Open Peer Review on Qeios

A Cognitive Investigation of the Zen Meditation through the Lens of Thousand-Brain Intelligence and the Cerebral Reward System

Zhiqing Wang[1]

1 East China Normal University

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.

Abstract

Zen Buddhism is perceived by many Buddhists as the path to transcendent truth, and Zen meditation is considered as an effective and representative approach. This article seeks to decipher the Zen meditation experience with the latest findings from Hawkins' theory of thousand-brain intelligence and the cerebral rewarding system. According to the findings, it suggests that Zen meditation might involve both the construction and integration of cortical column models and the liberation from everyday addictive behavior. Therefore, it may be interpreted as a form of cultural art and skill from a pre-scientific era, rather than religious mysterious activities in the traditional understanding.

Zhiqing Wang*

PhD student, ECNU (East China Normal University), Department of PhilosophyAddress: Dept. of Philosophy, East China Normal University, Shanghai 200241 P.R. China

*Email: wangzhq02@163.com

Keywords: Zen Buddhism, Transcendence, Reference framework, Zen Meditation.

1. The Role of Zen Buddhism in Buddhist Religious Practice

Buddhism, spanning over two millennia, stands as the world's most ancient globally recognized religion. However, Buddhism has undergone significant transformations, evolving into diverse practices and sub-belief systems. As far as in modern China, Buddhism has flourished in the form of eight major schools, each with its unique doctrines and practices. (, 2015) It is worth noting that within these eight schools, the Zen Buddhism stands out as a highly distinctive and unique branch.

Before examining the significance of Zen in Buddhism, it is necessary to trace the evolution of meditation practice. In pre-Buddhist India, meditation primarily focused on the cultivation of 'jhāna' and was not synonymous with what we now understand as Zen. Siddhartha Gautama, later known as Shakyamuni Buddha, embarked on various forms of meditation after his renunciation but did not attain enlightenment through these practices.

The elevation of Zen meditation to its central position within Buddhism can be attributed largely to the propagation of Zen teachings from the Mahāyāna tradition. This gradual shift marked the emergence of meditation as the supreme Dharma gate. Zen Buddhism, as it stands today, has thus garnered increasing reverence. Within the context of Chinese Buddhism, a saying holds profound significance: "There is only one path to return to the source, but there are numerous skillful means , (, 2010a)". This adage underscores the singular importance of Zen practice as "the one path." The elevated status of Zen Buddhism is attributed to the persistent advocacy and steadfast commitment of generations of Zen adherents.

It is believed that Siddhartha Gautama's own enlightenment was closely associated with certain seated meditation practice. His spiritual journey, including the previous training on 'jhāna', marked by ascetic practices, did not lead to enlightenment; it was only when he meditated under the Bodhi tree that he finally attained awakening. Subsequent generations of Zen Buddhists have placed significant emphasis on this experience, regarding it as the esoteric approach to the Buddha's enlightenment.

2. The Aims and Practice Traditions of Zen Buddhism

In general, Zen practice requires its practitioners to be deeply familiar with the teachings of the Buddhist school. For instance, in the case of Chinese Zen Buddhism, one would need to be well-versed in numerous scriptures such as *the Lankavatara Sutra* , *Verses on the Faith Mind* , *Diamond Sutra* , *Platform Sutra of the Sixth Patriarch* , *Treatise on the Awakening of Faith in the* Mahāyāna , *Avatamsaka Sutra* , *Vimalakirti Sutra* , *The Surangama Sutra* , and *the Contemplation of the Mind in Samadhi* , among others.

With deep familiarity with the scriptures, it allows practitioners to establish their goals, stages, paths, and specific methods of practice. Additionally, it is advisable for practitioners to seek the guidance of a qualified teacher and become members of a community of fellow practitioners. Although *the Mahaprajnaparamita Shastra* states, "Rely on the Dharma, not on individuals; rely on the meaning, not on the words; rely on wisdom, not on consciousness; rely on the definitive scriptures, not on non-definitive scriptures , , , , 2014 ", having a knowledgeable teacher can provide invaluable guidance from the perspective of insights and experiences. It is widely acknowledged that fellow practitioners serve as references and role models in the meditation practice, significantly contributing to one's progress and advancement on the path.

In Chinese Zen Buddhism, in addition to the aforementioned conventional and normative meditation paths, there exists a distinctive lineage known as the Patriarchal Zen tradition( ). This tradition aligns closely with the core principles of Zen Buddhism: "Realization of Buddhahood through Perceiving One's True Nature(, 2010b) ". To some extent, this tradition

represents an innovation within Zen Buddhism, particularly as a response to the conventional meditation practices of the Tathagata Zen tradition. While Zen's canonical teachings provide a fundamental theoretical framework and practice guidelines, strict adherence to these texts and excessive fixation on them can inadvertently limit a practitioner's intellectual and spiritual horizons. The core principle of *the Diamond Sutra* emphasizes cultivating a mind that abides nowhere, transcending attachment even to Buddhist teachings. As it is stated, "One should produce a mind that does not dwell anywhere (, 2010c) ". Perhaps in recognition of the potential pitfalls of rigid doctrinal adherence, Zen masters of the time championed the development of the Patriarchal Zen tradition, which encourages practitioners to move beyond textual fixation and engage in direct experiential realization. This shift aimed to foster a deeper understanding of selflessness and truth through firsthand experience, surpassing the limitations of intellectual attachment to scriptures.

