness** characterized by absorption (heightened concentration toward a particular concept or item), dissociation (from one's conscious self), and suggestibility accompanied with a sense of involuntariness and lowered critical judgment. Despite widespread misconceptions, hypnosis is not a treatment in itself; instead, it is a facilitator-a useful diagnostic tool that can help the practitioner choose an appropriate treatment modality and accelerate various primary treatment strategies.

Neonatology

prenatal and preterm exposure to cigarette smoke among fetuses is found to be associated with deficits in arousal, attention, as well as many cognitive deficits' It has been that there are nicotinic receptors on neurons in certain parts of the reticular formation and leading to hyperpolarization-activated cation channels.

Association with Sudden Infant Death Syndrome (SIDS) has been found in Post-mortem analysis of patients who expired due to SIDS. The large number of dendritic spines in the medullary reticular formation has been implicated in this association. Researchers hypothesize that this persistence of dendritic spines demonstrates incomplete development of the reticular activating system, potentially leading to dysfunction in higher levels of respiratory control, contributing to the pathophysiology of SIDS.

The clinical significance of reticular formation is highlighted in defining Death, Brain death and brain stem death. The acceptance of definitions of death varies from country to country, and the requirement of demonstration of the complete and permanent loss of capacity for consciousness has remained one of their core criteria.

Futurology

Scientific Fiction and futurology:

Digitization of consciousness and uploading /downloading of brain :

with the development of machine learning and artificial intelligence, downloading and uploading of brain-mind and consciousness is a and will remain a hot topic amongst computer technologists and neuroscientists in coming decades. Computer scientists have already started creating and speeding idea that our mind could live on in another form after the death of the physical body.

with Developments in information technology we are going closer to a time when mind uploading and downloading will be the reality of science fiction. One BBC Horizon TV program screened "IMMORTALIST " an episode in which a Russian millionaire unveiled his plans to work with neuroscientists, robot builders, and other experts to create technology that would allow us to upload

our minds to a computer to live forever. It is predicted that this will be achieved by 2045. In making this possible a technique is “scan and copy”, i.e. a working mind copy will be generated by scanning from i.e. by fMRI and other similar brain scanning technologies. The whole brain simulation and copying. appears alarming technology by extrapolations of current technology i.e Artificial intelligence and robotics. Legal, and ethical issues are still to consider. Researchers led by Duke University have already scanned the whole mouse brain. Though in making fiction into reality the key principle that is in the Centre is copying of the mind (the mind is an outcome of what the brain is)and separation of the mind from the body. This controversy is debated in academics including benefits vs risks, guidelines and legislation, and human and neural rights neurorights. The brain-to-computer interfaces and an implantable device i.e. Stentrode have already shown great impact in health industries in helping paralyzed individuals by making instruments and body parts work by thought (Internet of thing). Such some neuro implant companies have received approval from the Food and Drug Administration to start testing its device in humans. One of a growing cadre of neurotech and Neuralink pioneers is in with the goals of merging humans with machines to treat a range of medical conditions such as paralysis, blindness, depression and enhance existing abilities like memory. These brain-computer interphases allow us to interact with computers and computer-internet-linked devices (Internet of things) by thought alone. Brain implants electrically stimulate, block, or record (or both record and stimulate simultaneously) signals from single neurons or groups of neurons (biological neural networks) in the brain. This can only be done where the functional associations of these neurons are well known. These technologies will be a great blessing to people suffering from paraplegia, hemiplegia, and many similar neurological disorders including dementia, speech disorders, and Parkinson's disease.

It is worth noting that in the process of digitization of the brain-mind and copying /uploading and downloading digitally supporting devices, the self-awareness or body awareness part of consciousness is missing. self-awareness or body awareness of consciousness cannot exist without the body.

All animals even tiny creatures have bodies so they all have various degrees of self-consciousness of body. If the butterfly wishes to fly it must have some degree of body image or self-image. The human being is in the highest scale of consciousness because of the evolutionary outgrowth of the neocortex.

In this context, it is worth understanding the views expressed by Silicon Valley entrepreneur Sam Altman. In 2018 , Sam Altman paid a startup called Nectome \$10,000 which is formed to preserve the brain after death to upload memories and consciousness to the cloud. Based on transhumanists claim that when the technology becomes available, we will be able to upload our brain architecture to a supercomputer and that this upload will then become conscious, allowing us to gain immortality. Today, there is no supercomputer to store all the data from a single human brain. But quantum computers are on the way. In the future, it may be possible at some point. Neuroscientists have partially succeeded in downloading some data from the brain by already And in the future, our memory, our consciousness, and our thoughts are going to be digitalized. In other words, our brains are going to be digitalized. Now scientists are working on mapping and digitization of the brain, i.e., Connectome. It will be a comprehensive map of neural connections in the brain. An organism’s nervous system is made up of neurons that communicate through synapses. A Connectome is

constructed by tracing the neuron in a nervous system and mapping where neurons are connected through synapses. Once the Connectome project will be successful, we will be in a position to save our digital copy in a computer as a small folder that can be available to assess whenever needed will have interacted. We can have more copies that can be uploaded as artificial intelligence in Robots. we can have multiple copies also. With all, unlimited access to input and output; will be able to create multiple copies of our Connectome and save them to any supporting devices and transfer them as a computer file.

