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Fruits of the Buddhism-science dialogue in contemplative research

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The modern mindfulness movement rests largely on the twin pillars of scientific investigation and Buddhist philosophy of mind. However, in its current form and application, the scientific study of meditation is celebrated while the Buddhist roots of these practices and modes of investigation are often obscured. This paper highlights the utility and value of Buddhist ideas in the context of studying the mind in various domains of contemplative science. The role of Buddhism in the development of this field is discussed, as well as major areas of current influence, including neurophenomenology, subjective experience, attention, self, and the cultivation of prosocial qualities.

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In Western society today, meditation instruction often occurs in a secular space, with the most popular programs explicitly devoid of religious beliefs or practices. While this approach has many benefits in terms of widening the appeal and accessibility of contemplative practice, the secular frame can obscure the Buddhist roots of the modern Mindfulness movement. Much has been written about the pros and cons of secularizing meditation practice [1••], and my intent is not to rehash those debates here. Rather, I hope to highlight the utility and value of Buddhist ideas in the context of studying the mind in various domains of contemplative science. Below, I discuss how Buddhism has been a central element in the origin of this field from a research perspective, and remains influential in key areas of inquiry today.

Buddhist roots of contemplative science

At their core, both Buddhism and scientific inquiry are concerned with examining our world and uncovering truth. Examples of points of connection between Buddhist theory and Western science span broad domains, including the nature of physical reality and the nature of the human mind [2,3•]. Concepts such as interdependence and emptiness are foundational in both Buddhism and modern physics, and also have implications for fields such as ecology, psychology, and sociology. When it comes to the mind, Buddhist thinkers have, over several millennia, developed a deep and nuanced understanding of the structures of consciousness and human experience, the complexity of which often far outpaces modern psychology. With an emphasis on introspection and awareness as methods of discovery, Buddhism outlines mental functions related to subtle aspects of attention, emotion, and memory in rich detail. Indeed, the sophistication and relevance of Buddhist approaches to understanding the human mind is a primary driver of the ongoing dialogue between Buddhism and Western science [2,3•,4,5].

The seeds for contemplative research as a legitimate area of study were planted in the 1980's, primarily through two separate but intertwined efforts—both with Buddhist roots. The first is a series of dialogues between the Dalai Lama and leading scientists and philosophers, hosted by the Mind & Life Institute.[1] The Chilean philosopher, cognitive scientist, and Buddhist practitioner Francisco Varela played a major role in developing these conversations, which led to his co-founding the Mind & Life Institute along with the Dalai Lama and entrepreneur Adam Engle in 1987. Beginning in the late 1980's and continuing through today, these unique dialogues are designed to bring together scholars to investigate the intersections of Buddhist and Western thought, with the goal of surfacing new research ideas and developing a deeper, more integrated understanding of the human mind. The Mind & Life dialogues—a significant effort within the larger Buddhism-science dialogue—have generally been 5-day structured conversations held in the intimate setting of the Dalai Lama's living room at his home in Dharamsala, India. They serve not only to educate participants (and a wider audience) about various intersecting systems of thought, but also raise up new and exciting questions and methods for scientific inquiry. For example, early dialogues explored intersections of Buddhism and cognitive/neuroscience, asking questions like: Are there scientific ways of testing Buddhist theories, and

[1] See mindandlife.org/mind-and-life-dialogues/ for more information and videos of the dialogues. Books have also been published summarizing many Mind & Life dialogues, which can be found at mindandlife.org/books/.

Buddhist ways of testing Western science? How can the awareness of mental experience that comes with meditation help us understand consciousness? Indeed, many of today's leading contemplative researchers took part in these early conversations with the Dalai Lama, and attribute significant aspects of their research programs to the ideas that emerged in that living room. More recently, these dialogues have been held throughout the world, and continue to stimulate new research across disciplines.

The second effort that contributed to the establishment of contemplative science is the development of Jon Kabat-Zinn's Mindfulness-Based Stress Reduction (MBSR) program at the University of Massachusetts. This 8-week intervention was originally designed for pain and stress management, and takes place in a group setting incorporating sitting meditation practice as well as gentle yoga, walking meditation, and discussion [6,7]. Kabat-Zinn, also a participant in early Mind & Life dialogues and himself a Buddhist practitioner, has described how MBSR, while secular in its delivery, was based on Buddhist practices originating in both Theravada and Mahayana lineages—calling the program 'relatively intensive training in Buddhist meditation without the Buddhism' [8]. Increasing awareness and acceptance of one's cognitive and emotional experience through meditation is central to the training. In 1985, the first scientific study was published about the clinical benefit of MBSR, and the groundwork was laid for the eventual adoption of contemplative practices such as meditation into health and wellness efforts in the West. MBSR is now implemented around the world in a wide range of settings, from medical to business to personal (e.g., see Refs. [9,10] in this issue).

