

Consciousness, Awareness, and Presence: A Neurobiological Perspective

Abstract

It is proposed that consciousness is different from awareness. Consciousness can be thought of as a dualistic, embodied, and embedded cognitive process, whereas awareness is a nondual and nonlocal process. Nonlocal awareness is the ever-present, ever-fresh, and an affective self-awareness that can be aware of itself as well as of the ongoing subject-object duality, and cognitive conscious contents. This nonlocal awareness is our default mode state. Although very few of us are aware of it due to our habitual mental preoccupation and mind-wandering. We need to relax, learn to meditate, let go of all preoccupations, and return to our default mode state of being, which is peaceful, silent, fulfilling, energetic, and ever-fresh. Then, one feels effortlessly alive and free and at home in the world. This is the essence of meditation for living a happy, peaceful, and meaningful life. The rest of the article provides details of meditative presence, yoga meditation, and mindfulness meditation with their current practice and applications. The main focus of the article is on the neurobiology of meditation, which is discussed in detail. It covers the experientially perceived mind-space including personal, peripersonal, and extrapersonal space, the concepts of mind in the Western and Eastern literature, and the neurobiological foundation in the brain stem, reticular-limbic system, forebrain including the five thalamo-cortical-basal ganglia circuits, multiple sensory modalities, integrated perception, speech production, language communication, voluntary movements, and intentional actions. The wholeness of conscious mind is expressed as bio-psycho-social-abstract/spiritual.

Keywords: *Bio-psycho-social-abstract, cognitive consciousness, experiential mind-space, language communication, meditative presence, mindfulness meditation, nonlocal awareness, voluntary movement control, yoga meditation*

Vinod D. Deshmukh

*Department of Neurology,
Jacksonville Campus, University
of Florida, Jacksonville,
Florida, USA*

Introduction

“All experience is local. I am not limited to local events. I am nonlocal awareness. It is an awareness of local consciousness.”

There is a lot of ambiguity in the field of consciousness studies about the use of the terms *consciousness, awareness, presence, and experiential space*. Some authors think that consciousness and awareness are the same.^[1] Some authors differentiate between the dual and nondual consciousness.^[2] Some others write about self-consciousness and consciousness without contents.^[3] Self-consciousness has three essential features, namely subjectivity, unity of experience, and intentionality of action. These aspects are hard to understand and explain in simple neurobiological terms.

Consciousness and Awareness

In this article, I propose that consciousness and awareness are not the same.

Consciousness is a cognitive and dualistic process, whereas awareness is nondual, spontaneous, and nonlocal. Cognitive consciousness is processed by the neocortical, pallial circuits, whereas the nonspecific, nonlocal awareness is processed by the precortical (subcortical) circuits as an ever-fresh arousal-awareness-being. The specification of conscious arousal and conscious experiences occur downstream in the neocortex.

Conscious Contents, Experiential Space, and Nonlocal Awareness

With consciousness, we experience the *near-space* and the extrapersonal *far-space*. The near-space consists of the *personal space*, namely the body and its interior, and the *peripersonal space* is the reachable, interactive surrounding space. This is an eco-systems perspective with an individual organism surrounded by multiple objects, other organisms, and the natural

Address for correspondence:
Prof. Vinod D. Deshmukh,
No. 3600 Rustic LN,
Jacksonville 32217, Florida,
USA.
E-mail: vinodsmind@gmail.com

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biomolecules and biophysical energies. All experienced events occur locally, consciously, or preconsciously, in relation to the experiencing subject. Such conscious experiences are local and limited in the mind-space and time.

Some of the historic meditative experiences relate to this vast, unlimited silent, and peaceful experiential state. It is possible to have an unlimited and nonlocal spacious awareness, which is spontaneous, holistic, and ever-fresh. It is unaffected by the body, mind, and space events and experiences.

King Janaka's statement in Ashtaavakra Gita is profoundly meaningful:^[4] "Infinite as space am I, and the phenomenal world is like a limited (small) jar; this is true knowledge. There is nothing then to be renounced, nor to be accepted, nor to be destroyed."