According to this philosophy, enlightenment may not primarily come from studying scriptures; instead, the essence of enlightenment lies in the practitioner's intrinsic nature, circumstances, and the guidance provided by the teacher. During the Tang and Song dynasties, the Patriarchal Zen tradition emerged as a unique characteristic of Chinese Zen Buddhism. In this tradition, a practitioner first takes refuge under a teacher and gradually comprehends and practices the stages, objectives, paths, and methods of cultivation through the teacher's guidance. Specifically, the teacher and disciple coexist in a shared living world. The teacher is an accomplished individual who has realized the ultimate truth, while the disciple, at the outset, may only have a vague sense of the direction of enlightenment. Through the teacher's guidance over time, the disciple gradually gains clarity on the essence of the ultimate truth and the content of the living world. Eventually, through specific events and timing, the disciple will break through the barriers between the two and achieve personal realization and transcendence. Subsequently, the teacher confirms the disciple's realization, which is known as the transmission of the Dharma seal. *The Record of the Transmission of the Lamp* and *Further Transmission of the Lamp* , written during the Ming and Qing periods, stand as invaluable resources within the Zen tradition. These texts illuminate the Zen lineage, elucidate Zen practice, inspire awakening experiences, and provide enduring guidance for Zen practitioners in subsequent generations.

In the practice of Zen meditation, the Patriarchal Zen tradition appears to shift its focus away from rigid adherence to the theoretical framework established by the Tathagata Zen tradition. Instead, it places greater emphasis on inspiring and confirming self-cultivation and self-realization in the practitioners under the guidance of Zen masters. Indeed, this tradition sets higher demands on Zen masters. On one hand, they are expected to possess the realms and insights expounded in the Tathagata Zen teachings, and on the other hand, they must not be confined by these realms and insights. Furthermore, they need to have a clear understanding of the disposition and level of meditation practice of their disciples, enabling them to design and orchestrate events and opportunities tailored to facilitate the disciples' awakening.

It should be noted that in the context of Zen Buddhism, meditation serves as a fundamental aid to achieving enlightenment. By cultivating a state of mental and physical calmness, practitioners facilitate the integration of Buddhist teachings and life experiences. Throughout this process, the practitioner gradually realizes and firmly believes that the mind constitutes the essential nature of all things, possessing the power to unify and manifest phenomena, while the world reflects this inherent functioning. As the practitioner gains the ability to comprehend phenomena, liberate

themselves from their disturbances, and effectively utilize them, they transform into a realized individual, embodying the path of enlightenment.

3. The Fundamental Principles and Steps in the Practice of Zen Meditation

Based on the aforementioned content, it becomes evident that authentic Zen meditation is intricately linked with ultimate awakening. It is this association that has garnered widespread recognition and appreciation for Zen meditation. However, in practical life, individuals often engage in meditation with diverse objectives. From a certain perspective, such practices can be categorized as contemplation rather than true Zen meditation. According to the teachings of the modern Zen masters, Venerable Master Xuyun and Nan Huai-Chin, we will briefly introduce the core principles and practical steps of Zen meditation (, 2009).

Firstly, the purpose of Zen meditation is to realize one's true nature and remove the pollution of the self-mind. As Venerable Master Xuyun emphasized at the beginning of a meditation session, there are four prerequisites for dedicated practice: a deep faith in karma, strict adherence to precepts, unwavering confidence, and a determined commitment to the practice. In simple terms, Zen practitioners need genuine faith, concrete actions, considerable focus, and unwavering dedication. He quoted the words of Elder Weishan: "If the virtuous can avoid regression, the stage of Buddhahood can surely be expected." (, 2009, p.11)

Furthermore, in the process of Zen meditation, practitioners typically maintain a specific sitting posture known as the "Seven-Point Posture of Vairochana." This posture consists of seven key points, each addressing a particular aspect of the body. Specifically, it involves:

1. Cross-legged sitting, with one leg resting on the other.
2. Keeping the spine erect, ensuring that the spinal column remains vertically aligned to maintain stability.
3. Both hands form a circular mudra (hand gesture) and rest naturally in the lap, just below the navel.
4. Slightly spreading the shoulders, aiding in maintaining balance.
5. Keeping the head upright, with the back of the neck slightly tilted backward but not excessively.
6. Gazing straight ahead with both eyes open, without focusing on any particular object, maintaining a relaxed state.
7. Placing the tongue lightly against the roof of the mouth, preventing the mouth from opening.

These steps help practitioners maintain the correct sitting posture during meditation, promoting concentration and introspection. This posture aids in relaxing the body, reducing physical discomfort, and facilitating a deeper focus on the practice of meditation (, 2002).

On this basis, genuine Zen meditation can be conducted. According to the teachings of Master Xuyun, understanding the relationship between host and guest, and attending to the topic of meditation, are key aspects of the Zen meditation process. The notion of understanding the host and guest refers to the adept's skillful recognition of the changing and the unchanging elements within Zen practice. *The Surangama Sutra* offers a fitting analogy for their relationship: “Consider

a traveler who arrives at an inn, where they may stay and eat. After their meal and rest, they prepare to continue their journey, not lingering. If they were the actual innkeeper, they would have no place to go. Reflecting in this way, they do not abide as a guest but remain as the master. Not abiding is referred to as the guest principle. Another analogy is like the fresh clearing after a storm, where the sunlight penetrates through the gaps, revealing the emptiness above. Various dust particles stir, and the empty space remains undisturbed. This clarity and stillness is known as emptiness, while the movement is called dust". In meditation, the changing element is the "guest dust", which represents delusional thoughts, and the unchanging element is the 'host master,' signifying one's inherent nature. Just as dust particles naturally stir without affecting the clear and still empty space, so do delusional thoughts arise and pass without disturbing the unchanging nature of reality. If practitioners can comprehend the host, the guest, and the subtle dust in this way and deeply appreciate this, they are considered to have embarked on the path of meditation. (, 2009, p.13).