Beyond its role in the foundations of contemplative science, Buddhism continues to be highly relevant for the field today. Below, I expand briefly on several areas of study in which Buddhist ideas and practices have pushed the scientific study of the mind in new directions, opening doors for a richer understanding of our shared experience.

Raising up the subjective view

One aspect of Francisco Varela's interest in the Buddhism-science dialogue was to highlight the importance of subjective experience in the study of consciousness. Buddhist practices rely heavily on introspection and examination of one's own mental processes, thus elevating the subjective perspective to be taken seriously as a source of meaningful data when studying the mind. He advanced a project he referred to as *neurophenomenology*—the weaving together of phenomenology (the study of subjective experience) with neuroscientific investigations of consciousness, arguing that integrating first-person and third-person data would yield a more complete understanding of the mind [11,12]. He viewed Buddhist meditation as a potentially useful tool to aid in the systematic and rigorous investigation of consciousness. As he reflected on this new horizon in 1999, he explained,

> ".. . we foresee in the future that the mind sciences will evolve into a form of experiential neuroscience, bridging the gap between external and internal descriptions. Such a unification of our understanding of the world, a new frame for a mind science, is one of the major contributions Buddhism is capable of offering. The interest in such cross-fertilization with science was one of the main inspirations for the Mind & Life initiative, and remains at the center of its efforts to transform this vision into concrete laboratory collaborations." [3•]

Following this lineage, the integration of first-person and third-person perspectives has been a key theme within the Mind & Life Institute, and their grant-making programs have provided support for research in this arena [13].

Combining the introspective capacity of meditators with subjective report is beginning to bear fruit in cognitive neuroscience [14•]. For example, an initial model was put forward that leveraged subjective input from meditators to understand the neural underpinnings of dynamic fluctuations of cognitive states that occur during focused attention (FA) meditation [15]. FA meditation is a foundational practice in most contemplative traditions, in which the practitioner maintains her attention on an object (often the sensations of breathing), and brings her mind back whenever she realizes it has wandered away from the object. In this study, as meditators performed this practice in the fMRI scanner, they indicated the moment they became aware that their mind had wandered. This temporal information was used to drive the neuroimaging analysis, and brain networks associated with focus, mind wandering, awareness of mind wandering, and shifting/reorienting were revealed. A related design has also been used with EEG analysis, showing distinct frequency band correlates of mind wandering and attention [16]. More recently, a similar approach was used with experienced Vipassana meditators to investigate the brain systems that may generate the onset of a thought [17]. By asking meditators to report the precise moment a thought began to arise in the midst of FA meditation, researchers identified key brain regions associated with the early inception of spontaneous thoughts.

Another example of the neurophenomenological approach in contemplative science involves the use of neurofeedback technology, which allows participants to observe their own mental activity in real time. Garrison *et al.* [18] had meditators perform FA meditation in the scanner, and report on their subjective experience while viewing—and then trying to volitionally manipulate—their brain activity by shifting their internal experience. This work identified subjective correlates of activity in the posterior cingulate cortex, including efforting, distraction, and discontentment.

In all of these examples, it's important to note that while the studies investigate mental processes that arise during meditation, these functions are common to non-meditative states as well; thus, findings are generally applicable across broad domains of cognitive science. The examples discussed above involve attentional processes, but other examples of neurophenomenology derived from the Buddhism-science dialogue include unconscious processing [19], body ownership [20], dreaming [21], and self processing [22]. In general, this approach serves to broaden the perspective of all studies of mind, and will surely continue to be a productive avenue in the future.

Self

Ideas around the concept of self are central to Buddhist philosophy of mind. A fundamental claim is that the tendency humans have to believe in an unchanging, separate, and intrinsically real 'self' is in fact misguided. Instead, what we think of as our self is constantly shifting, and is dependent on the current external context, those around us, biological fluctuations, and so forth. Buddhism goes further to assert that this mistaken belief in—and clinging to—such an illusory self is a major factor in our suffering. In many Buddhist traditions, the realization of this reality and the loosening of self-clinging is a central goal of meditation practice [23•].

