

CHAPTER – 1

INTRODUCTION

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CHAPTER 1 – INTRODUCTION

1.0 INTRODUCTION

This thesis concerns ideas about human creative cognition and innovation from both eastern and western perspectives, and how experimental investigation of enhancement of creativity through meditation may affect our understanding of the phenomenon. There is a great deal of background material that could be presented, too much for a single thesis. It comes from the ancient traditions of India, particularly the Vedic tradition, with great seers like *Ādi Śaṅkarācāryaḥ* and *Saint Jñāneśvara*, and entirely different studies from modern science, some stimulated by modern inheritors of the Vedic tradition; but most background studies setting the scene for more detailed analysis of creative cognition. These eastern and western bodies of background literature will be given in more detail in Chapters 2 and 3 respectively. Chapter 4 and 5 presents the aims and objectives and the materials and methods. Chapter 6 covers the data extraction about the experiments and in Chapter 7 results are presented and discussed in detail. And, finally Chapter 8 the discussion and Chapter 9 the appraisal of the study is done along with recommendations for future research and greater insights into forthcoming prospects, based on this thesis, in depth.

Here, in the introduction, we shall set out their more important points, particularly as they will pertain to discussion of the results of the experiments on creativity, and associated changes in EEG in different regions of the brain, set out in Chapter 7. The observed associations between creative cognition and changes in EEG are set out in Chapter 8.

1.1 WESTERN APPROACH TO CREATIVE COGNITION

Western approaches to studying creative cognition are based around experimental tests that can be administered to different age groups, either high school students, or adults including university students. In our case, available subjects dictated choice of the latter, for which the Abbreviated Torrance Test for Adults (ATTA) is the most widely used instrument to measure creative cognition. Thousands of studies have been performed, of which a representative sample of published studies are reviewed in Chapter 3.

Qualitatively, based on observations of creative professionals at work in the arts, on one hand and science and technology on the other, western science divides the creative process into four stages: i. preparation, ii. incubation, iii. illumination, and iv. verification.¹ The ATTA is able to assess for artistic, verbal, visual and figural creative cognition; on scales of fluency, flexibility, elaboration and originality.² All that is discussed in more detail in Chapter 5, concerning methods. All this sets the stage for the approach of the present study to investigating the effect of Cyclic Meditation on creativity, and associated changes in EEG.³

Of the four stages of the creative process, western cognitive science⁴ including cognitive neuroscience⁵ only has good suggestions for understanding the first two stages. The illumination stage presents a mystery, but one which the eastern approach treated below along with the incubation stage and Chapter 2 can help explain, as we shall see in the Discussion in Chapter 8. The scientific approach to understanding stages of preparation and incubation, based on the storage of, retrieval and access to, specialised and domain knowledge present in the parietal lobe of the brain.⁶ Improving access to the parietal lobe would obviously help in this regard.

The current concern of western neuroscience⁷ is to identify brain regions and brain activities involved in creative thinking processes, which may lead to an understanding of mechanisms involved; the challenge has been to identify the large scale brain networks involved in creativity. Special reference is made to the various networks and pathways in the brain, to identify processes, which coordinate their activity. The fundamental idea is that various brain areas are involved in creative cognition, and that clear connections between them facilitate creative cognition.⁸

A fundamental concept in both east and west is that of focus and attention, with different modes of attention discussed by their different approaches. In the western approach, the two main modes of attention are the flow mode, named Vector Attention, and the Non-Flow mode, named Matrix Attention.⁹ In Chapter 2, we shall discuss the Vedic understanding and mechanics of attention, which names two modes, *Cit-nāḍi* and *Cit-sāgara*, which we shall equate to the first and second respectively. In terms of meditation, the Yoga system names three attentional modes operating at various different levels of meditation,¹⁰ which we treat in the next Chapter, Chapter 2, with connections between the two systems spelt out in detail in Chapter 3.

1.2 EASTERN APPROACH TO CREATIVE COGNITION

These three A's, ¹¹ attention, arousal and awareness, are all enhanced by meditation, and can be correlated to the three stages of meditation described in *Pātañjala yoga sūtra*, *dhāraṇā*, *dhyāna* and *samādhi*.¹⁰ From the perspective of neuroscience, studies of creativity showing that states of deep rest induced by meditation enhances creativity, suggest that silencing the mind and developing goal directed activity, which focuses the attention, and the one pointed state, are primary steps to initiating the beginning of the creative process, the 'preparation' stage.¹²

In the Vedic tradition, levels of mind functioning were classified and discussed in the *Sāṅkhya* system of Indian philosophy.¹³ *Sāṅkhya* starts with the five senses, which are the sources of information entering the mind. It then names the level which stores that information, *manah*, commonly translated as mind; second, it names the level which discriminates between various available pieces of information, directs the attention and makes choices, *buddhi*; this is also the level where cognition occurs. The final level is that of the little Ego, or personality self, *ahankārah*, with reference to which both *manah* and *buddhi* function. The sum total of personal experience, known as Citta, is held to form the basis for the autobiographical self.¹⁴