In addition to recognizing the relationship between host and guest at any moment, practitioners must also continuously attend to the topic of their meditation. This attentiveness to the meditation focus, often encapsulated in a specific phrase such as 'Who is the one reciting the Buddha's name?' involves paying heed to the mental state preceding the utterance of this phrase. To elucidate further, individuals engaged in spiritual practice are required to maintain their awareness of the mental landscape immediately preceding the emergence of this meditation phrase in their consciousness. This precise moment represents the inception of thought and resides within the realm of neither arising nor ceasing. The practitioner's unwavering attention to the meditation focus is a crucial manifestation of their proficiency in Zen meditation.

Through such training, practitioners can continually cultivate an awareness of their own nature, which is referred to as the host or the immovable. When proficiency reaches a certain level, practitioners may suddenly experience a cessation of thought, gaining profound insight into their own minds. At this moment, all delusions and anxieties meld into a single, genuine heart. To practitioners of Zen, this is regarded as the fruit of genuine practice, distinct from the outcomes of ordinary brain-based thinking. In general, practitioners, upon reaching this stage, have achieved a preliminary level of attainment. If practitioners aspire to attain even higher levels of accomplishment, it is necessary for them to integrate the insights gained from meditation into their daily lives. When the realizations acquired in both daily life and meditation merge seamlessly, the practice can be considered approaching a state of fulfillment.

If Zen practitioners achieve this realization, they will be regarded by the religious community as enlightened beings, Buddhas, or great individuals. The community will claim these practitioners have indeed attained complete transcendence and a profound understanding of the truths of the universe and human life. As claimed, they can also understand the conditions of other practitioners well and provide targeted guidance. Moreover, their responses to various situations will become effortless due to their correct understanding. From these descriptions, it can be inferred that Zen practice encompasses strong cognitive claims and expectations.

4. The Core Tenets of Hawkins' Theory of Thousand-Brain Intelligence

In 2021, Jeff Hawkins published the book*A Thousand Brains: A New Theory of Intelligence*. In this work, the author

elucidates the evolutionary progression of the old brain and the new brain, presenting a profound reference framework theory with far-reaching implications for our understanding of intelligence and cognition.

From the perspective of the relationship between the old brain and the new brain, the new brain has evolved as a novel component based on the foundation of the old brain. Consequently, animals with the new brain possess the capacity for sophisticated behavioral control. According to Hawkins, “The neocortex is in a decidedly unfair position, as it doesn’t control behavior directly. Unlike other parts of the brain, none of the cells in the neocortex connect directly to muscles, so it can’t, on its own, make any muscles move. When the neocortex wants to do something, it sends a signal to the old brain, in a sense asking the old brain to do its bidding”. (Hawkins, J. 2021. pp.25-26)

Hawkins further explains that the neocortex is the organ of intelligence. It is a napkin-size sheet of neural tissue divided into dozens of regions. There are regions responsible for vision, hearing, touch, and language. There are regions that are not as easily labeled that are responsible for high-level thought and planning. The regions are connected to each other with bundles of nerve fibers. Some of the connections between the regions are hierarchical, suggesting that information flows from region to region in an orderly fashion like a flowchart. But there are other connections between the regions that seem to have little order, suggesting that information goes all over at once. All regions, no matter what function they perform, look similar in detail to all other regions. (Hawkins, J. 2021. p.32)

Within the neocortex, there exists a mechanism similar to that of the older brain, involving the utilization of displacement cells and grid cells to construct various reference frames and models. Currently, the process of constructing reference frames can be intuitively observed through functional magnetic resonance imaging (fMRI) technology. Hawkins introduced the relevant work of Alexandra Constantinescu, Jill O'Reilly, and Timothy Behrens. Firstly, the subjects were presented with images of birds. These birds varied in terms of neck length and leg length. Subsequently, the subjects were instructed to engage in various mental imagery tasks related to the birds, such as envisioning a new bird that combined features of two previously observed birds. Not only did the experiments show that grid cells are present in frontal areas of the neocortex, but the researchers found evidence that the neocortex stored the bird images in a maplike reference frame —one dimension represented neck length and another represented leg length. The research team further showed that when the subjects thought about birds, they were mentally “moving” through the map of birds in the same way you can mentally move through the map of your house. Again, the details of this experiment are complex, but the fMRI data suggest that this part of the neocortex used grid-cell-like neurons to learn about birds. The subjects who participated in this experiment had no notion that this was happening, but the imaging data were clear. Hawkins further points out that “Reference frames in the old brain learn maps of environments. Reference frames in what columns of the neocortex learn maps of physical objects. Reference frames in the where columns of the neocortex learn maps of the space around our body. And, finally, reference frames in the non-sensory columns of the neocortex learn maps of concepts.” (Hawkins, J. 2021. p.92)

To some extent, Hawkins' proposed theory of intelligence explains that many of our human concepts are inherently rooted in the cerebral cortex, encompassing both the old and new brain, which constructs numerous reference frames. The richness of these reference frames allows us to generate numerous predictions, thereby obtaining more information, and

further complexifying the reference frames themselves. In the brain, these "maps" are distributed across neural networks. Knowledge is not confined to a single location, nor is it stored in a holographic manner where all information exists in any given location. Instead, it is distributed across thousands of cortical columns. As a result, even if thousands of cortical columns are damaged, the brain can continue to function normally.