Sri Raman Maharshi summarized his advice for meditation as follows: "Within the sanctum of the heart, *Brahman* alone exists. 'I...I' feeling pulsates and shines as the *Atman* itself. Enter your *heart* yourself, by self-inquiry or ego-mergence. By quieting breathing (and mind), abide in your true being, the self."^[5]

J. Krishnamurti expressed it as, "Silence and spaciousness go together. The immensity of silence is the immensity of mind in which a center does not exist."^[6]

Another example of such nonlocal awareness is the insightful statement by Sri Nisargadatta Maharaj about his own self-perspective. Here is his quote: (M for Maharaj and Q for Questionnaire): "M: Where there is no mind, there is no back to it. I am all front, no back! The void speaks; the void remains. Q: Is there no memory left? M: No memory of past pleasure or pain left. Each moment is newly born. Q: Without memory, you cannot be conscious. M: Of course, I am conscious and fully aware of it. I am not a block of wood! Compare consciousness and its contents to a cloud. You are inside the cloud, while I look at it. You are lost in it, hardly able to see the tips of your fingers, while I see the cloud and many other clouds and the blue sky too and the Sun, the moon, the stars. Reality is one for both of us, but for you it is a prison and for me it is home."^[7]

Mind

Mind can be defined in four different ways: (1) a processor of neuroelectric patterns in the flow of conscious or preconscious arousal-energy-information within the brain-mind; (2) the human consciousness that originates in the brain and is manifested, especially in thought, perception, feelings, will, memory, and imagination; (3) the totality of conscious and unconscious processes of the brain that directs the mental and physical behavior of a sentient organism; (4) the principle of intelligence; the *spirit* of consciousness regarded as an aspect of reality.^[5]

An ambiguity persists in the use of the term, *mind*. In the Western literature, this umbrella term *mind* has a broader scope. It includes all nonphysical processes and even self-consciousness. Mind for instance is defined by Dr. Siegel as "all that is related to our subjective felt experience of being alive, from feelings to thoughts, from intellectual ideas to inner sensory immersions before and beneath words, to our felt connections to other people and our planet. And mind also refers to our consciousness, the experience we have about being aware of this felt sense of life, the experience of knowing within awareness. Mind is the essence of our fundamental nature, our deepest sense of being alive, here, right now, in this moment."^[8]

In the Eastern literature, the word *mind* has a limited scope with only four functions, namely *manas*: mentation, cognition, and thinking; *buddhi*: Intelligence and decision-making; *ahamkar*: a feeling of being an ego, a subject, or an agent; and *chitta*: the storehouse of memory including the lexicon of language and images. Such a limited brain-mind belongs to the self-conscious person.^[5,9]

I would also add that the mind can be local and related to an individual person with her/his personal, peripersonal, and extrapersonal experiential space. In another sense, the mind can also be nonlocal, nonpersonal, and unrelated to the individual person and her/his personal world. Traditionally, the mind has three levels of organization, namely biological, psychological, and social. I would add one more level to it, *abstract or spiritual*. We need to achieve, not only a horizontal understanding at each level, but also a vortical, holistic insight through all levels, *bio-psycho-social-abstract!*

Mind-Space Awareness

In neurobiology, the experientially perceived space (EPS) is divided into personal, peripersonal, and extrapersonal space. The EPS is a very dynamic, adaptive, and ever-fresh process. The EPS is continuously mapped, remapped, and represented in the posterior parietal and the multimodal association cortices (Brodmann's areas 2, 5, and 7). The related cortical networks include the default mode network and the dorsal and ventral attentional networks. The whole of the experienced body including its experienced parts such as the face, mouth, lips, trunk, genitalia, hands, and legs is represented as a neuroplastic ever-evolving homunculus in the sensorimotor and the multimodal association cortices. Not only the bodily person, the self, but also the personal surroundings are represented in the posterior multimodal association cortex as a representational map of the individual experience and its neural pattern.

There is an extrapersonal space called the *far-space*, based on one's experiential memories of far or remote events, and their perceptual representation. For instance, patients with right posterior parietal stroke develop a left-sided hemineglect syndrome. Not only that they are unaware

of the left hemisphere, but their cognitive and mental orientation to their familiar surroundings including their home and the city, are also hemi-neglected. It is called the *representational hemineglect syndrome*. Their observations and experiences depend on their unique vantage point of the perceived space of the current scene. Clinical examples of such brain-mind and space alterations include the phenomena of phantom limb, part or whole body illusions, surgery for syndactyly, and the out-of-body experiences.^[10]

Presence and the Holistic Abstract Space

By *presence*, I mean being fully present and receptive in the current moment or the situation. It is being in existence now wholeheartedly without any judgment, criticism, reactions, expectations, or comments. It provides an opportunity for experiential learning, insight, and integration. It is being spontaneously aware of one's embodiment as well as one's embeddedness in the human and the natural world. There is a spontaneous feeling of existential unity with profound mental clarity, spaciousness, silence, vitality, and peace. In such a state, there is also sense of wholeness, self-fulfillment, transparency, curiosity, creativity, and the caring for all.^[5]