In the Vedic tradition, the power of creative cognition is said to develop through meditation.¹⁵ Progress in meditation, eliminating a certain amount of the *citta-vṛttayah*, results in clearer cognition of inner states at deeper levels of the mind. Questions by the student about this state provide the opportunity for the *Guru* to explain its nature, with statements made famous in the *Chāndogyopaniṣat* as *Mahāvākya*.¹⁶ First the Master says, '*Ahami Tat*';¹⁷ 'I am That', i.e. '*That* is the clear experience of my inner nature', which he follows with the statement, '*Tat Tvam Asi*';¹⁸ '*Thou art That*', i.e. That is also your inner nature coming to clear experience. The latter statement is included in the list of five major *Mahāvākya*, great wisdom statements of the Vedas. These are fully elaborated in Chapter 2. The *upaniṣats*' insights define the information structure of experience:¹⁹ it has two separate components, information content, and a '*witness aspect*', which can reflect on all forms of experience.

Meditation training strengthens the witness, until its power of reflection identifies it as the innermost aspect of ‘self’.²⁰ This agrees with a new scientific theory of mind²¹ fulfilling all known philosophical and scientific conditions.

If the scientific validity of such statements is questioned, first person accounts of experience traditionally being excluded from science, Varela and Shear’s book²², reviewed in Chapter 3, should be quoted. It defines conditions where such statements can be accepted as valid. They now form useful sources of information about the nature of mind and self, and are used to interpret EEG data. Here, we quote such Vedic ‘First Person Accounts’, the *Mahāvākya*, to help understand conscious experience.²³ They are contained in many sections of the Vedic literature, as reviewed in the next Chapter and form part of the elucidation of experience. Made from highly refined levels of consciousness,²⁴ such statements are authoritative. They agree with statements from western science and philosophy²⁵ about the nature of the self²⁶ and awareness.^{27, 28} Shear shows that such statements are found in descriptions of meditation in all great cultures in East and West. They transcend cultural boundaries, and can be used to judge philosophers’ level of development of consciousness.²⁹

1.3 INTEGRATING THE TWO APPROACHES TO CREATIVE COGNITION

Experimental methods like neuroimaging are at the forefront of research identifying the principle brain regions involved in creative cognition.³⁰⁻³³ These include parts of the frontal, parietal and temporal lobes, which participate in various brain networks,³⁴ as discussed below. Integration of activity of these networks between left and right hemispheres depends on the corpus callosum, which may also be involved in inherently creative processes like integration, forming associations, and lateral thinking.^{35, 36} As we shall see, various kinds of meditation technique have been observed to increase connection between, and integration of, brain regions and brain hemispheres.

Neuroscience has analyzed brain function in terms of activation of different brain regions and networks in which they participate, and major nerve clusters, or nodes, which participate to form important brain networks.³⁷ Four important networks include: the default mode network (DMN),³⁸ which comes into play in states of rest; the self-referential network (SRN),³⁹ which is concerned with the personality and self-concepts based on the person’s memories; and the Executive Attention Network (EAN),⁴⁰ which is involved in organising and planning – executive functions. Details are given in Chapter 3, and their roles in creative cognition discussed fully in Chapter 8.

These phenomena can be understood in terms of various approaches to brain function. One is ‘self-organized criticality’,⁴³ which has been proposed as the basis for cognitive states, and which raises levels of resonance between regions, and increases corresponding levels of EEG synchrony.⁴⁰⁻⁴³ In this way, western science is now putting emphasis on the study of creativity and the neuro-physiological processes involved.⁴³ Its main focus is on localized brain function, the various brain regions involved, with their coordination and integration^{30, 31, 34.}

In outline, western science holds that when a person is allowed to relax without directing the attention, the default mode network (DMN)³⁸ takes over, which may only be expected to enhance the flow of thought processes with simple and unoriginal levels of creativity. In other words, just resting or relaxing and going into the self thinking mode should not be expected to increase creative cognition. What has been observed to happen in scientific studies of creativity is activation of the frontal lobe and the executive attention network. This represents the creative process’s goal directed stage: when a person focuses their attention during the preparation stage of creative thinking with a creative intention, it starts to unfold the whole process. Consistent practice of focus enhances connections between the frontal lobe and the parietal lobe^{36,44-45} where domain specific and specialized Knowledge is stored.⁴⁶ Developing sufficient connectivity in the parietal lobe, enabled by focused attention and goal directed activity, leads to deactivation of the DMN.^{47, 48} The brain thus moves from a distracted mode of function to an undistracted mode of function, in favor of the executive network. On the other hand, a person involved in Yoga meditation classified as ‘*Dhyāna*’ will experience increased connectivity, as the brain’s connectome is enhanced.^{49,50} The result of these considerations is that pathways in the brain for creativity stages i. Preparation, and ii. Incubation, correspond to attention and awareness by enhancing arousal.⁵¹