5. A Thousand-Brains View of Zen Meditation

Building upon the theory of Thousand Brains Intelligence, this paper offers an alternative interpretation of Zen meditation practice, suggesting that Zen meditation itself is founded on a complex intellectual basis and mechanism. The source of this complex intellectual foundation and mechanism is none other than the new cortex itself. According to Hawkins' argument, we can ascertain that the neocortex is the product of later-stage evolution in mammalian brains. It is precisely because of the existence of this intellectual premise that humans can undertake the construction of Buddhist world models and conduct the Zen practice. In other words, the beginning of Zen meditation might seem unattainable without this complex intellectual foundation.

While Hawkins' Thousand Brains Theory does not specifically analyze religion, he demonstrates a keen interest in employing the reference frames theory to construct analyses of subjects such as mathematics, politics, and language. Based on his analyses of these domains, we can reasonably speculate that religion, including Zen Buddhism, is likewise a product of cortical column activity and reference frame construction. Similarly, building upon the theory of reference frames constructed by cortical columns, the Zen meditation can be perceived as a process of reconstructing or linking relevant reference frames.

When viewed from a historical perspective, whether meditators adhere to the Tathagata Zen tradition or the Patriarchal Zen tradition, they inevitably possess a preconceived cognitive framework encompassing their prior conceptions of life, the natural world, and the realm of concepts. Undoubtedly, through the study of pertinent scriptures, meditators may undergo a partial transformation of their preexisting holistic cognitive framework, rendering it more internally coherent and unified. However, whether these were preexisting notions, concepts acquired through subsequent scripture exposure, or guidance from Zen masters, they can be fundamentally construed as products of cortical column model construction within the neocortex. In contrast, Zen meditation represents the culminating stage of integration, capable of amalgamating a multitude of concepts and elements. Significantly, this process is also a consequence of grid cell and place cell activities within the reference frames. During meditation, practitioners not only gain insight into critical nodes and ultimate objectives within the integrated model but also attain the realization of more intricate neural circuits. This, indeed, constitutes the fundamental essence of realization and transcendence for practitioners.

It is worth noting that Zen meditation fundamentally transforms the models held by practitioners regarding the world, life, and society. This new model achieves extensive connectivity among various elements while also eliminating many incompatible aspects. For instance, classical learning in the Tathagata Zen tradition not only helps Zen practitioners grasp the essence of Zen but also imparts a coherent and unified Buddhist worldview and methodology. It's important to

recognize that practitioners themselves come with pre-existing concepts and behavioral guidelines. While the Patriarchal Zen tradition doesn't emphasize acquiring a complete system like the Tathagata Zen, instead imparting scattered assertions to practitioners, we must acknowledge that not all of these assertions are necessarily consistent. In other words, this necessitates practitioners to make corresponding adjustments in Zen meditation, i.e., to integrate and unify the model and eliminate unsuitable details.

Furthermore, belief reconstruction is another crucial aspect of this unified model construction. As mentioned earlier, Zen meditation, in addition to facilitating model integration, also involves certain novel constructions. One significant function of these constructions is belief reconstruction. It's important to note that the unified model can be purely rational and devoid of entwined beliefs. In Zen meditation, practitioners internalize the beliefs of certain important doctrines or tenets. In doing so, they discard their previous worldviews and methodologies, adopting an entirely new set of concepts. From the perspective of the reference frames theory, this undoubtedly entails a series of profound and intricate transformative processes.

With the establishment of this new model, the entire cognitive process of practitioners undergoes corresponding changes. When information enters the brain, the previously held information processing models become obsolete. It is worth noting that the models or model-like structures held by practitioners initially exhibit significant diversity. For instance, natural cognition serves as a fundamental model framework, while Zen practitioners may acquire alternative frameworks from classical texts. In contrast, the fragmented guidance from Zen masters can be regarded as the architecture of certain model-like structures. Consequently, individuals are presented with numerous, and at times conflicting, behavioral options before specific actions. This may, to a certain extent, lead to anxiety or distress among practitioners. However, all of these effects are irrevocably replaced by the new model. As information is integrated into the new model, individuals gain access to more appropriate courses of action. Moreover, regardless of the behavioral references obtained, individuals' beliefs are further strengthened with the generation of these outcomes. In other words, this new model enables individuals to become more composed and proactive when accepting and processing new information. Using Hawkins' theory, the introduction of new information further delineates or reinforces certain connections within the unified reference frames.