Presence is possible only when there is a homeodynamic coordination and full integration between the goal-directing, cerebral neocortex and the spontaneously active, limbic-reticular precortex (subcortex). For instance, the deliberate smile is initiated by the prefrontal-basal ganglia-thalamic, skeleto-motor circuit, whereas a spontaneous smile is initiated by the anterior cingulate cortex and the related limbic precortex. These differences can be seen obviously in certain types of stroke patients. These patients may lose their ability for a voluntary or deliberate smile, and also a smile on command, but their ability to smile spontaneously, emotionally, is retained. For instance, when they hear a funny joke, they smile effortlessly.

There is vast literature on yoga meditation, mindfulness meditation, and transcendental meditation. Reviewing that literature is beyond the scope of this article. Briefly, in *Patanjali's Ashtanga Yoga Meditation*, there are five preparatory steps, namely Yama, Niyama, Asana, Pranayama, and Pratyahara. Yamas are the rules of good social conduct. Niyamas are the rules for healthy personal care, conduct, and lifestyle. Asana is a steady and comfortable posture with stillness that can be maintained for sufficient time for meditation. Pranayama is the calm slowing down of breathing to a default quiet state, *eupnea*. In *eupnea*, only the diaphragm contracts and relaxes. I call it the *one-muscle breathing!* By doing *Bhramari pranayama* and *Deergha Omkar* (prolonged recitation of AUM till it ends in the natural silence), one can stop the internal speech and wandering mind, and return to the default peaceful silent awareness, which is our normal state of wellbeing.

Pratyahara is letting go of all local body-related experiences from the personal, peripersonal, and extrapersonal space. One has to relax back into the ever-present background self-awareness. It is nonlocal and nondual. It is the freeing of awareness from the conscious mind with its habitual and persistent thoughts and experiential contents. Then, one naturally returns to the nonlocal self-awareness with a sense of self-freedom.

Dharana is calm, alert, and focused attention on some chosen object like one's breath, or a beloved idol, or an image. It may also be called a full mental concentration on the chosen activity. *Dhyana* is sustained calm attentiveness or vigilance for a long period of time. *Samadhi* is complete self-mergence in the dhyana meditation. One is so completely absorbed in dhyana meditation, that one forgets oneself completely, as if one does not exist as a separate entity. *Samadhi* can be with or without conscious contents (*sabeeja* and *nirbeeja samadhi*). It has been called *Dharmamegha samadhi*. *Dharmamegha* is the *cloud of dharma*, which can be understood as an unlimited *cloud* of peace, silence, virtue, effortlessness, sense of perfection, *kaivalya*, or *nirvana*.

Mindfulness meditation is awareness that arises through paying attention, on purpose, in the present moment, nonjudgmentally. It is currently very popular, and it is being widely used in general population and also the academia. It is used for personal wellness, stress reduction, and for the treatment of anxiety and depression disorders. In the long-term mindfulness practitioners, the gray matter increases in posterior cingulate cortex, supramarginal gyrus, and hippocampus, whereas it decreases in amygdala. The posterior cingulate cortex mediates self-related processes. The supramarginal gyrus participates in perspective-taking, theory of mind and attentional processes. The hippocampus stores memory and serves in orientation and navigation. Amygdala is active in detecting and responding to any dangerous situation. It mediates fear and anxiety for actual as well as imagined situations.

Long-term practice of meditation minimizes internal perceptual noise and distractions and increases one's perceptual sensitivity to meaningful stimuli and events. A steady posture with head and body stillness minimizes the noisy input from the vestibular and cerebellar circuits due to gravity and other bodily movements. *Eupnea*, a quiet and slow natural breathing, is our normal default state of breathing and being. Ideally, only one skeletal muscle is active rhythmically in this state, namely the diaphragm. *Eudaimonia* is a condition of general wellness or being in good *spirit*. Such a state is a natural outcome of meditative practice. One also needs to minimize one's internal speech, wandering mind, distractive thoughts, and habitual emotional reactions. Then, one can be still, silent, serene, and immersed fully in every newly fresh moment, with a spontaneous feeling of spacious awareness and existential unity.