1.4 VEDIC ACCOUNT OF STATES OF CONSCIOUSNESS

The *Māṇḍūkyaopaniṣat* recounts the Vedic conception of consciousness from the perspective of various states of consciousness,⁵² starting with the commonly experienced states of Waking (*Jāgrat*), Dreaming (*Svapna*) and Deep Sleep (*Suṣupti*) which it follows by naming the fourth state, *Caturtham*, known as *Turīya*. It then continues, by speaking of how consciousness can rise from the fourth state to witnessing the first three states, explaining the various levels of attainment that flow from these accomplishments.^{27,28} These may be considered 5th, 6th and 7th states of consciousness, sometimes called respectively, Cosmic Consciousness (*Turīyātīta Cetana*), God Consciousness (*Bhagavat Cetana*), and Unity Consciousness (*Brāhmī Cetana*)⁵³

names given in *Kāṣmīrī Śaivāḥi*.⁵⁴ How these states of consciousness follow one another is discussed in more detail in Chapter 2.

Attaining the state of pure consciousness, the 4th state, purifies the mind from *vṛttis* or fluctuations of thoughts and emotions that cause pranic disturbances and disease in physical health, since they block the flow of *prāṇaḥi* in the *Prāṇamayakośaḥi*. The attainment of the 4th state has therefore been proposed as a biomarker for improvement of health, eventually for achieving the state of Perfect Health.⁵⁵ The various Higher States of Consciousness correlate with different levels of *Kośaḥi*, an idea that will be treated in detail in Chapter 8, Discussion. Similarly, in that Chapter, functioning of different *Kośaḥi* is correlated with functioning in the different *Ākāśaḥi* or Spaces i.e. *Cittākāśaḥi*, *Cidākāśaḥi* and *Mahākāśaḥi*.^{27, 28, 56}

1.5 THE VEDIC APPROACH TO MEDITATION AND CREATIVE COGNITION

Journey towards our self, through exploration of our inner Being by way of meditation also deepens understanding of experiences of its Nature; developing conscious Creative Intelligence, which activates creativity in daily life; Integration of heart and mind (in the metaphorical sense), is analogous to developing EEG coherence between right and left hemispheres, enabling feelings and reason to function in harmony, coordinating visual and linguistic (auditory) senses. We therefore need to define both meditation and creativity. First, Meditation, which in Yoga is defined by the word *Dhyāna*, the 7th of its 8 limbs.⁵⁷ *Dhyāna* is the process connecting *Dhāraṇā*, the 6th limb involving focus of attention, to *Samādhi*, the 8th limb, the Silent State of Mind.⁵⁸ Considering the process by which an active mind may become silent leads to a second, more practical definition of meditation as the process of reducing mind's information content to zero. Eliminating mental activity, even of the subtlest form, infuses energy; calmness and bliss into the mind, as may be understood from the following diagram (see Figure 1.1). When the attention turns away from the five senses, in the process of *Pratyāhāra*, it is naturally attracted by the bliss of the source of thought. When it dives deep within in meditation, and merges with its source, it infuses qualities of infinite energy, infinite creativity and infinite intelligence into the mind, also coloring it with total freedom, expansion, bliss and happiness.

Based on preliminary experience of *Dhyāna* and *Samādhi*, the *Yogasūtra* elaborate a process called *Samīyama*,⁵⁹ which involves introducing specific mental impulses in the state of infinite expansion, freedom and bliss, and is held to enhance the creative process. This will be discussed in detail in Chapter 2. The eastern approach to creativity thus bases itself on the idea that expanded states of mind, described in sections of the Vedic literature like the Upanishads^{10, 20, 27, 60} and the *Yoga Sūtras*⁶¹ present the key to developing reliable creative cognition. That is the fundamental reason why this study to investigate the influence and its mechanism Cyclic Meditation and in turn on creative cognition was designed.⁶²

1.6 COSMIC INTELLIGENCE, PRĀJÑĀ AND SELF; UNIFYING THESE THREE AS SYNCHRONY

The disparity between these two basic approaches, the objective approach of western science, and the subjective approach of eastern science, suggests that deeper insights may be gained by unifying the two. In particular, brain mechanisms for the third stage are immediately suggested: illumination is a subjective correlate of the high levels of synchrony resulting from such inter-regional connects in the cortex.^{63, 64} In this kind of way, current limitations in the western approach may be resolved by insights from the Vedic Sciences. Of great importance in this regard is the concept of flow of creative cognition⁶¹ that occurs as the mind expands and progresses from being dominated by random thoughts, the *Citta-vṛttayah*, to being aware of input from Cosmic *Citta* or *Ahaṅkārah*, as it connects to the *Cidākāśah* discussed in Chapter 8. This is when true creativity i.e. *Prājñā* begins to blossom.⁶⁰