6. Zen Meditation in the Context of the Cerebral Reward System

Within the context of Zen meditation, new neural circuits are established alongside the construction and integration of mental models. These circuits, in addition to conventional information processing, also influence the internal experiences of practitioners. In Zen practice, apart from addressing koans, a gateway for practitioners is to focus on their breath. As attention remains steadfast on steady breathing, daily thoughts gradually recede. During this phase, practitioners are no longer troubled by the comings and goings of daily thoughts, referred to as "guests," but rather, they coexist with the ever-present "host," observing the movements of these thoughts. Following the dissolution of this state, practitioners experience a sense of bliss. This bliss corresponds to the tranquility and Dharma joy encountered by practitioners during meditation. As previously discussed, meditation can be understood as the process of constructing, expanding, and integrating models within the cortical columns. To elucidate the notion of Dharma joy, it is essential to provide an

explanation based on the cerebral reward system.

To elucidate the concept of Dharma joy, Sharp (2014) primarily draws from the teachings of the esteemed Tibetan Buddhist master Yeshe (1998). According to the assertions of Nan Huai-Chin, a respected figure in the field of Buddhist practice, Zen and Tantra share commonalities in their inner experiences, both serving as pathways to enlightenment. In his view, "While Zen and Tantra may appear to follow different philosophical paths in their meditation practices, they undoubtedly induce similar physiological phenomena" (, 2006). Consequently, the meditative practices within Tantra can be considered, to some extent, as alternative versions of Zen meditation. Yeshe(1998), in his teachings on Tummo or inner Fire mentioned:

> *Notably, Tummo emphasizes the naval chakra, positioned approximately four finger-widths below the navel. During Tummo meditation, practitioners draw energy into this region while inhaling, simultaneously envisioning that this action generates intense heat at the chakra. Upon exhaling, it is believed that the heated energy ascends through the central channel, growing stronger with each repeated exhalation until it reaches the crown chakra situated in the head. As the practice unfolds, it actually results in a significant increase in body temperature (see Benson et al., 1982). This elevated temperature grants the practitioner an extraordinary ability to withstand extremely cold conditions (David-Neel, 1932). (Sharp, 2014)*

With the Tummo begins, the bliss will rise into the body's central and through the higher chakras, which are said to contribute developing the experience of bliss. Upon reaching the crown chakra, intense bliss is said to be fully energized and to flow back down through the central channel and throughout the body. Interestingly, certain of these blissful experiences involve a clear and acknowledged overlap with bodily regions and sensations that are related to sexual pleasure. To be specific, the naval chakra corresponds to the location of the reproductive organs, while the crown chakra is approximately situated in the region of the nucleus accumbens. This overlap unmistakably suggests that the Tummo meditation triggers biochemical responses within nucleus accumbens, akin to those commonly experienced during sexual pleasure.

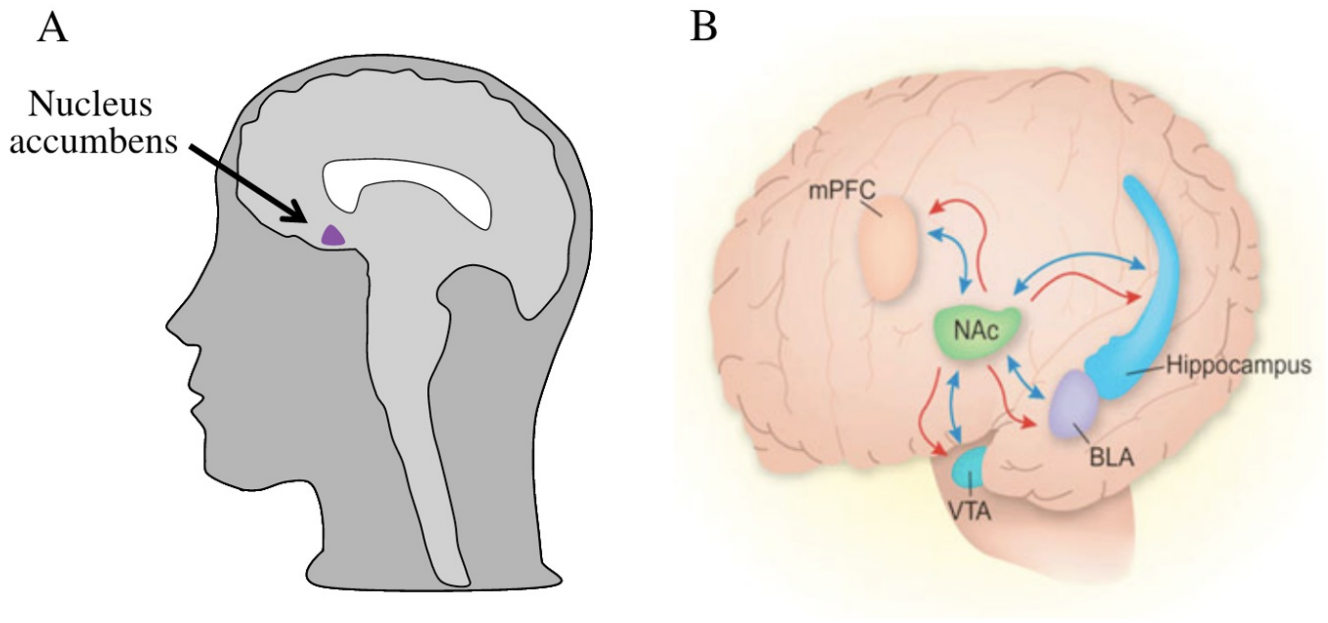

Figure 1.

