



Self, Free Will and Compassion: Shared Constructs in Neuroscience and Buddhism

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The authors, a neuroscientist and a Buddhist monastic who met through the Emory Tibet Science Initiative, highlight similarities in the understanding of mental activities found in both traditions. An important principle discovered is the parallel processing of multiple mental activities, which reveals the existence of a unitary self and free will as illusions. These insights provide the rationale in Buddhism to develop a culture of compassion. Meanwhile western psychology and neuroscience have found brain circuits that have evolved to support social and even altruistic behaviors, giving compassion a physical basis in our brains as well. These insights then set the stage for a shared interest in an altruistic compassionate society.

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INTRODUCTION

The authors (DJ, LG) met each other through the Emory Tibet Science Initiative (ETSI) programs first in 2009 in Dharamsala, and later at Mundgod, India. From the beginning, ETSI was a bidirectional relationship—western scientists learn about Buddhist principles as much as Buddhist monastics learn about western science. DJ remembers fondly evening podium discussions in Dharamsala after full days of teaching neuroscience to very attentive students. In these sessions, senior Tibetan monastics asked questions about science, and scientists asked questions about Buddhist principles. In many cases answering these questions came down to trying to better define what we each mean by “mind,” “self,” and “consciousness,” and the concept of “causality” underlying it all. LG became interested in Science reading the Mind and Life dialogues “Sleeping, Dreaming and Dying,” (Varela, 1997) “Consciousness at the crossroad,” (Houshmand et al., 1999) where His Holiness the Dalai Lama had mutually fruitful discussions with some of the prominent scientists in the field on topics such as memory, emotions, states of consciousness, death, etc. He was fascinated by the interesting findings of modern science about how our memory forms, how lesions in some parts of the brain lead to altered cognitive and behavioral processes.

What we realized over time is that in many aspects Buddhist and Scientific thinking converges on similar key insights—though with different background philosophies and terminology. In this short perspective article we are presenting some aspects of these shared insights. We note that the aim is not to present final truths, but to contribute to an ongoing discussion with the hope to increase mindfulness—and ultimately compassion.

THE MIND AS MULTIPLE PARALLEL PROCESSES

DJ: Neuroscientists by and large these days are materialists in the sense that to them the mind originates with neural activity. Therefore, there can be no mind and no mental activity without a so-called “neural correlate.” This neural correlate is then conceived as a complex activation pattern of neural networks in the brain that through their activity code “represent” mental activity. Thousands of studies have been published on the activity and function of these underlying neural networks, and quite a few principles of operation have been determined. For example, we now know that neurons communicate through electrical impulses called action potentials, and that each neuron receives on the order of ~1,000 inputs from other neurons through connections known as synapses that require the passing of a chemical messenger for transmission to occur (Kandel et al., 2021). Additionally, through input-dependent biochemical modulation of proteins in our neurons, the signaling properties in our neural networks are adapted on the timescale of seconds, minutes, and hours. Processes such as sleep, emotions, excitement, and importantly memory formation all depend on both electrical signaling as well as biochemical modulatory processes. We have also learned that neural networks are not homogenous but composed structurally of distinct functional subsystems such as thalamus, cerebellum, basal ganglia, and cerebral cortex, that each have distinct and complex arrangements of different cell types with highly specific connectivity.

The overall neural correlate of mental activity then involves a parallel activation of all these subsystems, each dedicated to specific aspects of the computational tasks at hand, such as evaluating sensory inputs, memory retrieval, eliciting emotions, decision making, and motor control of our limbs. We can now through a technique called optogenetics in experimental studies mostly carried out in mice transiently inactivate or activate each of these subsystems and determine their contribution to the overall network function and behavior. Remarkably, between mice and men (and everything in between), the identity of these functional subsystems and their internal architecture and dynamical properties is largely preserved, though of course involve different overall brain sizes and numbers of neurons. From another angle then, the same networks that are studied through optogenetics in mice, can also be examined with techniques of cognitive psychology and fMRI imaging in humans. The conclusions are much the same—many brain structures carry out dedicated pieces of the overall computational task underlying the processing of our mental content. Importantly, the brain does not wait for external input to start processing, rather it can act as a simulation engine anticipating the results of one’s actions in the world (Buzsaki, 2019), and playing through alternative scenarios of such actions before choosing one.

LG: According to Buddhism, each and every moment of the so called psycho-somatic entity is not a single unit, but consists of five separable but interconnected aggregates, called skandhas: the material form (*rupa skandha*), the feeling (*vedana*—affective aspect of the experience, such as pleasant, unpleasant or neutral) associated with it, the perception/recognition (*samñā*—identifying raw sensory data with the help of concept or labels, such as when one tastes a food

and recognizes it as a sweet, sour, salty etc.), the mental formations (*samskara*—reactive or purposeful aspect of mind) and consciousness (*vijyana*—the cognitive aspect of the experience). Insight on these skandhas is gained when one contemplates how mind and body interact to give rise to different experiences, and one reflects on the changing nature of consciousness. Carefully observing the conditioned and dependent nature of these five skandhas both on external and internal factors, one further notices their interactions. This conditional interrelationship creates the world of experience, with consciousness being responsible for subjective awareness.