1.7 CLASSIFICATION OF THREE KINDS OF MEDITATIONS

Following work by Lutz (2008),⁶⁶ Travis and Shear (2010)⁶⁷ defined three classes of meditation: Focused Attention, Open Monitoring, and Self-Transcending (See Table 1.1), distinguished by patterns of brain waves and EEG activations, and substantiated by many published studies of each kind. They may also be correlated with awareness; arousal and attention in specific cortical and sub-cortical networks¹¹ (see Chapter 8). The first, Focused Attention, keeps the attention focused on an object (e.g. in *Mantra Japa*, a mantra is continually repeated), while the second, *Open Monitoring*, keeps the awareness involved in a monitoring process (e.g. in *Vipassana* the awareness scans stress sensations along the spine)⁶⁸. In the third, *automatic self-transcending*, techniques are designed to transcend the activity required to start them.⁶⁷

In this category, Travis and Shear gave seven examples of studies, six from TM, and one from Qigong.⁶⁷ Another possibility, not yet studied, is a *Nātha Sampradāya's So'hanii* technique of *Dhyāna*, which starts by focusing attention on the *Ajñā Cakra* (point) between the eyebrows (mPFC); beginning with one pointed focus and then inducing expansion of awareness (defocus) to unboundedness happening naturally and spontaneously, beyond space-time dimensions; thus transcending all focus of attention into the infinite consciousness. Of the three kinds of meditation named by Lutz,⁶⁶ Travis and Shear⁶⁷, only techniques falling in the category of self-transcending of *Dhyāna* are specifically designed to take the awareness to *Samādhi* and beyond to infinite pure consciousness, and bring the mind, in experience of its natural pure silent state.

Table 1.1: Classification of Meditation Techniques and its Interpretations

Sr. No.	Meditation Category & EEG Band	Elements of the categories	Different Meditation Practices
1.	Focused Attention Gamma (30-50 hz) Beta2 (20-30hz)	Voluntary Control of attention & cognitive processes	1.Loving-kindness-compassion (Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004); increased frontal-parietal gamma coherence & power 2.Other studies with single group or case study designs 3.Qigong: (Litscher, Wenzel, Niederwieser, & Schwarz, 2001) 4.Zen-3 rd ventricle: (Huang & Lo, 2009)
2.	Open Monitoring Theta (5-8 hz)	Dispassionate, non- evaluative awareness of ongoing experience	1.Vipassana meditation (Cahn et al., 2011): decreased frontal delta, increased frontal midline theta & increased occipital gamma power 2.Zen Meditation (ZaZen) (Murata, Koshino, & Ormari, 1994): increased frontal midline theta 3.Sahaja Yoga (Baijal & Srinivasan, 2009): increased frontal midline theta and coherence 4.Concentrative Qigong (Pan, Zhang, & Xia, 1994): increased frontal midline theta
3.	Self-Transcending Alpha (8-10 hz)	Automatic transcending of the procedures of the meditation practice	1. TM (Dillbeck & Bronson, 1981): increased frontal alpha coherence 2. TM (Travis et al., 2010); increased frontal alpha1 power & decreased beta1 & gamma power, increased alpha1 & beta1 frontal coherence; & increased activation in default mode network 3. TM (Travis & Wallace, 1999); increased frontal coherence 4. TM (Travis, 2001); higher frontal alpha coherence during transcending 5. TM (Travis & Arenander, 2006); higher frontal alpha1 coherence (cross-sectional design) & increasing frontal alpha coherence 6. TM(Hebert, Lehmann, Tan Travis & Arenander, 2005) enhanced anterior/posterior Synchrony 7. Qigong (Qin, Jin, Lin & Hermanowicz, 2009).

This kind has most promise to develop creativity; it is depicted in Figure 1.1. Normally the attention is directed outwards through the five senses depicted as the five upward directed arrows at the top of the figure 1.1. According to *Patanjali*, the starting point of meditation is his fifth *Anga*, *Pratyāhārah*, a central meeting point of *Bahiraṅga* and *Antaraṅga*, which directs the attention inwards, away from the external world of the senses .