Neurobiology of Presence

In order to understand the neurobiological processes involved in presence, one needs to have a good background of how the organism's brain-mind-body works, it being embedded in the world. Human organism is embodied and embedded in the natural and the human world. All of the organism's action-perception-action cycles and other activities are mapped and remapped in the organism's brain. Such dynamic, summated, sensorimotor, and representational maps in the brain are called the somatotopic homunculus. These maps are continuously updated throughout the organism's lifetime. There is a great flexibility and neuroplasticity in these brain maps. There are several excellent reference books on the neurobiology brain-mind-behavior.^[10]

Brain stem

The brain stem is a versatile structure. It is critical to life. There is a functional hierarchy in the brain stem from medulla, pons, cerebellum, and midbrain. Medullary neural networks regulate blood pressure, breathing, gastrointestinal motility, ingestion, and equilibrium. Pontine nuclei control horizontal gaze, reflexive eye movements, posture, rapid eye movement (REM) sleep, and facial expressions. Cerebellum coordinates motor activity, postural balance, gait, eye movements, reaching, grasping, and speech. Midbrain regulates vertical eye movements, near vision, pupillary control, posture and locomotion, non-REM sleep, and the level of conscious and preconscious arousal. The reticular formation with its complex neural networks is the key region for holistic integration of the organism and its behavioral actions including the locomotion, bodily homeodynamics, circadian sleep-wake cycle, and the ongoing unity of self-experience.

There is a highly connected chain of central pattern generators in the brain stem, serving a variety of life-regulating as well as behavioral functions. The essential activities such as breathing, swallowing, coughing, walking, chewing, speaking, approaching or avoiding, and defending depend on the well-functioning brain stem. Breathing is instantiated by high levels of CO₂ and/or H⁺ ion concentration in the local cerebrospinal fluid or extracellular fluid. Breathing is initiated from the preBotzinger complex of the ventral respiratory group. The breathing rate is modulated by the pontine parafacial nucleus and other related networks including the voluntary control from the prefrontal neural circuit. There is an upward as well downward flow of energy-information in the brain stem. It connects the spinal cord with the precortex and cortex, both structurally and functionally.^[11] The lumbosacral spinal cord has a central pattern generator for basic walking movements. The cervical spinal cord C3–C5 has the motor neurons for diaphragmatic movements. The thoracolumbar spinal cord mediates the sympathetic outflow for the whole body.

Forebrain

Forebrain consists of the cerebral cortex, basal ganglia, and thalamus with their multiple neural circuits. The collective properties of the forebrain in coordination with the brain stem are responsible for making us *human*. It transforms movements into *meaningful actions* and sensations into conscious *perceptions*. It also enables us to have a variety of complex *emotions* and *thoughts*. Emotion can be thought of as e-motion equal to *energy for action* and *motivation*. The emotions are processed by the limbic system, which consists of hypothalamus, mammillary bodies, amygdala, anterior thalamus, hippocampus, parahippocampal gyrus, fornix, cingulate gyrus, and the orbitofrontal cortex. The Papez circuit is well known for emotional processing and conscious decision-making.

Sensory Modalities

The sensory modalities greatly exceed the classical five senses, namely vision, audition, touch, smell, and taste. Some of the additional modalities are our sense of gravity, vestibular input for our head and body position in space, proprioception, tissue damage, and visceral sensation of bladder, colon, stomach, and lungs. We code for the intensity of perception in relation to the background sensory activity. This is known as the *Weber's law*. For instance, we can see a candle more easily at night than on a bright sunny day. In meditative presence, perceived signal-to-background ratio increases, and thus, one's perceptivity is enhanced.

Perception

Perception is the awareness of a conscious self, interacting with its surroundings. It is mediated by multimodal sensory pathways. Sensing the self, interacting with the world, is critical for survival as well as reproduction and thriving. Sensory stimuli pre-consciously guide movements, affect homeodynamics, and influence mood. The sensory energy and information goes through three fundamental processes, namely *transduction*, *transmission*, and *modulation*. This results in a unique neuroelectric pattern called the *neural code*, which is interpreted and stored as a representational-symbolic memory and experience. The bioelectric pattern memory endures through body transforms, metamorphosis as well as through sequential generations.^[12] This memory may be of an experienced somatic sensation, an action, a sound, a vocal sound, a word, a verbal thought, or a visual image. Our perceived experiences of self-surround events are continuously integrated and updated throughout our lifetime.

Speech Production

Professor Mason has clearly described the whole process of speech production in simple words. "Air from the lungs is placed under pressure from contraction of the diaphragm.