Note: The nucleus accumbens is thought to be a major center for the generation of positive hedonic (pleasure) states. (A) Here is shown a mid-sagital view. (B) Here is an additional view, which also indicates some of the accumbens' connections with other brain regions. As described in the text, the location of the accumbens seems to correspond well with at least some descriptions of the location of the crown (bliss) chakra within the Tantric tradition. Reprinted by permission from Macmillan Publishers Ltd: Nature Neuroscience, Schoenbaum, Stalnaker, & Shaham, 2007.

In a study conducted by Kjaer et al. (2002) on dopamine levels during meditation, it was observed that experienced meditators experienced a significant increase of approximately 65% in dopamine levels in the nucleus accumbens during deep meditation states. With consistent practice, the ability to induce states of happiness through meditation tends to improve over time, making long-term and dedicated practitioners more proficient in eliciting dopamine release. Also, Kjaer et al. (2002) found in individuals who engage in long-term meditation practices, dopamine release remains intact or even elevated after meditation sessions.

In Sharp's view (2014), meditative practices, including Zen meditation, appear to induce states of bliss, which can be attributed, at least in part, to the release of conditioned dopamine suppression commonly associated with daily life. Within the context of daily life, the inclination towards repetitive and compulsive thought patterns, such as daydreams, fantasies, and obsessions, might represent an internal form of reward. These patterns exhibit addictive characteristics and could be subject to the same mechanisms that govern behaviorally exhibited addictions (see Rescorla & Wagner, 1972; Hazy, Frank, & O'Reilly, 2010). Generally speaking, these thought patterns may lead to the down-regulation of dopamine release into the nucleus accumbens, thereby perpetuating a continued state of relative dysphoria. However, the state of Zen meditation can disrupt this typical brain activity, rendering the conventional dopamine secretion inhibition ineffective.

More specifically, Sharp (2011) mentions Buddhist meditation practices serve to break up the ongoing activity in these cortical attractor networks. During this phase, the brain enters a state where most, if not all, structured attractor-based

activities cease, leading to unstructured and random activity across a significant portion of the cortex (as shown in Figure 2). Since these random patterns would be entirely novel, they would be nameless (i.e., not attached to any conditioned assemblies in language-coding networks) and imageless (i.e., not corresponding to any worn-in visual system assemblies). Electroencephalogram (EEG) recordings from adept practitioners of Buddhist meditation also reveal extreme levels of cortical synchronization during meditative absorption (e.g., Austin, 2006; Cahn & Polich, 2006; Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004). This implies that meditation can result in a state of consciousness characterized by a tranquil mind, where typical thoughts, including those previously mentioned as habitual and addictive in daily life, no longer manifest. From the perspective of traditional Zen Buddhism, the meditator, in this case, has transcended the desire realm and the form realm, entering into the four meditative states of the formless realm, which include the states of boundless space, boundless consciousness, nothingness, and neither perception nor non-perception ( ). (, 2018)