Figure 1.1: Meditation in terms of the Ocean of Mind

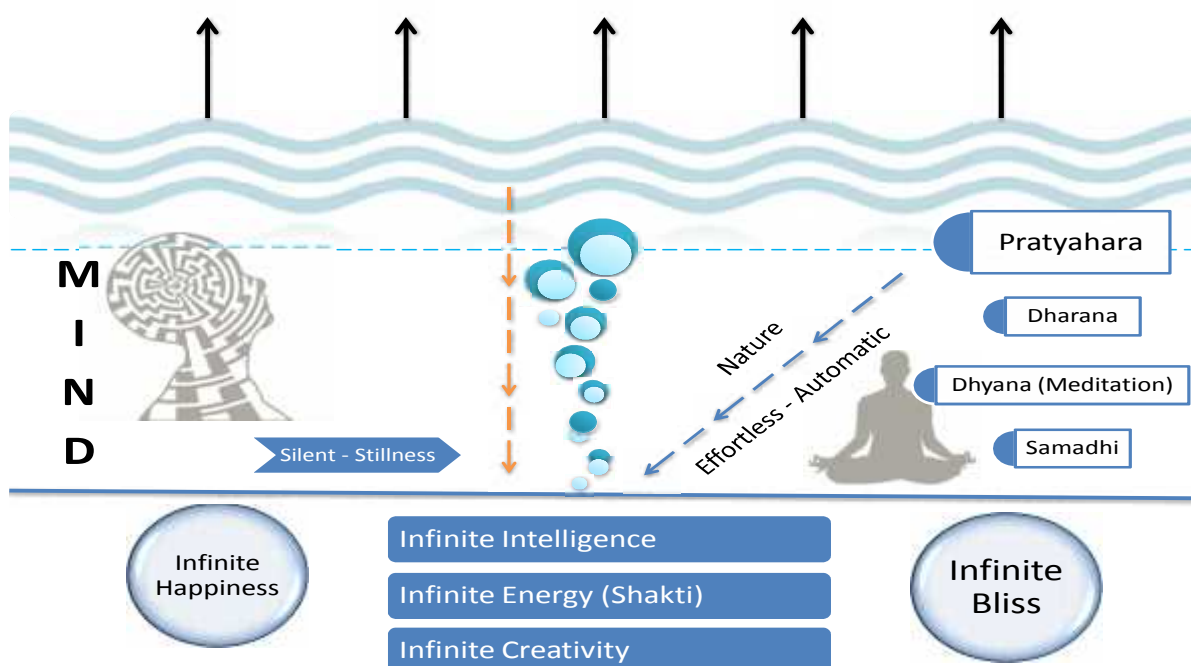


Figure 1.1: depicts the action of dhyana on the mind as movement of attention within the ocean of awareness.

Self-transcending techniques achieve this by letting the awareness focus on the Mantra, on the natural experience and sense of breath, calmness within, or on one of the spiritual centres ⁶⁹ the enlivenment of which is associated with depth of meditation. Cyclic Meditation directs the attention to progressively refined aspects of inner awareness. Most spiritual masters concur that after a start like this, the attention is spontaneously drawn to deeper levels of the ocean of mind because they offer more bliss to the mind, so the attention is naturally drawn to them. Eventually it moves to the supreme level of good feeling at the bottom of the ocean, where, in the words of *Ramaṇa Maharṣi*, it merges with the ‘*source of thought*’ with its Infinite Intelligence, Infinite Energy, and Infinite Creativity, which then infuse into the mind.

Maharṣi Maheṣ Yogi describes the steps as “1.Awareness of consciousness, 2. Expansion of consciousness, 3.Transcending to consciousness and merging into pure consciousness”⁵³ which may be equated with *Dhāraṇā*, *Dhyāna* and *Samādhi*.^{57- 59. 69}

Another perspective is that, rather than proceeding directly to transcending, some techniques first develop receptive attention and then capacity for focus. Observed brain mechanisms for orientation of attention correspond to this.^{70,71} They develop the power of focus or concentration. This will be discussed in Chapters 2 & 3. Studies using these kinds of meditation for attention training document changes in attention-related brain areas and creation of new networks also termed as large scale networks in the domain of creative cognition, that improve executive attention functioning.⁴³ They also help realise the Self and full manifestation and expression of creativity, but not so directly as self-transcending.

1.8 CYCLIC MEDITATION – THE TECHNIQUE FOR ENHANCING CREATIVE COGNITION IN THE CURRENT STUDY

Cyclic Meditation (CM) also called ‘*Avartan dhyān*’ is a ‘moving meditation’ technique, which combines the practice of yoga postures with guided meditation.⁷² Its origin is the famous *Gauḍapāda Kārika* on the *Māṇḍūkyaopaniṣat*⁷³ which says: ‘In a state of mental inactivity awaken the mind, when agitated, calm it; between these two states realize all possible abilities of the mind. When the mind reaches the state of perfect equilibrium, do not disturb it’. The underlying idea is that, for most persons, the mental state is routinely between the extremes of being ‘inactive’ or of being ‘agitated’ and hence to reach a balanced/relaxed state the most suitable technique would be one which combines ‘awakening’ and ‘calming’ practices. CM starts with a distinct kind of focus, or *Dhāraṇā*, on various body parts. It then begins to refine the awareness by drawing the attention towards the subtle levels of feeling in those body parts. An essential part of the practice is being aware of sensations arising in the body. It thus induces a quite state of mind, so its effects are similar to *Dhyāna*, described by *Maharṣi Patañjali*: ‘*Tatra Pratyayaikatānatā Dhyānam*’.⁷⁴ All meditations, irrespective of the strategies involved, are believed to help reach a higher state of silence and bliss.

