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Crucial Philosophical Implications of Neuroplasticity

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Abstract

This article briefly reviews neuroplasticity's basic terms and mechanisms and then emphasizes three crucial philosophical implications. (1) Considering the relationship of epistemology with the brain, the main organ of human intelligence is now proven to have the capacity to reorganize itself structurally. (2) Neuroplasticity has startled metaphysicians by embodying a mechanism that appears to challenge any strict—non-interactive—interpretations of the controversial term mind-body dualism. (3) Within morality and ethics, many neuroscientific studies performed on Buddhist meditators of Indic meditative traditions have linked positive neuroplasticity with empathy, compassion, and loving-kindness, indicating that these qualities can be developed consciously and suggesting that they may be intrinsic to human beings.

Key Words: neurophilosophy, neuroplasticity, mind-body dualism, evolution, empathy, compassion, loving-kindness

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Introduction

Many scientists consider *neuroplasticity* to be the latest paradigm of neuroscience. While the dominant view in neuroscience for centuries, was that neurons (the cells that constitute the brain and the rest of the nervous system) do not regenerate or form new connections, in recent decades, with the advent of advanced microscopy and neuroimaging techniques, this paradigm has been challenged: neurons regenerate and form new connections (Doidge, 2016).

The discovery of neuroplasticity has fascinated therapists and philosophers, as the nervous system represents the physical substrate of the human mind. For therapists, the most optimistic horizon of neuroplasticity includes the healing of neurological diseases once thought to be incurable (Doidge, 2016). For philosophers, neuroplasticity destabilizes the organic substrate of intelligence and subjectivity.

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This article on *neurophilosophy* outlines a few crucial philosophical implications surrounding the discovery of psychological factors that cause structural neurological changes in humans. The discovery suggests that the mind-body relationship is one of mutual influence. The interaction evokes an age-old metaphysical problem many consider unfathomable: *mind-body dualism*, meaning that mind and body are distinct and separate. Furthermore, structural changes affirm that the main organ of human intelligence, the brain, is not immutable.

Another implication emphasized relates to the anecdotal coincidence of psychological factors such as *empathy*, *compassion*, and *loving-kindness* with the healthy functioning of the human organism. This coincidence is often taken to mean that these feelings are essential to human beings. The study of neuroplasticity can provide compelling evidence by confirming the existence of structural neurological changes caused by practices—such as meditation—imbued with these factors. A significant positive neurological change would indicate that the expression of the aforementioned feelings can be enhanced and suggest that they may be essential to human beings.

Neuroplasticity: *Origin and Meaning of the Term*

The word nerve traditionally refers to the white fibers that constitute the nervous, or neural system, distributed throughout the body; the neuron is the fundamental cell of this system. Synapses are the physical contacts between neurons that transmit a microelectrical impulse and have often been, along with neurons, the basic units for the study of neuroplasticity. Even though the functioning of the nervous system is currently considered by many to be holistic (Doidge, 2016), many crucial discoveries in neuroscience have arisen from studies at cellular and synaptic levels.

The Nobel Prize in medicine and physiology in 2000 was shared by the American neurologist Eric Kandel, who demonstrated that learning in the mollusk *Aplysia* causes neurons to form new and enduring synaptic connections. Many other studies have proven the occurrence of changes in the branching and synaptic connectivity of existing neurons, along with the more exceptional genesis—and death—of neurons (Doidge, 2016). Therefore, the plastic capacity of the nervous system, or neuroplasticity, was proven without any doubts. The diversity of its mechanisms and locations of organismal activity have given the term myriad meanings (Keshavan *et al.*, 2015).

Neuroplasticity encompasses minimal structural changes at synaptic levels to general reorganizations of the nervous system and the surrounding cells that affect it. Specifically applied to the human brain, one definition relates neuroplasticity to the brain's ability to change its own structure and functioning in response to mental activity or experience (Doidge, 2016).