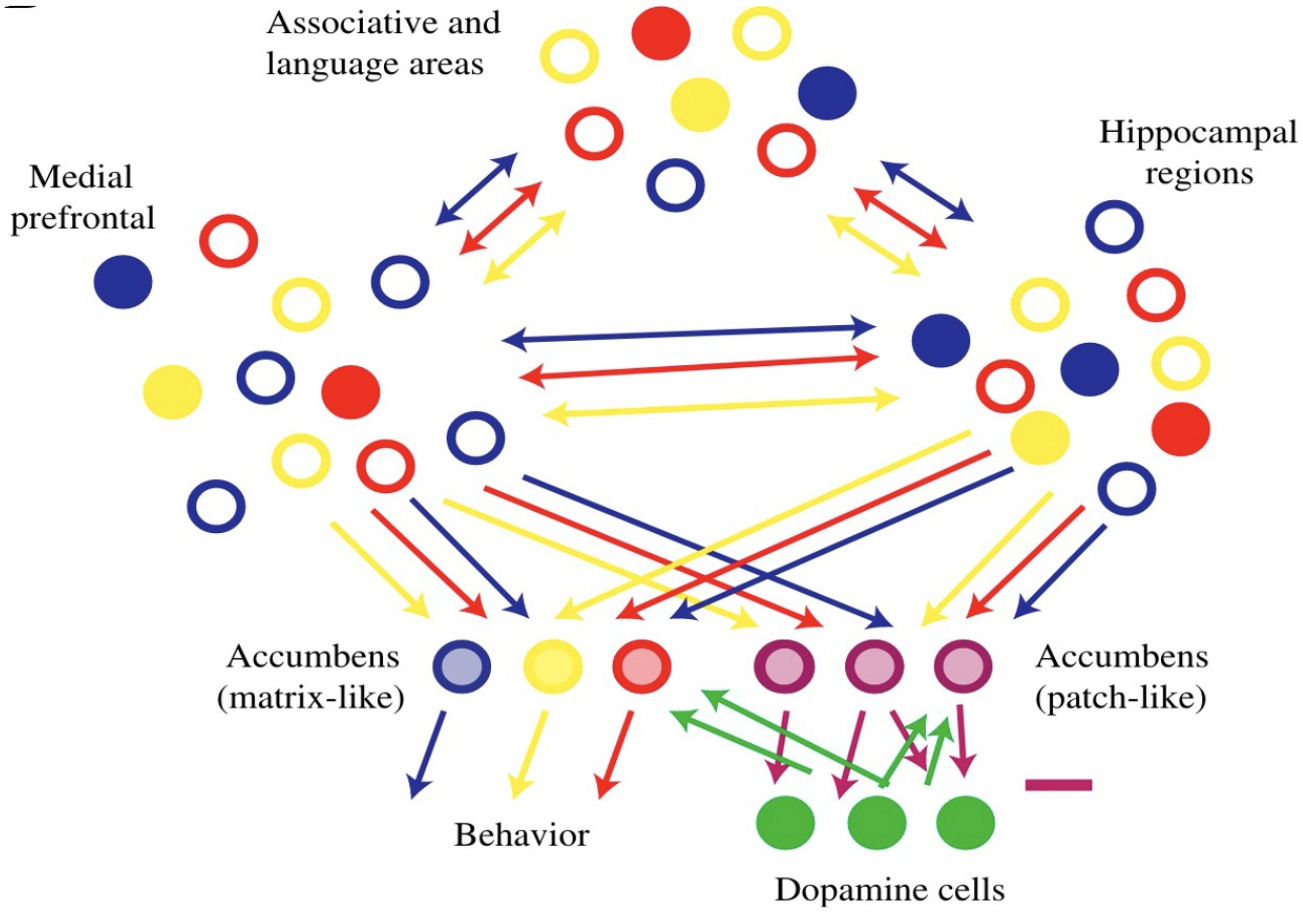

Figure 2.

Note: Here, attractor-based activity has been broken up, so that even though there is still random neural activity (from randomly selected cells in all three attractor networks), no one attractor is dominant. It is suggested that this state may be induced through meditation, and may correspond to the meditative state in which there are no identifiable thoughts, even though there remains the ‘‘clear light of consciousness.’’

In other words, through meditation, including Zen meditation, the disintegration of cortical attractor networks in the brain prevents the formation of extensive and routine attractor activities typical of everyday states. Noticeably, it is the activity of habitual attractors that enables addictive behaviors to occur, subsequently suppressing dopamine release. As dopamine suppression diminishes, dopamine levels within the nucleus accumbens gradually increase, effectively eliminating dopamine inhibition. Supporting evidence for this hypothesis can be found in a recent functional magnetic resonance imaging (fMRI) study of brain activity in experienced meditation practitioners (Brewer et al., 2011).

7. The Cognitive Implications Behind the Mechanism of Zen Meditation

Based on the explanations derived from the Thousand Brains Theory and the cerebral reward system, this paper significantly advances the scientific understanding of Zen meditation practice. Given the pronounced cognitive significance within Zen Buddhism, we aim to provide a cognitive perspective by analyzing and evaluating its cognitive foundations, principles, functions, meanings, and effects.

Firstly, the analysis presented in this section offers an evolutionary framework to comprehend Zen Buddhist theories. Notably, it sheds light on the cognitive underpinnings and essence of Zen meditation. Zen Buddhist theories have historically evolved from past religious and cultural concepts, natural cognition, philosophical contemplation, and inspirations from meditation. According to the Reference Frame Theory, all these theories are rooted in the repetitive construction of location cells and grid cells within the neocortex. The existence of these cognitive faculties largely results from human evolution building upon the foundation of the ancient brain. In other words, the intricate fabric of Buddhist theories originates from human intelligence shaped by evolution.

Secondly, this analysis enhances our understanding of the transcendental claims made by Zen Buddhism. From a Buddhist perspective, Zen meditation has conventionally been perceived as a pathway to transcendence. This perception primarily stemmed from the absence of reliable scientific methodologies in earlier times, compelling practitioners to explain meditation experiences through mysticism and religious philosophy. In Zen Buddhism, there is a classic saying, "The three realms are only mind; all phenomena are only consciousness." From a cognitive philosophy standpoint, individual experiences involve sensory integration and information processing conducted through mental constructs. While Buddhist assertions may appear harmonious with cognitive philosophy, emphasizing the central role of the mind in construction, cognitive philosophy does not negate the ability to objectively model the external world based on scientific evidence. Simultaneously, with regards to subjective experiences, they can be objectively validated and assessed from multiple angles. In other words, science does not negate the objectivity of both the external and internal worlds, even when the mind is acknowledged as the core constructor.

However, Zen Buddhism veers towards the extreme of idealism, as seen through the lens of the Reference Frame Theory. Individual thoughts are essentially activities within the modeling of the neocortex or activities within internal models. Therefore, Zen Buddhism's claims of transcendence do not rest on objective or factual foundations but rather on subjective, internal redefinition of reference frames. For instance, if an individual in meditation still perceives themselves

as operating within the realm of the mind or experiences within a reference frame, Zen Buddhism maintains that they have not yet transcended the realms of desire and form. Progressively, when the habitual attractor network activity within the cerebral cortex exhibits characteristics of structurelessness and randomness, Zen meditation is believed to have reached the realm without form because at this point, the practitioner can no longer achieve structured and ordered thoughts.

Consequently, it can be reasonably asserted that Zen Buddhism may not fully achieve the cognitive functions it professes. Furthermore, regarding the dopamine release induced by Zen meditation, Zen Buddhism historically regarded it as a natural occurrence during the practice, rather than considering it as the ultimate goal. It is evident that the real manifestation of transcendence is the reconstruction of beliefs. However, the processes by which practitioners reshape their beliefs during Zen meditation are complex, necessitating additional scientific research and interpretation in the future.