1.9 THE SELF IN COGNITIVE NEUROSCIENCE

Modern psychology identifies various aspects of the 'sense of self': core self, proto-self, and autobiographic self.⁷⁵ First subjectively identified in *Turīya*, Pure consciousness, the Self, *Ātman*, is beyond such things. Its form, *Svarūpaḥ*, is of the nature of pure bliss.⁷⁶ This identification slowly develops into the final realization, that '*Ayam Ātmā Brahma*'⁷⁷, '*Ātmān is Brāhman*,'⁷⁸ the Self is the Ultimate Reality, lying behind all appearances.⁷⁹ The closest to this in western studies comes from the recent publications by Antonio Damasio, Craig and Kandel⁸⁰⁻⁸³ who consider specific feelings and emotions, and their brain pathways; rather than such an abstract level. Problems in psychology and social interactions that arise from this level of experience are generally discussed under cognitive neuroscience and the science of Emotional Intelligence (EI). In this field, *Dhāraṇā* and *Dhyāna* offer a means to improve cognitive faculties by developing the sense of inner space, detachment and patience. By bringing clear experience of Self, and distinguishing it from physical and mental traits associated with personality, its *Antaraṅga* of *Dhāraṇā*, *Dhyāna* and *Samādhi*, put the aspirant on the path to fulfilment of *Dharma*, Life's Purpose, leading to self realisation. The expansion of awareness occurring as the mind approaches the experience of Self during *Dhyāna* creates a space, which expands the boundaries of the mind, increasing freedom to make choices, thereby recognizing one's quest for creativity and enhancing creative cognition.

Another relevant development in modern biology concerns the physics of control theory in physiological systems seen through the eyes of complexity biology.⁸⁴ Complexity has identified a universal law of regulation, namely that the Locus of Control of every biological regulatory system is placed at a very special condition known as criticality.⁸⁴ A consequence is that the brain's cognitive functions work on gestalts, forms and patterns, cognition of objects of perception as wholes.⁸⁵ All cognition works this way, including creative cognition, the topic of this thesis. A useful way to understand creative cognition is thus in terms of patterns recognized as gestalts. Such patterns form the basis of cognition; they also form patterns of expression, so stages of learning, in parallel to the first two stages of creative process, involve refining levels of cognition of gestalts.^{86, 87}

Another property of criticality is high internal coherence, which can interact with similar sources of coherence in the external world ⁸⁴ important in the process of incubation during creativity. By these means cognitive functions become capable of intuitive insights received from external sources, up to and including the whole universe, which itself has massive internal coherence.^{88,89} This will be taken up in the Discussion in Chapter 8, to provide physical models for the *Cittākāśaḥ*, *Cidākāśaḥ*, and *Mahākāśaḥ* ⁹⁰ and the faculty of creative cognition grounded on the level of pure consciousness and *Ṛtambharā Prajñā*.

1.10 PANCHAKOSHA MODEL TO INTEGRATE LEVELS OF MIND, SELF, CONSCIOUSNESS, FOR PRAJNA AND CREATIVE COGNITION

Creativity happens on the ground of the Self or Singularity. Self is a process and subject to the structure and the levels of mind. This structure of subjective experience based on various properties and the levels of mind can play various roles in the human make-up, namely, *Manasḥ*, *Buddhiḥ*, *Ahaṅkāraḥ*, *Citta* and *Antakaraṇa*, constituting the underlying driving force for any thought or action.^{90, 91} These are linked to independent vehicles for conscious experience or koshas existing apart from the gross body, *Sthūlaśarīra*.⁹² They are open to pure consciousness and cognition of *yogis* developed through meditation. The ancient Vedic civilization developed a unique approach to understand the human mind, cognitive faculties and means to optimize its use so as to fulfill all desirable goals in a person's life, at mental (mind) and cognitive (*Citta*) level of human consciousness.

The Vedic understanding of mind ⁹³ was based on a completely different kind of investigation from those used in contemporary western psychology ⁹⁴. Whereas the latter is largely derived from studies of psychopathology, ^{95, 96} and how the mind can go wrong when subject to overloads of stress, ⁹⁷ pain ⁹⁸ and suffering; ⁹⁹ the Eastern approach ⁶⁹ emphasized the means to leave suffering and its effects behind. A person then learns to live from deeper levels of the mind, completely transcending levels of suffering, to arrive at states of pure *Ānanda*, Bliss.^{28,100} Such high blissful states, *Ānanda* states, come out of the deeper reserves of infinite energy from cosmic intelligence and there are examples of such expressions in the form of creative cognition and its expression.^{101, 102}

Such examples of higher self, bliss and fulfillment comes from the sukshma levels of silence which points to the reality of cosmic intelligence at deeper and subtlest levels of experience, classified through the approach of Śīkṣā.¹⁰¹ Further stating four levels of expression physical through sound, mental, ideational and transcendental, corresponding to totality information and digital, experience information integrated at higher order experience information.