Positive and Negative Neuroplasticity

Positive neuroplasticity evokes optimistic potentials for connectivity and development, often associated with learning. A saying stating that neurons that fire together wire together (Keshavan *et al.*, 2015) has been circulated as the most common description of positive neuroplasticity, pointing to a use-dependent process discovered by the father of neuropsychology, Donald Hebb (1904-1985), at synaptic levels. Regarding negative neuroplasticity, or dysplasticity, specialists will add a generally pessimistic saying stating that neurons that do not fire together do not wire together. It is important and necessary to clarify, because of the length limitations of this synopsis, that the use-dependent mechanism defined at synaptic levels is one among many and that neuroplasticity does not always involve synapses (Keshavan *et al.*, 2015). The use-dependent mechanism is critical in conscious long-term plans to direct neuroplasticity.

The most impressive manifestation of large-scale positive neuroplasticity occurs in the connectionist networks of the human brain. Science maintained for centuries that the attributes of the brain would be too complex for it to repair itself or restore lost functions. However, many studies suggest that the brain's sophistication includes these very attributes (Doidge, 2016). A wide variety of neuroplastic healing methods have appeared in clinical practices. These methods generally depend on informed, disciplined practices sustained over many years (Doidge, 2016). From the latter, it is inferred that the effectiveness of the neuroplastic mechanism must be extremely delicate and of minimal magnitudes within any given time. Neuroplasticity is statistically more prevalent and effective during development, childhood, and youth, but given the right conditions, it can occur in adults of all ages (Doidge, 2016).

The lesser-known negative neuroplasticity can signify unhealthy neurodegeneration in the form of dysplasticity (Keshavan *et al.*, 2015). The human brain is particularly susceptible to change for the worse under adverse circumstances, so negative neuroplasticity could just be more common than positive neuroplasticity (Loizzo *et al.*, 2017), a fact that should have implications for public health.

Functional and Structural Neuroplasticity

Structural neuroplasticity refers to changes in the physical structure of the nervous system, composed of neurons, their connections, and other surrounding cells. Functional neuroplasticity refers to the nervous system's ability to reorganize or modify functions without underlying enduring organic changes.

Neuroplasticity can interfere with the functional-structural dichotomy, blurring the line between these two categories once considered by some scientists as separate. The challenge to the

functional-structural dichotomy is one of the foundations of the paradigm shift announced by neuroplasticity.

Buddhist Meditative Practice

Discoveries about neuroplasticity in human subjects include a particularly significant number of publications on Buddhist meditative practices. One reason for this interest is that Buddhism is an ancient belief system often open to dialogue with science. The religious aspects of Buddhism include the abundant mystical concepts typical of ancient spiritual traditions, but its philosophy is generally open to empirical evidence. Moreover, the fact that the main ambition of Buddhist psychology is not to understand the human mind but to transform it has always fascinated neuroscientists (Vollmer, 2010).

Crucial Philosophical Implications

I. The Mutable Brain: *The Normality of the Intelligent Brain*

Epistemology is the branch of philosophy that delves into the roots of how knowledge is acquired, how we justify our beliefs and regard them as truths. Studies related to neuroscience are very rare within the vast literature encompassing epistemology.

A fundamental reflection on neuroplasticity and epistemology should revolve around the fact that if the brain is mutable, the objectivity and universality demanded by science could be compromised. However, along the arch of the brain's development, a normal structure may just exist that would furnish optimal theorizations. Within the paradigm of brain plasticity, it would make sense to consider the mind's optimal perception of the external world as something to be cultivated as much as possible. Ultimately, arguably, this may even be its most reliable mindset.

A hopeful perspective may consider the increased potential for learning furnished by changing and growing mindsets. To highlight the importance of neuroplasticity in education, Gholami *et al.* (2022) interviewed teachers to examine the correlation of pedagogical sophistication with their knowledge of neuroplasticity. Their data corroborated the hypotheses proposed, including that teachers' knowledge of neuroplasticity reduces naïve epistemological beliefs—including that brain structure is immutable—decreases fixed mindsets, and fosters growth mindsets (Gholami *et al.*, 2022). Moreover, the teachers' mindsets mediate the negative relationship between knowledge of neuroplasticity and fixed epistemological belief systems (Gholami *et al.*, 2022).