Modern cognitive psychology has also wrestled with the concept of self, and contemplative research in particular has invoked self-regulation as a major possible mechanism underlying the positive effects of mindfulness training [24–26]. There is an interesting tension here within Western psychology. On one hand, the self is accepted as central to well-being, and is something to be bolstered, understood, controlled, and treated with care [24,27,28]. On the other hand, the self has also been examined as a possible source of clinging or 'stuck-ness,' a driver of craving and addiction, and something to be seen through or even moved beyond [26,29–33]. This same tension exists in Buddhism, and is resolved through the notion of two levels of truth [34]. As applied here, the concept of a self is considered necessary to operate in the world, and at this level (relative truth) it should be made as healthy as possible, while at a deeper level (absolute truth), a firm belief in a stable and unchanging self is detrimental and ultimately untrue.

The neural correlates of self-processing have also been highlighted in many discussions of meditation's effects, and are often associated with activity in the brain's default mode network [35,36]. Default mode network activity is closely associated with the experience of mind wandering or 'task unrelated thought,' and researchers have noted that the majority of such spontaneous thought content is self-focused [36–38]. Mind wandering has also been associated with negative affect [30, but see Ref. 29], and it is well-established that self-focused rumination is a core feature of depression [39]. Meditation has been associated with reduced activity and/or altered functional connectivity within default mode regions, and research suggests that meditation may serve to reduce mind wandering, thus potentially reducing self-focus (see Ref. [14•] for review).

The self is surely a fertile area for further development in contemplative research across theoretical, neural, behavioral, and clinical domains. As a core feature of mental life, expanding our understanding of this construct will have major influences on both human suffering and flourishing.

Prosociality

Another way that Buddhism encourages reduced self-focus is through practices that generate caring emotions directed toward others. In light of the challenges posed by the current societal and political landscape, perhaps one of the most powerful results of the dialogue between Western science and Buddhism has been the emphasis on positive human qualities like kindness and compassion. The cultivation of these values and emotions is a core goal of many forms of Buddhist practice [23•]. In a natural extension of this fundamental motivation, the Dalai Lama has steadily been making the case, through the Mind & Life dialogues as well as in other public appearances, for what he calls 'secular ethics'—values that are common to and even transcend-specific religions, like compassion, care, kindness, and generosity [40]. These prosocial qualities are quickly being recognized as key ingredients for the future of a healthy society, and research is proceeding in kind.

Buddhism's emphasis on prosocial qualities has had a major influence on the work of leading investigators and also contemplative research and application more broadly [41]. Richie Davidson, one of the early pioneers of contemplative science and frequent participant in the Mind & Life dialogues, recalls how his career was set on a different trajectory when the Dalai Lama posed a challenge to scientifically study positive emotions like compassion and kindness with the same rigor as scientists had used to understand fear and anger [42]. At that time, these prosocial qualities were not considered to be within the realm of rigorous scientific inquiry. Inspired by the Dalai Lama's suggestion, Davidson and other dialogue participants became some of the first researchers to systematically study meditation and its effects on human psychology and physiology, including these positive interpersonal qualities.

Another example reveals the unique benefits that can emerge when scientists and Buddhist scholars and practitioners work together. Tania Singer attributes her collaboration with Buddhist monk Matthieu Ricard as being

crucial for her research program distinguishing empathy from compassion and studying their separate neural underpinnings. As she described in 2013 at a Mind & Life dialogue [2], she scanned his brain while he was generating the experience of loving-kindness (mettā), expecting to see activity in the anterior insula and anterior cingulate, regions related to empathy and feeling the pain of another person. Instead, brain activity arose in a different network involving the ventral striatum and medial orbitofrontal cortex—these areas had been implicated in affiliation, reward, and positive affect. Through subsequent conversations with Matthieu incorporating Buddhist perspectives, a distinction was clarified between empathy and compassion that challenged the prevailing Western psychological view and expanded our understanding of these human capacities. This distinction was critical for subsequent social neuroscience research on the neural and subjective basis of empathy versus compassion [43,44]. More recently, this perspective inspired the ReSource Project, a nine-month intervention and large longitudinal study examining the differential effects of specific elements of meditation training on brain, body, cognition, and social interactions (see Ref. [45] in this issue).