The Vedic system^{103, 104} therefore begins to explain the structure of human experience and its inherent subjectivity¹⁰⁵ through the idea that the mind has different levels that can be explored by directing the attention inwardly in meditation.¹⁰⁶ Each has particular abilities and roles to play in the human make-up of self and creative cognition. They include: *Manah*, the level that contains information in the form of ideas generated by sensory perception, together with their emotional associations based on experience; *Buddhi*, the level of the discriminative faculty, decides on intentions and associated courses of action, and has the power to control ideas; the *Ahaikārah*, or little ego, is a point-like structure supported by a person's underlying sense of personal existence, i.e. one's sense of individuality with its authorship of action; finally the *Citta*, or storehouse of past memories and 'impressions' reaching back into the deep past, provides the motivation for a person's activities, and choices of further action, and refined creative cognition.

Citta constitutes the driving force behind all a person's actions. Together these four concepts are grouped into an entity called the *Antakaraṇa*, a term treated in specific sections of the Vedic literature.^{90, 91} It has no equivalent in western languages because of their ignorance of internal levels of mind due to lack of techniques to explore them systematically.

Western psychology sticks to more limited concepts of body and mind, and does not go beyond them. Neuroscience has taken steps to understand causes behind various mental and cognitive states⁹⁶ linked to a person's heart and mind, and to their sentience^{80, 81} which is a base or ground for any kind of creativity. *Kośah* provide a missing link between these eastern and western approaches⁹² to experience and access pure consciousness, from which the self draws resources to flow in the mode of creative consciousness, by controlling the *vṛttayah* and any activity of self in the default mode activity.

1.11. FRONTAL LOBE AND FLOW OF CREATIVE COGNITION

The most powerful system to remove problematic and distracting activity of the *Cittā*, the *Cittā-vṛttayaḥ*, by Yoga and meditation,¹⁰⁷ particularly its forms of meditation. The *Yogasūtrāṇi* states, *Yogaḥ Cittavṛtti Nirodhaḥ*: the purpose of Yoga is to purify the *Cittā* of its problem causing activity,¹⁰⁸ originating in unresolved memories and experiences. Modern neuroscience offers possible explanations. For example, focus on the medial pre-frontal cortex (mPFC) activates and regulates the attention-forming executive network^{109, 110} in the frontal lobes, and prevents intrusion of distracted states of functioning caused by the *Cittavṛtti* which may generate activation or deactivation of the default mode network (DMN).¹¹¹

Such meditative focus replaces DMN activity with more goal directed processes that can maintain and stabilize inner peace and silence important for the activation of creative cognition.^{109,110} Only then is the executive network set to function efficiently, and prevent the *Cittā* interfering with its ongoing activity, enabling the creative cognition to come online. This promotes efficient functioning of the various neurobiological aspects of self, dissected by Damasio⁷⁵ as the 1. Autobiographical self, 2. Proto self, and 3. Core self, which will be discussed more fully in Chapters 2 and 3. These constitute the self-referential network⁵, and can be mapped to the *Pañcakoṣāḥ*,⁹² which has a deeper source for the activation of the large scale networks involved in the creativity.¹¹²

The executive network can then process functioning without interference, mainly in a goal-directed manner like a CEO, i.e., Chief Executive Officer; the Yoga Sutras state: ‘*Tadā Draṣṭuḥ Svarūpe’Avasthānam*,¹¹³ the personality self is established in its inner self, ‘*Svarūpa.*’¹¹⁴ The executive network and the self-referential network can then integrate, and work together in coherence and silence, bringing harmony to a person’s life and continuing experience of *Śānti*, inner peace. By such means of correct focus of attention, the ability of Yogis to enhance the functioning of all four levels of the *Antakaraṇa* is enlivened and enhanced. This essential focus maintains unrestricted goal-directed activity, enabling the core networks in activation called as the large scale global networks of creative cognition.