The “normality” of the intelligent brain is challenged by the article by Lutz *et al.* (2004). This article generated great expectations

and has been—occasionally and informally—singled out as one of the most consulted scientific references in history, partly because it suggested that the most sophisticated functions of the human brain appear coincidentally with mental states of unconditional loving-kindness and compassion.

The article documented how some accomplished Tibetan Buddhist meditators generated the highest levels of synchronized gamma waves (the highest frequency generated by the brain) that science has ever recorded from non-pathological contexts (Lutz *et al.*, 2004). Synchronized gamma waves are related to high cognitive processing typical of understanding complex information—they are also associated with states of intense happiness. The effects of a virtuous circle caused by meditation and positive neuroplasticity were inferred because the *basal* level of gamma wave activity was greater in the meditators than in the control group, pointing to a structural brain difference (Lutz *et al.,* 2004).

Basic Physiological Neuroplastic Mechanisms are Similar Across Species

Many crucial findings on neuroplasticity have emerged from countless experiments with relatively simple organisms—such as insects, mollusks, rodents, etc.—and the molecular and cellular mechanisms discovered have many similarities in human cells. Orvis *et al.* (2022) conducted genetic studies on mollusks and octopuses to investigate the *evolution* of the nervous system from molecular and cellular levels. The researchers proposed that the increase in intelligence from mollusk to octopus is more related to an increase in the number and connectivity of neurons than to the molecular complexity residing in synapses (Orvis *et al.*, 2022).

Mishra and Gazzaley (2016) analyzed the validity of parallel neuroscientific studies on experiments with humans and rodents. These studies complement each other conveniently and necessarily since experiments in humans must be non-invasive, whereas they can be invasive in animals. Generally, the microcellular dynamics that generate large-scale neuroplastic structural changes are very similar in humans and rodents, making these studies helpful in developing therapeutic methods (Mishra and Gazzaley, 2016). Therefore, the authors conclude that discoveries in simpler animals can be translated into understanding the human brain.

In a genetic study comparing groups of twins, Brans *et al.* (2010) demonstrated that the human brain changes in size throughout adult life and that this change is related to intelligence. The research proposes a genetic contribution to intelligence and also, remarkably, to the brain's plastic capacity (Brans *et al.,* 2010). Notably, the

researchers detected that the thickened areas of the brains that they studied are the same as those detected with plastic properties in many other species of adult mammals (Brans *et al.,* 2010).

The physiological similarities of the human neuroplastic mechanism with that of other species provide particularly significant support to the theory of the natural evolution of human beings. While the theories about the processes driving evolution are controversial, a reflection may spontaneously arise on the debt that human intelligence should have toward the natural world that nourishes it and from which it supposedly emerged.

II. A Challenge to Strict Interpretation of Mind-Body Dualism

Mind-Body Dualism: Overview

The exact meaning of the word mind, and therefore of mind-body dualism, continues to elude philosophy and psychology. The relationship between the mind and body has been a central problem of philosophy. This topic is expounded in a vast literature with many controversial theories, some of which incline toward mysticism.

For several centuries, the dominant paradigm regarding the mind-body relationship has been the dualism of the French philosopher René Descartes (1596-1650). His famous "I think, therefore I am" separated the mind from its physical substrate, the body, into two distinct substances. While Descartes had his own hypotheses about mind-body interaction, he is mainly remembered for his substantial separation. Cartesian dualism is part of the theological and spiritualistic descriptions of a disembodied mind that are fundamental in most religions.

Physicalism, or reductive materialism, is a monism through which every mental phenomenon can be located and explained physically or neurologically. Its opposite is the ineffable mental monism, according to which every physical phenomenon should have a mental correlation and explanation. Many theories have been published, intertwining and refining these two opposite views. Physicalism is prevalent in modern science, freeing psychiatry and neurology from contact with mysticism.