DJ and LG: Comparing the neuroscience and Buddhist perspectives we realize that we both understand the mind as a set of conscious and subconscious component processes that operate in parallel. By not understanding the subconscious processes and their causal influences over our thoughts we are bound to their influences without seeing them. In Buddhism, mindfulness meditation is a practice of bringing one’s attention on the momentary nature of mental phenomena, and can be used to raise awareness of subconscious processes. In neuroscience the identification of neural networks subserving specific subconscious functions leads to their better understanding.

THE ILLUSION OF A UNITARY SELF AND FREE WILL

DJ: A neuroscientist looking at activation patterns of the neural networks of the brain may not expect a “self” emerging from the distributed parallel processing taking place. So where does our mental sense of “self” come from? One aspect to consider is that in terms of evolution our brain exists in order to optimize survival of the body. Our brain activity centers around planning actions and judging the consequences of actions (Buzsaki, 2019), all of which involve moving our body. Hence our body acts as an agent that affects change in the environment and in turn is affected by it. Tracking the state and possible motion of the body is therefore central to the processing function of our neural networks, and reflected in many sub-networks. We have only one body through space and time. Our memory of past actions using this body is embedded in our neural networks, as are future expectations of what it might do and where it will be. These processes provide an important aspect in the formation of “self” as a single unique entity.

For humans specifically, the self is also a concept on which we can reflect using language. A special frontal cortical network of the left hemisphere then has taken on the function of an “interpreter” as defined by Michael Gazzaniga (Gazzaniga, 2011). The input from other neural networks as received by this interpreter then fills our conscious perception of “self,” and our perceived reasons for acting. Importantly, such reasons and actual causes of actions can arise from many different subsystems, and be executed before the “interpreter” becomes even aware of such reasons. For example, my lab studies how the basal ganglia will nudge the brain to commit actions that bring us immediate rewards, such as a sweet. Subconscious neural networks like the basal ganglia have evolved to be fast and efficient in guiding vital decisions such as fight or flight, or food intake. In contrast, the deliberate system of our cortex that can guide decisions based on

associative processes and deliberations involving memory and cognitive goals is much slower (Kahneman, 2011).

How does the presence of multiple parallel brain processes involved in decision making impact our concept of “free will”? One thing we are certain of is that brain activity involves chaotic dynamics, meaning that infinitesimal small differences in brain state at one time can lead to large differences in brain state soon afterwards. For this reason alone, human behavior and decision making will remain unpredictable at the level of individual decisions. In addition there is evidence that individual synaptic transmission events between neurons in the brain are stochastic, and therefore neural processing at the finest scale is inherently random. So in which sense may our “Will” be “Free” then? Operationally what we may mean by “Free” is that we can pick choices that are not immediately bounded by some brain process, but encompass considering our entire past experience in making decisions. Hence, if freedom involves taking into consideration as many factors and prior experiences (such as our moral education) as possible, our cortex needs to take control, and make sure that decisions are made after sufficient deliberation. These deliberations of choosing actions are instantiated by underlying multiple parallel neural processes that are in part chaotic, and in part random as described above—hence ultimately the conscious impression that our decisions are freely willed by a unitary self is an illusion.

LG: Buddhist philosophy holds that due to ignorance, the five aggregates are experienced as an independent, single, unified self. One of the five aggregates, the mental formation (*samskara*), which is the reactive aspect of mind and acts like a magnet drawn towards a metal, plays an important role. The so-called “I” does not have a will free from any cause or condition, and there is no single unified self. Upon examining the perceptual process, which is a central aspect in mindfulness meditation, the perceptual process leads to thoughts (*vitarka*), which in turn trigger conceptual proliferation (*prapancha*). This conceptual proliferation creates a deeply embedded net of thoughts, projections and associations, leaving strong karmic imprints, which in turn, along with the current appraisal of the situation, determine how we make a decision. All these processes happen at lightning speed, which creates this illusionary sense of unified, independent “I,” and this illusion inevitably creates attachment towards “I,” and fear concerning this “I,” which becomes the root cause of our suffering. The strong habitual blind reaction to different stimuli is thought to be happening on a subconscious level. As the Buddha himself said: “Avidya (ignorance) is various types of unawareness such as the perception of these very 6 dhatus (basic elements) as unitary, as a whole, as permanent, as stable, as enduring, as source of happiness, as “self,” as “I,” as “mine” etc.” (the Buddha, *Salistamba Sutra*, Reat, 1993). In the words of Chandrakirti, 7th century Buddhist master of Prasangika school: “First, one grasps for “I.” Then one clings to the objects as “mine.” I bow to the one that gets compassionate towards beings that helplessly turn the water-wheel of *samsara* as such” (Trisoglio, 2003). Through mindfulness meditation, by examining clearly these five aspects of the notion of “I,” the dissection of the subjective personality into its constituent parts clears the misleading assumption that an independent, freely willing, unchanging agent “I” is behind our every experience. This analysis leads to insight into