Astrophysicists believe that our current biological form is not fit to survive in space and on any unknown planets or stars, but this Humanoid Robotic form will be able to survive in any unusual abnormal environment. So we will be truly eternal without a body. This is the most awaited merger of biotechnology and information technology. But it is worth noting that in human consciousness bodily awareness is crucial for self-consciousness. A mind uploaded to a supercomputer could never gain consciousness of the body because it will be nothing more than a disembodied virtual brain with bodily awareness. And researchers in the U.S. have developed a robot that builds its updatable body model and can adapt its movements when one of its limbs is removed. Is this robot conscious, too?

conclusion

Though the significant developments of our knowledge of physiology and neuroanatomy have helped us to understand the concepts and mechanisms of consciousness, philosophy, and spirituality will continue to through more knowledge as it is the core of humanity...

background:

Human consciousness is considered mysterious since the millenniums in philosophy and spirituality, medical sciences consider consciousness as a vital function of the body/brain. Though the origin and mechanism of consciousness were a puzzle in physiology the discovery of reticular formation and reticular activating system has significantly helped to solve the mechanism of consciousness and sleep. The new era of development of brain-computer interphases has raised a novel Idea of downloading and uploading the brain and mind and in that way giving immortality of human life and consciousness in digitally supporting devices i.e.computer or robotic machines... Though it is scientific fiction but may carry reality in the future. Legal, ethical, and human rights are the unanswered areas. The limitation of this form of immortality is questionable as the said technology i.e.digitalization of the human brain-mind and copying of the brain and transfer to supporting digitized devices will lack the element of self and body awareness in consciousness. This is the question after the next 100 years. Meanwhile, brain-computer interphase-based devices will continue to grow and already proved and going to prove blessings to human neurological disorders like paralysis, paraplegia, and hemiplegia.

References:

1] Angela Thornton "How uploading our minds to a computer might become possible" University of Nottingham online published on <https://theconversation.com/how-uploading-our-minds-to-a-computer-might-become-possible-206804#:~:text=At the moment whole brain,science should have voice.>

2]Bebin J. The cerebellopontile angle, the blood supply of the brain stem and the reticular formation. II. Anatomical and functional correlations relevant to surgery of acoustic tumors. *Henry Ford Hosp Med J.* 1968 Summer;16(2):163-83. [PubMed]

3]de Vignemont, F. Body schema and body image—Pros and cons. *Neuropsychologia* (2009), doi:10.1016/j.neuropsychologia.2009.09.022

4] Dr. David Hawkins.MD, PhD ,Understanding the Levels of Consciousness From Power Vs. Force., Book *The Qualitative and Quantitative Analysis and Calibrations of the Level of Human Consciousness*, an elaborate discussion of the Scale of Consciousness and its significance as outlined in his groundbreaking book, *Power vs. Force*:

5] Faraguna, U., Ferrucci, M., Giorgi, F. S., & Fornai, F. (2019). Editorial: The Functional Anatomy of the Reticular Formation. *Frontiers in Neuroanatomy*, 13, 469922. <https://doi.org/10.3389/fnana.2019.00055>

6] Garcia-Rill, E. (2009). Reticular Activating System. *Encyclopedia of Neuroscience*, 137-143. <https://doi.org/10.1016/B978-008045046-9.01767-8>

7] Herbert Spiegel, David Spiegel ;*Trance and treatment: Clinical uses of hypnosis* A book ;published by American Psychiatric Pub, 20-May-2008 - Medical - 576 pages

8]Ken Hub: Book “ Reticular formation”
Available:<https://www.kenhub.com/en/library/anatomy/reticular-formation> (accessed 26.4.2022)

9] Meredith W, Rutledge R, Fakhry SM, Emery S, Kromhout-Schiro S (May 1998). "The conundrum of the Glasgow Coma Scale in intubated patients: a linear regression prediction of the Glasgow verbal score from the Glasgow eye and motor scores". *The Journal of Trauma.* 44 (5): 839–44, discussion 844–doi:10.1097/00005373-199805000-00016. PMID 9603086

10] Moheb Costandi Book; “Body Am I” – the new science of self-consciousness ISBN 9780262046596 Published: October 4, 2022 Publisher: The MIT Press

11] Morasso, P., Casadio, M., Mohan, V., Rea, F., & Zenzeri, J. (2015). Revisiting the Body-Schema Concept in the Context of Whole-Body Postural-Focal Dynamics. *Frontiers in Human Neuroscience*, 9. <https://doi.org/10.3389/fnhum.2015.00083>