Can the meaning of the word mind be irrevocably separated from its Cartesian mystical connotations? For many philosophers, if the mind is understood as something distinct from the body, its definition may veer toward theology and spirituality. Arguably, mind-body dualism will, therefore, always continue to be elusive.

The importance of materialism among contemporary neurophilosophists is reflected in the prevalent dichotomy of the mind-body relationship between reductive and non-reductive materialism (Tarlaci, 2023). The reductive standpoint held by Patricia Churchland emphasizes the importance of understanding the neural basis of

mental phenomena and considers the brain's physical matter as the substance of the mind (Tarlaci, 2023). The non-reductive materialism put forth by Georg Northoff recognizes the importance of the physical aspect of the mind. However, it posits it to be heavily influenced by cognitive functions and subjective experience, giving much importance to phenomenological evidence (Tarlaci, 2023). Since neuroplasticity often furnishes proof that the brain is influenced by cognition and the subjective interpretation of external events, it tilts this dichotomy toward non-reductive materialism.

An Attempt to Refute Physicalism

A purely volitional action can be defined as one whose beginning is free from any external stimulus. Cucu (2022) delved into the neurophysiological origins of bodily volitional actions, reaching their molecular levels, with the plan to refute physicalism on its own territory: the physics of neuronal physiology. The researcher assumed that volitional actions begin in the brain's basal ganglia and continued investigating the causal chain's hypothetical origin (Cucu, 2022). The causal origin should be found in an increase in the frequency of the action potentials from a basal state, activated without any external stimulus, of one or perhaps a few primordial neurons somewhere in the basal ganglia (Cucu, 2022). Cucu withstands the objection that the increase in frequency could be caused by the ebb and flow of the brain, arguing that a primordial increase should be found somewhere anyway (Cucu, 2022).

Cucu's (2022) study is purely theoretical and dedicated exclusively to refuting physicalism. According to Cucu, at the moment a “solitary” primordial neuron starts increasing the frequency of its action potentials to hypothetically initiate a volitional action, neurophysiology finds no physical or biochemical cause for the process, so it becomes necessary to postulate a non-physical cause. This research proposes a substantial but interactive mind-body duality, postulating the hypothesis of an immaterial mind that acts delicately on physical molecules (Cucu, 2022).

While the possible influence of an immaterial mind on the physical molecules involved in volitional actions already evokes a paradoxical mystery, the far-fetched opposite interaction is almost inconceivable. In any case, a dilemma that invites theological mysticism is detected here: Is there a primordial cause in this interaction that deserves capitalization? Some monotheistic theologians, detecting here what is perhaps the fundamental question of metaphysics, would be satisfied if the word to be capitalized were Mind. (On a fleeting note, Cucu [2022] mentions that the causal mind he refers to could be called God.)

The Mind as Psychological Activity

Generally speaking, the mind encompasses cognitive activities such as consciousness, perception, thinking, memory, and imagination. For modern psychologists, events considered to be mental do not have strict psychophysical laws and are expressed openly as desires, beliefs, intentions, or memories that can determine non-instinctive actions (García de Frutos, 2011). In any event, the portion of our psychological activity that is truly independent of the body should correspond to the distinct mental realm.

According to the social psychologist Kolstad (2012, p.691), "A scientific psychology cannot ignore that human consciousness exists. Humans' higher psychological functions, their language and thinking, have to be the core of human psychology. The psychological functions cannot be dissolved into biological, neurological processes."

Can a conscious, intentional decision to direct brain function be defined as mental? Is the decision to engage in practices that cause healthy neuroplasticity by studying recommended psychological factors, of a mental origin? These factors arise from wisdom documented and offered to each individual by external agents: Doesn't this tilt the balance toward a mental foundation of this intentional psychological process?