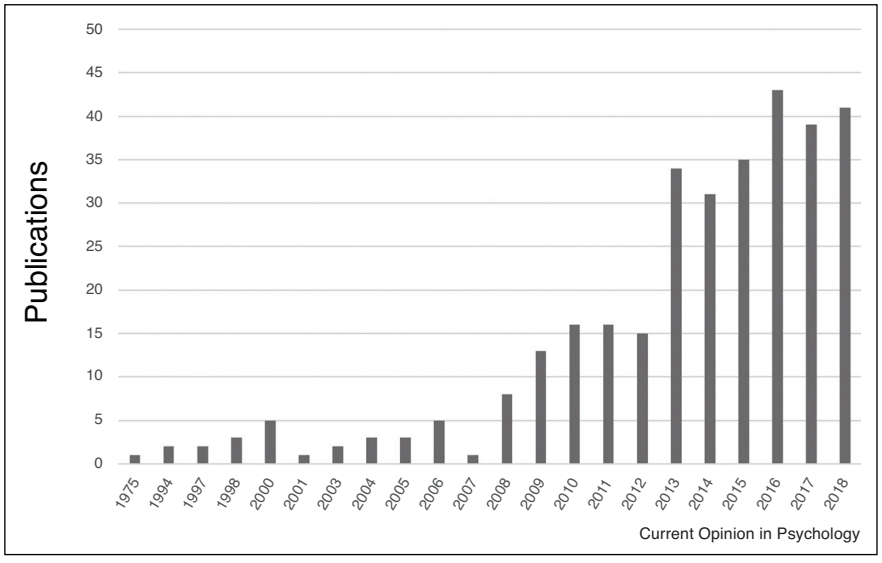
The number of studies on contemplative practices that seek to cultivate prosocial qualities such as compassion and loving-kindness meditation has been growing rapidly over the last decade (Figure 1). Building on foundational attention and awareness skills, the goal of these practices is to intentionally generate positive emotions like warmth, care, love, and compassion. These emotions can be directed toward oneself or others, and the practice usually proceeds by extending the natural warmth and connection we feel for close loved ones outward to an increasingly inclusive circle of others. Following the model of MBSR, interventions have been developed to systematically train these qualities in a secular format (e.g. Cognitively-based Compassion Training [46], Compassion Cultivation Training [47], Sustainable Compassion Training [48]), and research has been accumulating on their effects.

The overarching intention of compassion practices is not only to generate prosocial emotions within the practitioner, but also to *reduce the conceptual differences* between self and other. Positive impacts of compassion meditation have been reported with regard to immune function [46], prosocial behavior [41], and clinical efficacy across disorders [49]. Most recently, contemplative researchers have asked whether meditation may be beneficial in reducing implicit biases that so often result in discriminatory societal structures and behavior. This line of inquiry is still very new, but early findings point to exciting possibilities including reduced implicit bias, increased helping behavior toward outgroups, and reduced discriminatory behavior [50•,51,52,53,54]. Taken together, this work highlights the need for continued study of practices that integrate self and other, and calls for greater incorporation of measures that can assess a range of prosocial outcomes.

Future of contemplative science

This is an exciting time for contemplative research. The groundwork has been laid to establish these lines of inquiry as legitimate and fruitful, and early

Figure 1



The rise in research on prosocial meditation practices. Annual publications from the PubMed database containing the words 'compassion' OR 'loving' OR 'metta' and 'meditation'.

methodological challenges are beginning to be addressed to more rigorously evaluate the effects of contemplative interventions [55]. In addition, we are beginning to see deeper theoretical work about the nature of core cognitive changes that may be enabled by meditation [24,56], many of which are anticipated from Buddhist theory. Moreover, technology is advancing to allow researchers to study multiple brains and bodies simultaneously, and the new frontier of understanding social and interpersonal effects of contemplative practice is before us.

Now more than ever, open dialogue between systems of thought is essential. Continuing to foster exchange between contemplative traditions like Buddhism and all domains of science will result in a more complete and integrated understanding of our experience as humans, and illuminate possibilities for personal and societal transformation.[2] Beyond Buddhism, more voices must enter the conversation. As meditation and other practices are disseminated into everyday life, we need to engage additional disciplines in our research practices including anthropology, law, public policy, systems thinking, and political science. We also must become aware of perspectives that have been excluded in the conversation. This involves challenging existing power structures, including underrepresented voices, working to remove barriers, and ensuring that our research addresses diverse populations. With such an inclusive approach to theoretical and applied work on contemplative practices, we can move continuously closer to reducing suffering and promoting collective flourishing.

Conflict of interest statement

The author is employed by the Mind & Life Institute, a non-profit organization that has figured prominently in the development of contemplative science. Programs and activities of the Mind & Life Institute are discussed in relation to the topic of this paper.

Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

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[2] It should also be noted that there are many other domains beyond those discussed here where a rich exchange between Buddhist ideas and scientific studies of the mind may yield fruit. One important and broad topic that warrants further exploration is how the mind generates and uses concepts—mental categories that serve to filter experience and guide action. This area of inquiry is well explored in both Buddhism [57] and constructivist theories of cognition [58], and has major implications for research on self, implicit and explicit bias, predictive processing, and basic cognitive science.

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