When a sufficient pressure is reached, the vocal cords are pushed apart, and the glottis opens. The pressure quickly dissipates and the glottis closes. The glottis opens and closes at a frequency that is the fundamental frequency of speech, 100–250 Hz. Phonation at the fundamental frequency is then filtered by the vocal tract to produce articulated speech. The shape of the vocal tract can be modified by muscles of pharynx, tongue, uvula and lips.”^[13] The fundamental speech frequency averages about 120 Hz for men and about 210 Hz for women. Humans are capable of making the most precise and complex voluntary speech movements creating various sounds, musical notes, and songs. That is why so many human languages have evolved in the world. Every human newborn has the intrinsic capacity to learn any language. Up to the critical period of 3 years, a child can learn whatever languages she/he is exposed to.

Language Communication

Phonemes are the acoustic units of speech production. Various combinations of phonemes create words and sentences. Typically, the Broca’s area is involved in speech production and the Wernicke’s area is crucial for language comprehension. Language is a way of communication not only by spoken words, but also by the American sign language and by the Braille text reading with touch for the blind people. Broca’s and Wernicke’s areas serve in all human communications. The temporoparietal junction (TPJ) serves as a lexicon, a dictionary of words in one’s vocabulary, the learned numbers, and various symbols and images. The left-hemispheric TPJ specializes in processing linguistic words and numbers, whereas the right TPJ processes visual images, music, prosody, and directed attention to both hemispheres.

Basal Ganglia and the Default Condition

Basal ganglia together with thalamus and cerebral cortex form five major neural circuits that generate complex behavioral actions and decision-making. The five circuits are:

1. Skeleto-motor circuit
2. Oculomotor circuit
3. Dorsolateral prefrontal circuit
4. Orbitofrontal circuit
5. Limbic or anterior cingulate circuit.

The skeleto-motor circuit helps to choose one voluntary action at a time out of many possible actions. There are three pathways involved in this process of choosing an action: (a) the *hyperdirect* pathway provides a global stop signal to stop all movements. This is the global inhibition pathway; (b) the *direct* pathway releases a selected action from inhibition. This is the action initiation pathway; and (c) the *indirect* pathway selectively inhibits certain movements, but not all movements. This is the selective inhibition pathway.

The oculomotor circuit controls gaze and orienting movements. The dorsolateral prefrontal circuit is involved in the executive control, working memory, and sequencing of behavioral actions. One can keep in the working memory up to 7 ± 2 items for 20–30 s without rehearsal. The orbitofrontal circuit is involved in emotional processing, emotional intelligence, motivation, and socialization. The limbic or anterior cingulate circuit influences emotional monitoring and behavioral self-organization.

Voluntary Motor Control

All movements and actions are interdependent on one’s homeodynamic state, the sensory feedback and feedforward loops, and the cognitive brain functions. We have a fresh homeodynamic (homeostatic) feeling of one’s present state of being at each new moment. Antonio Damasio defines these primordial homeostatic feelings as follows: “Feelings allow us to experience and become conscious, to unify our mental holdings around one singular being. Homeostatic feelings are the first enablers of consciousness...My use of the term ‘primordial’ is conventional and meant to refer to the simple and direct nature of what I conceive as feelings as having been as they emerged in early human evolution and as they still are likely to be in many nonhuman species not to mention human infants. I refer to all such early feelings as ‘homeostatic’ to separate them clearly from emotional feelings whose source is the engagement of emotions.”^[14]

“All movements proceed upon a platform that depends entirely on motivation, mood and thought. Most fundamentally, without motivation – either conscious or unconscious – we simply do not make voluntary movements.”^[13] The motor hierarchy involved in voluntary movements and meaningful actions flows down the following path: (1) motor planning in the prefrontal cortex depending on the situational context, (2) actual or imagined sequences of actions in the supplementary motor area, (3) specific motor action programs with sensory-perceptual feedback from the parietal cortex, (4) neuroelectric instructions to the motor homunculus, (5) modulation by the basal ganglia and the cerebellar loops, (6) brain stem motor control centers, (7) central pattern generators, (8) motor interneurons, (9) motor neurons, and (10) skeletal muscles.^[13]

Now, we can appreciate the enormous complexity and beauty of multiple brain networks that operate flawlessly at multiple levels, when we voluntarily breathe, walk, lift a finger, pick a cup of coffee, look at a flower, and say “Hi” to a friend! Being alive, well, and truly aware is the greatest wonder that we all experience daily. We need to appreciate the wonderful wholeness of bio-psycho-social-abstract reality.

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