Consciousness as a Promoter of Neuroplasticity

According to Askenazy and Lehmann (2013), the distinctive features of human consciousness are subjectivity, intentionality, self-awareness, and will. In a theoretical study about consciousness, brain, and neuroplasticity, the researchers infer that the initiation of conscious mental processes in the cerebral cortex should activate the lower parts of the brain, favoring neuroplasticity in a top-down way (Askenazy and Lehman, 2013). Interestingly, the investigators point out that neuroplasticity is absent during brain death and coma and propose that it occurs during dreaming (Askenazy and Lehman, 2013).

Askenazy and Lehman (2013) propose that consciousness emerges from the physical brain but consider it a higher, more sophisticated phenomenon involving large-scale neural integration. A paradox of consciousness is that while there are no scientific explanations about the exact localization of subjectivity and consciousness based on brain structures and functions, there is clear evidence of a correlation and even causality between them (Askenazy and Lehman, 2013).

Similarly, Kolstad (2020) places consciousness as the embodiment of humanity's higher psychological functions and, therefore, on a higher pedestal than bodily functions. Kolstad opines that consciousness sets humanity apart from the species that respond blindly to external stimuli. The investigator proposes that consciousness directs positive neuroplasticity by stimulating neural

growth within a dialectical relationship between biology and human culture, restructuring the brain (Kolstad, 2020).

The Buddhist Perspective: Interdependent Origination

In the detailed thesis by Vollmer (2010), Buddhism is described as a transformative path that aligns perfectly with the discovery of neuroplasticity. Vollmer elaborates extensively on the implications of the mind-to-brain (top-down) causality, where plasticity originates in cognitive activity, documented in Buddhist meditators. In her presentation, Buddhism proposes a middle way between an exclusively physical mind and mind-body dualism: the mind and its organic substrate are distinct but dialectically related within a bidirectional causality (Vollmer, 2010). In other words, the mental cannot be reduced to the material but depends on it to function…and vice versa from the material. The researcher criticizes dualism, relying on the classic position that if the mind and body were entirely different, they could not influence each other: “Mind and body are distinct, but not wholly separate, related, but not equivalent” (Vollmer, 2010, p. 34).

The middle way described by Vollmer (2010) is endorsed by Lin (2013), who defines the mind-body relationship within Buddhism as one of non-duality and non-identity. The Buddhist perspective is peculiar by emphatically asserting that our definitions of mind and body are practical conventions and not ultimate realities (Lin, 2013; Vollmer, 2010): after all, in Buddhist philosophy, nothing exists outside a causal relationship, and all things are empty of inherent existence.

For Vollmer (2010), subjectivity is the primordial aspect of the mind that, poignantly, separates it from the physical, objective world. Therefore, the mind could not be objectively investigated, and its study may not be able to dispense with the meditator's first-person perspective. The lucid subjective awareness of each meditator would ineffably contemplate the interdependent origination between what is conventionally considered mental and its neural correlates (Vollmer, 2010). Moreover, Lin (2013) stresses that the ultimate reality of the mind cannot be separated from the ethical and axiological concepts leading to Buddhist Nirvana, or spiritual salvation.

Furthermore, Vollmer (2010) theorizes that Buddhist karma—the intentional actions of the body and mind—may positively and negatively modify brain structure through neuroplasticity. The Buddhist meditator would thus generate an enactive conscience, where mental phenomena are a significant cause for the enduring accumulation of positive and negative karma. Obviously, mind-body causality appears here underpinned by ethics.

Neuroplasticity and Free Will

According to Kormas *et al.* (2022), free will and consciousness are intertwined within time: without free will, consciousness would have no purpose in the succeeding moment. Neuroplasticity cannot be equated with free will, as it is based on unintentional physiological processes (García de Frutos, 2011) with a genetic component (Brans *et al.*, 2010). Kormas *et al.* (2022) refer to the recent findings that suggest the unconscious mind is increasingly involved in the very onset of mental activity—thus denying the existence of free will—and then infer that neuroplasticity would also have modified the neurological substrate of the unconscious.