Furthermore, the analysis in this section underscores that Zen meditation is essentially a set of skills enveloped by Buddhist concepts. For instance, the Zen tradition claims that sentient beings typically undergo eight forms of suffering, including the suffering of birth, aging, illness, and death, encountering undesired suffering, losing desired suffering, and being unable to obtain what they desire, in addition to the suffering associated with the five aggregates. These claims appear to be more rooted in natural cognition and simple experiences rather than religious dogma. In conjunction with the previous explanations regarding addictive behaviors, it is evident that most of this suffering results from the consequences of addictive activities, and Zen meditation effectively offers a means to suppress these behaviors and trigger increased dopamine secretion. Consequently, Zen meditation is far from being mere superstition and powerless discourse.

It can be affirmed that Zen practitioners may not fulfill their envisioned objectives, such as becoming Buddhas possessing boundless supernatural powers, similar to how ancient Chinese alchemists were unable to produce elixirs for immortality or ascension to the status of immortals. However, just as alchemists' efforts contributed to the accumulation of valuable experience for the advancement of chemistry, Zen meditation brings about highly positive experiences and influences by reducing stress, alleviating suffering, and fostering inner joy.

As mentioned earlier, Zen meditation essentially achieves the replacement and restructuring of cognitive systems. This new system can deconstruct and digest all incoming information, whether from internal or external sources, ensuring that practitioners maintain a considerable degree of tranquility and joy. Moreover, continuous meditation experiences enhance the efficiency and stability of this cognitive system. Given the successful interaction between the cognitive system and inner experiences by practitioners, Zen meditation appears more as an ancient pre-scientific art of achieving feelings of joy, rather than a religious activity.

8. Conclusion

In this paper, we conducted an analysis of Zen meditation using the Thousand Brains Theory and the cerebral reward system. We delved into the scientific implications of Zen Buddhism and Zen meditation from a cognitive perspective. Our research findings indicate that Zen meditation is both an intelligent activity rooted in evolution and an effective means of attaining a sense of happiness. Simultaneously, we have gained a more precise and profound understanding of the

transcendental claims made by Zen Buddhism. We believe that this study offers an effective and distinctive approach to advancing an objective understanding of religious phenomena and cultural traditions. Zen meditation is an activity and art wrapped in the attire of religion and philosophical interpretation. Therefore, we also urge that, based on the proper distinction between Buddhist concepts and scientific theories, there should be more valuable scientific research and philosophical analysis in the future.

References

- . (2015). . . pp: 344-381.
- , ( ). (2014). (2). . . p.315.
- , . (2010a). . . p.219.
- , . (2010b). . . p.121.
- , . (2010c). · . . p.33.
- . (2002). . .
- . (2006). . . pp: 135-138.
- , (2018). . . p165.
- . (2009). . .
- Austin, H. (2006). ***Zen-brain reflections***. Cambridge, MA: The MIT Press.
- Benson, H., Lehman J.W., Malhotra, M.S., Goldman R.F., Hopkins, J., & Epstein, M.D. (1982).***Body temperature***.
- Brewer, J.A., Worhunsky, P.D., Gray, J.R., Tang, Y.Y., Weber, J., & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. ***Proceedings of the National Academy of Sciences of the USA***, 108, 2025420259. doi:10.1073/ pnas.1112029108
- Cahn, B.R., & Polich, J. (2006). Meditation states and traits: EEG, ERP, and neuroimaging studies.***Psychological Bulletin***, 132, 180211. doi:10.1037/0033-2909.132.2.180
- David-Neel, A. (1932). ***Magic and mystery in Tibet*** New York: Dover Publications.
- Hazy, T.E., Frank, M.J., & O'Reilly, R.C. (2010). Neural mechanisms of acquired phasic dopamine responses in learning. ***Neuroscience and Biobehavioral Reviews***, 34, 701720. doi:10.1016/j.neubiorev.2009.11.019
- Hawkins, J. (2021). ***A Thousand Brains: A New Theory of Intelligence***(1st ed.).
- Lutz, A., Greischar, L.L., Rawlings, N.B., Ricard, M., & Davidson, R.J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. ***Proceedings of the National Academy of Science,***101, 1636916373. doi:10.1073/pnas.0407401101
- Kjaer, T.W., Bertelsen, C., Piccini, P., Brooks, D.R., Alving, J., & Lou, H.C. (2002). Increased dopamine tone during meditation-induced change of consciousness. ***Cognitive Brain Research***, 13, 255259. doi:10.1016/S0926-6410(01)00106-9
- Rescorla, R.A., & Wagner, A.R. (1972). A theory of Pavlovian conditioning: Variation in the effectiveness of reinforcement and non-reinforcement. In A.H. Black & W.F. Prokasy (Eds.), ***Classical conditioning II: Theory and research*** (pp. 6469). New York: Appleton-Century-Croft.

- Sharp, P.E. (2011). Buddhist enlightenment and the destruction of attractor networks: A neuroscientific speculation on the Buddhist path from everyday consciousness to Buddha-awakening. ***Journal of Consciousness Studies***, 18, 137169.
- Sharp, Patricia E. (2014). “Meditation-Induced Bliss Viewed as Release from Conditioned Neural (Thought) Patterns That Block Reward Signals in the Brain Pleasure Center.” ***Religion, Brain & Behavior***4(3): 202–29.
- Yeshe, L.T. (1998). ***The bliss of inner fire: Heart practices of the six yogas of Naropa***Somerville, MA: Wisdom Publications.