the ultimately selfless (*anatma*) nature of our existence, to the truth that all the constituent parts of our psycho-somatic entity are ever-changing, and that there is no “I” apart from these five aggregates, nor any of the five aggregates is “I.” This insight leads to the realization that the self is nothing but a construct conceptually designated on the interaction of interrelated but separable systems within our psycho-somatic entity. We can find a reflection of this realization in statements on the nature of mindful observation by noted scholars: “Through meditation, mindful observation of our own experience and its ever-changing nature can lead to more balanced, equanimous management of emotions, without blind reactions to stimuli, thus creating a mental gap between stimulus and response” (Brown et al., 2007). Or as stated by Krishnamurti (1980), “In observation one begins to discover the lack of freedom. Freedom is found in the choiceless awareness of our daily existence and activity. (. . .) Our action is based on knowledge and therefore time, so man is always a slave to the past.”

DJ and LG: Buddhist and neuroscience through different methods come to the same conclusion: A unitary self and free will are constructs, i.e., they are conceptually designated. Both traditions see these constructs as acquired illusions. In cognitive neuroscience, acquiring them can be attributed a specific cortical interpreter module. In Buddhism we learn that the illusions can be overcome through introspective processes in mindfulness mediation, perhaps by broadening the function of the interpreter module and diminishing our blind dependence on subconscious processes.

THE MIND AND SOCIETY

DJ: Among the multiple subsystems in the brain, recent research has brought social centers in the brain to the forefront as well. Social behavior is essential to human survival and has co-evolved with our brains for millions of years (De Waal, 2006). Hence, behaviors such as child care, or smiling at others, are deeply wired into special neural networks in the brain, and are to some degree automatic. Altruistic behaviors and compassion towards other individuals have also been described in primates, elephants, and dolphins (De Waal, 2009). The most amazing and unique of human social behaviors is of course language, and multiple well defined brain areas are dedicated to sensory, semantic, and motor aspects of language processing (Kandel et al., 2021). Through language we are also educated during our upbringing about what behaviors are socially acceptable and meritorious, and are encouraged to strive towards such behavior. The memory of this education then becomes embedded in the information processing networks in the cortex that can help determine the course of our actions. Hence what it means to act morally is defined by our social interactions, often early in life, and moral behavior becomes shaped through our environment. As far as this morality is unique to the group that a person grows up in, so is moral behavior not necessarily defined in objective terms. Nevertheless, many core components of moral behavior such as child and family support, and working in small groups are essential to survival of human populations, and as such universal.

LG: According to Buddhist perspective, everything is dependently arisen and relative. The realization of this relative and dependent nature of all phenomena leads to the insight that nothing exists on its own, nothing has inherent existence. In this regard, the very understanding of good or bad is very much dependent on the social norm of a particular society. However, there are certain norms that are universal such as killing, lying or stealing being accepted as morally wrong.

The very insight about the relative nature of morality definitely helps one to not be judgmental of other people's behaviors, but rather develop a true compassion based on clear understanding of experiential reality. The very nature of compassion (Nyingje in Tibetan, Karuna in Sanskrit) is the absence of hatred, and when one gets rid of hatred, it becomes natural to develop compassion. As 8th century Buddhist master Shantideva said, "Since I and other beings both, in wanting happiness, are equal and alike, what difference is there to distinguish us, that I should strive to have my bliss alone?" (translated into by Stephen Batchelor, Shantideva, 1979).

DJ and LG: Again neuroscience and Buddhism come to matching concepts on this level, which can be succinctly summarized by the term "dependent origination," meaning that causal processes going far back in history determine our decision making and are not "freely" willed. Nevertheless, compassion emerges as a deeply rooted biological principle to support survival of a species, and it emerges in Buddhism as a clear moral principle when one considers the interdependence of all beings.

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CONCLUSION

LG and DJ: Neuroscience and Buddhism both discover that our "self" is made of multiple interacting parallel processes, many of which are subconscious. The concept of a unitary self arises as an illusion from our embodiment and from a high-level cortical "interpreter" module that forms part of our consciousness. These insights have important implications for our understanding of free will as an illusion, but also of how the society we live in shapes important aspects of our decision making abilities. In an increasingly global community of societies we understand through the Buddhist insight that all living beings are interdependent, and that emotional balance and compassionate behavior can be imprinted on our brain circuits through mindfulness meditation. In science, research in animal and human behavior shows that altruism is built into our brains as a part of social behaviors that ultimately serve the survival of species.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: <https://tibet.emory.edu/>.

AUTHOR CONTRIBUTIONS

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