However, free will could nourish neuroplasticity itself and thus embody the beginning of a genuinely indeterministic path applied to human decisions. The neurophilosopher Muñoz (2013), after explaining the many weighty philosophical opinions that limit or even refute the existence of free will, concludes that the neuroplasticity paradigm will have its weight in supporting the proponents of free will. The possibility of escaping a deterministic physical law evokes studies—especially in meditators—showing that humans can direct neuroplasticity volitionally. In this way, some individuals may be able to overcome their biological pulsions through a lucid and deliberate choice with an origin that may be defined as mental.

III. The Human Organism Contains Fertile Soil for Positive Emotions

The Place Where One Dwells

Ethics studies human behavior, reflecting on the good and the bad, virtue, happiness, and duty. It has been said that ethics lies in the philosophical examination of existing moral values. An ancient etymology associates the word ethics with “the place where one dwells,” although more accepted etymologies revolve around “custom” or “character.”

Considering the new paradigm in which psychology and neurology are not entirely separated, the existence of a valence—i.e., “positive” or “negative”—of neuroplasticity within the development of mind-body causality may be able to provide evidence of the moral validity of human emotions.

Among interdisciplinary humanists, a fascination should arise as qualities such as empathy, compassion, and loving-kindness may be proven to be developable capacities of the human mind. Neuroscience has discovered that these qualities, widely accepted by humanity as positive, contribute to healthy neuroplasticity across the age spectrum of people of diverse backgrounds (Goleman and Davidson, 2017).

An Empathic System: Mirror Neurons

Mirror neurons are a class of neurons discovered in primates in the 1990s. They are activated when an individual acts and when that same action is observed being performed by another member of the species; thus, they reflect the behavior of others. In humans, they play a significant role in learning in general and in many aspects of social intelligence, such as gestural language, imitation, and emotions like empathy (Acharya and Shukla, 2012). Some have described them as the neurons that formed civilization (Acharya and Shukla, 2012).

Some studies have found that more empathic individuals have stronger connections in mirror neurons related to empathy (Acharya and Shukla, 2012). Trilla *et al.* (2015) documented that the functional neuroplasticity of the brain's mirror neuron system is positively regulated by reward conditioning along with empathy. Through use-dependent neuroplasticity, it is expected that these functional changes may extend to the neural structure.

From Empathy to Compassion and Unconditional Love

Generally speaking, compassion can be understood as active empathy to alleviate suffering, while loving-kindness should also be imbued with happiness. Within specific Indic meditative practices, both are gradually extended to all beings, starting with oneself. The final result should be an unwavering unconditional predisposition for compassion and loving-kindness.

Of course, the validity of extending loving feelings to difficult people is more often than not put into question. Without being hypocritical, unconditional love may be seen as a heroic personal strategy; ultimately, it may be the only way to break free from the affective torments that our enemies cause (Salzberg and Thurman, 2013). Another argument claims that loving feelings may succeed in appeasing difficult people (Salzberg and Thurman, 2013). In addition, strong admonitions on the spiritual pitfalls caused by anger and hatred are common in all spiritual traditions (Salzberg and Thurman, 2013).

Among the thousands of studies published in peer-reviewed journals on the benefits of meditation, the ones that have addressed Buddhist mindfulness[2] are prevalent. However, a significant number have studied compassion and loving-kindness. The following paragraphs synthesize the results of five neuroscientific articles that have linked compassion and loving-kindness with positive neuroplasticity.

[2] In regular practice and its successful clinical applications, mindfulness's main recipe is sustained, voluntary, and equanimous attention to the present moment. Mindfulness, in theory, can be morally neutral. However, meditators consider it a preliminary step to calm and strengthen the mind before developing ethical qualities such as compassion and loving-kindness. Mindfulness is an analogous and important term in the jargon of Yoga, the Hindu practice that stresses meditation.