They generate a subtle energy that integrates the functioning of the *Pañcakoṣāḥi*,⁹² which come into coherence and harmony naturally.^{115, 116} The subtle energy, *Prāṇaḥi*, is a massive power to activate latent abilities, and is the creative energy, known as *Śaktiḥ*, that shines through all great people's lives in their highest accomplishments.^{117, 118,}

One of its major centres is the *Ājñā Cakraḥi*¹⁰ in the forehead^{1*}. Focus in the frontal lobes infuses this energy into the system, which is a converging centre of the brain, strengthening the attentional network and directly connecting it to the *Antakaraṇa* and its innate higher abilities. These are described in *Yogasūtrāṇi Pāda* III, based on mastery of earlier advanced stages and results of regular meditation practice. Such exercises activate a person's latent abilities by triggering various states of consciousness, based on pure self-referral awareness forming the foundation of the familiar states of consciousness²⁴, waking, dreaming, and deep sleep. They do so by fine tuning the three A's, Attention, Awareness and Arousal of meditation. This idea is acknowledged in the eastern sciences in the *Māṇḍūkyaopaniṣat*²⁴ and *Muṇḍakopaniṣat*.²⁶

Cognitive Neuroscience suggests its proof by listing neural correlates of waking, dreaming and sleeping.¹¹⁹ The Vedic civilization thus understood how higher abilities such as creative cognition, *ṛtambharā prajñā*, can be developed by extended practice of meditation and associated exercises to enhance the activations of the core networks^{109,110,112} involved in the process of creativity.

An important aspect of these activations is based on the functioning of the *Kośaḥi* while they do not function on the same kind of information as the gross senses. They function on information of a different kind, the information used in cognition and experience. This is not physical, digital information, acknowledged as similar to information in thermodynamic entropy, or disorder. Analysis shows it to be new and different, 'Experience Information'. At subtle levels of experience, a different kind of reality operates, far more inter-connected than the commonly experienced gross world of *Sthūla* forms and phenomena.

¹ * Svāmī Mādhavānanda, Swaropyog, Pune, personal training & private communication on Science of Meditation, in Natha Sampradaya.

1.12 ŚIKṢĀ AND CREATIVE COGNITION

The various information types used in human conscious experience can be classified through the Vedic science, Śikṣā, the first of the six *Vedāṅgāni*, the limbs of the Veda.^{107,120} Śikṣā tells us that human cognition encompasses four levels of verbal expression: (1) *physical* through sound, *Vaikhari*; (2) *mental speech*, *Madhyamā*; (3) *ideational*, *Paśyanti*; and (4) *Transcendental*, *Parā*.⁶⁰ These four levels can explain many aspects of human cognition that simple neuroscience hypotheses of digital information content. They cover four distinct types of information: digital information; experience information; integrated, higher order experience information; and totality information.

Only quantum reality and proposed extensions to quantum fluctuation fields can model these various information types. Experience information requires extending quantum field theory to quantum fluctuation fields by using consequences of quantum field commutation relations; the higher order forms are then easily constructed. Yoga, in the fullest sense of its eight-limbed practice of *Aṣṭāṅgayoga*,¹⁰⁷ its final three limbs, the *Antaraṅga*, provide systematic understanding of how to access deep levels of the mind, and transcend them to reach the final state of inner silence and highest levels of creative intelligence and cognitions. Subjective confirmation of the existence of these states capable of creative cognition comprises *Dhāraṇā*, focus of the attention on the mental stimulus being used, *Dhyāna*, allowing the stimulus to spontaneously refine so that the attention slips spontaneously to deeper levels of the mind, culminating in its reaching one of the states of *Samādhi* where the state of Pure Consciousness slowly becomes accessible.¹²¹ As we know, *Nāgārjuna* characterized the latter as a state of *Śūnya*, Emptiness.¹²²

In contrast, *Ādi Śaṅkarācāryaḥ*⁹ adopted the *Turīya* perspective of *Manomaya* and *Vijñānamaya Kośa* in accordance *Māṇḍūkyaopaniṣat*²⁴ and *Taittirīyaopaniṣat*.⁹² He emphasized that these are states of *Purna*, Fullness or Completeness,^{121,123} which is the way they are experienced through the *Prāṇamaya Kośaḥ*, because unrestricted fullness of the flow of *Prāṇa* is enabled.

Once it is accepted that information gained at deeper levels of awareness is valid in the process of creativity, the question arises as to how to explain the phenomena that become available at these subtle, *Sūkṣma*, levels of experience. Only by extending quantum physics to include quantum fluctuation fields do explanations for such phenomena become possible. Adopting these new forms of quantum theory extends modern science to include this reality in its fields of theory and understanding the cognitive stages and the phenomena of creativity itself.

The Vedic sciences explain the detailed structure of subjectivity in terms of various *Kośalī* that surround the *Ātman* or self, and can be witnessed by the Self, through its Self-referential Cognitive abilities. Then the processes of cognition and corresponding brain mechanics for the fundamental process in meditation and creative cognition can be explained: by the elimination of problems in the *Cittā*, and subsequent merging of the personality self into cosmic intelligence, and coming out shining and radiating Creative Self, leading to infinite freedom, self-realization, enlightenment and *mokshā*.^{10,28,58 124}