The article by Lutz *et al.* (2004)—already described above—documented how some accomplished Tibetan Buddhist meditators generated the highest levels of synchronized gamma waves that science has recorded within non-pathological contexts. Meditators generated the records during advanced loving-kindness meditations in the form of non-referential compassion (Lutz *et al.*, 2004). Neurological imprints in the form of traits were inferred because high basal levels of synchronized gamma waves persisted outside meditation *per se* in the meditators (Lutz *et al.*, 2004). Therefore, compassion appeared to be linked to positive neuroplasticity.

Leung *et al.* (2013) found that loving-kindness meditation caused an increase in the volume of gray matter in the hippocampi of long-term meditators. The originality of their findings was underscored by the detection of a more significant increase in specific areas related to cognitive empathy and social cognition (Leung *et al.*, 2013).

Valk (2017) studied the structural plasticity of the brain within social parameters. Notably, the longitudinal investigation involved a group of subjects without meditation experience. The article focused on specific daily training to improve attention (or presence), socio-affective skills (affects), and socio-cognitive skills. In each specific training, an increase in gray matter volume was detected in brain areas that exercise each skill (Valk, 2017). Notably, the volume increase in specific areas was related to increases in individual capacities for attention, compassion, and social intelligence (Valk, 2017). Valk (2017) honestly clarifies that, since human experiments such as these are non-invasive, the neurobiological mechanisms underlying structural changes can only be speculated on (something that applies, of course, to the other articles on meditation mentioned in the present article).

Leung *et al.* (2018) tested groups of subjects with different awareness-based compassion meditation training levels by showing them emotional images. It is known that cortisol, the paradigmatic stress hormone, can create a vicious circle that weakens the hippocampus: the cerebral amygdala secretes the debilitating cortisol, and the hippocampus controls the amygdala (Loizzo *et al.*, 2017). The researchers confirmed that meditation alleviates the negative emotional modulation of the right amygdala, which aligns with the fact that meditators have lower cortisol levels (Goleman and Davidson, 2017). They also inferred structural changes in the right amygdala since the final tests were performed outside meditation training (Leung *et al.*, 2018).

Förster and Kanske (2021) reviewed the effects of compassion in psychotherapy. Their research concluded that compassion increases affective levels toward others and neural activity related to positive emotions. It also culminates in structural changes in related neural areas after long and intensive training (Förster and Kanske, 2021).

Conclusions

The promise of neuroplasticity, as the latest paradigm of neuroscience, lies in its therapeutic applications. In the healing of neurological diseases once deemed hopeless. I have attempted in this article to bring to light and summarize a few crucial philosophical implications.

Considering the relationship of brain structure with epistemology, the plastic brain paradigm increases the influence of subjectivity in human knowledge. In a mutable brain, it would make sense to consider the perfecting of the mind's perception of the external world as its most reliable mindset. Notably, positive neuroplasticity in the most sophisticated parts of the brain has been related in some studies to unconditional loving-kindness and compassion, bringing the welcome news that human intelligence may have particular purposes and responsibilities.

The fact that the human brain shares basic neuroplastic physiological mechanisms with relatively simpler and primitive species lends particularly significant support to the theory of the natural evolution of human beings.

The detection of causality between psychological activity and brain structure through neuroplasticity has brought to light an age-old metaphysical problem: mind-body dualism. While the descriptions of the mind are controversial, the causal relationship suggests that dualism in some form does exist; non-interactive interpretations of mind-body dualism seem to have been refuted clearly by modern neuroscience. Arguably, because sophisticated thinkers can steer the definition of the mind toward theological and spiritual connotations, mind-body dualism will always remain an elusive concept.

With neuroplasticity linking psychology with neurology and considering the optimal development of human beings, the abundant neuroscientific articles on Buddhist contemplatives from Indic meditative traditions have left an important challenge to moral and ethical nihilism. The belief that feelings such as empathy, compassion, and loving-kindness are innate human qualities that can be consciously developed has received a backing from modern neuroscience that is difficult to oppose, due to the quantity and diversity of related articles. The effects and causes of neuroplasticity may have demonstrated that the human organism contains fertile ground for the altruistic emotions cherished by a large part of humanity.

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