Reconstructing and deconstructing the self: cognitive mechanisms in meditation practice

Cortland Dahl, Antoine Lutz, Richard J. Davidson

HHS Public Access

Author manuscript

Trends Cogn Sci. Author manuscript; available in PMC 2016 September 01.

Published in final edited form as:

Trends Cogn Sci. 2015 September ; 19(9): 515–523. doi:10.1016/j.tics.2015.07.001.

Reconstructing and deconstructing the self: Cognitive mechanisms in meditation practice

Cortland J. Dahl[1,2], **Antoine Lutz**[1,2,3,4], and **Richard J. Davidson**[1,2,5]

[1] Center for Investigating Healthy Minds, University of Wisconsin-Madison, WI 53705-2280, USA

[2] Waisman Laboratory for Brain Imaging and Behavior, University of Wisconsin-Madison, 1500 Highland Avenue, Madison, WI 53705-2280, USA

[3] Lyon Neuroscience Research Center, INSERM U1028, CNRS UMR5292, Lyon, France

[4] Lyon 1 University, Lyon, France

[5] Department of Psychology, University of Wisconsin-Madison, WI 53705-2280, USA

Abstract

Scientific research highlights the central role of specific psychological processes, in particular those related to the self, in various forms of human suffering and flourishing. This view is shared by Buddhism and other contemplative and humanistic traditions, which have developed meditation practices to regulate these processes. Building on a previous paper in this journal, we propose a novel classification system that categorizes specific styles of meditation into attentional, constructive, and deconstructive families based on their primary cognitive mechanisms. We suggest that meta-awareness, perspective taking and cognitive reappraisal, and self-inquiry may be important mechanisms in specific families of meditation and that alterations in these processes may be used to target states of experiential fusion, maladaptive self-schema, and cognitive reification.

Keywords

meditation; mindfulness; meta-awareness; experiential fusion; insight; self-inquiry

Cognitive Mechanisms of Meditation Practice

Well-being is a complex phenomenon that is related to a variety of factors, including cultural differences, socio-economic status, health, the quality of interpersonal relationships, and specific psychological processes [1,2]. While mindfulness (see Glossary), compassion, and other forms of meditation are increasingly being studied as interventions to alleviate suffering and promote well-being [3–10], it is not yet clear how different styles of

Corresponding author: Davidson, R.J. (rjdavids@wisc.edu).

meditation affect specific cognitive processes, nor how alterations in these processes might impact levels of well-being. Here, we address this question from the perspective of psychology and cognitive neuroscience to better understand how changes in well-being are mediated by alterations in distinct cognitive processes and in the structure and functioning of corresponding brain networks.

In a previous article in this journal, we proposed a preliminary framework to discuss commonly practiced forms of mindfulness meditation [11]. Recent theoretical models have advanced our understanding further by attempting to identify potential cognitive and neural mechanisms in different forms of meditation and to classify different forms of contemplative practice [12–17]. While some models have proposed specific cognitive and biological processes that inform the practice of mindfulness meditation [18–20], theoretical accounts of other families of meditation are lacking, especially models that identify important mechanisms in other styles of practice. Thus, while these pioneering efforts provide crucial insights for the scientific study of meditation, rigorous efforts to examine the psychological processes involved in different families of meditation are needed to understand the precise manner in which they might impact various aspects of well-being.

In this article we expand our original framework to accommodate a broader range of traditional and contemporary meditation practices, grouping them into attentional, constructive, and deconstructive families. According to this model, the primary cognitive mechanisms in these three families are (1) attention regulation and meta-awareness, (2) perspective taking and reappraisal, and (3) self-inquiry, respectively. To illustrate the role of these processes in different forms of meditation, we discuss how experiential fusion, maladaptive self-schema, and cognitive reification are differentially targeted by these processes in the context of Buddhist meditation, integrating the perspectives of other contemplative, philosophical, and clinical perspectives when relevant. The mechanisms and targets we propose are drawn from cognitive science and clinical psychology. Although these psychological processes are theoretically complex, as are the meditation practices that target them, we propose this novel framework as a first step in identifying specific cognitive mechanisms to aid in the scientific study of different families of meditation and the impact of these practices on well-being.

The Attentional Family: Meta-awareness and Experiential Fusion

The group of meditative practices that we refer to here as the ‘attentional family’ trains a variety of processes related to the regulation of attention. These include the capacities to manipulate the orientation and aperture of attention, to monitor, detect and disengage from distractors, and to re-orient attention toward a chosen object [20–23]. We propose that a shared characteristic of all meditation practices in this family is the systematic training of the capacity to intentionally initiate, direct, and/or sustain these attentional processes while the strengthening the capacity to be aware of the processes of thinking, feeling, and perceiving (see Box 1 and Table 1).

In scientific literature, the term *meta-awareness* has been used to describe the cognitive function of being aware of the processes of consciousness [24]. In the absence of meta-

awareness, we become experientially "fused" with what we experience. We may be aware of the objects of attention, yet unaware of the processes of thinking, feeling, and perceiving. This state of experiential fusion has been referred to using a variety terms in the study of meta-cognition, including "cognitive fusion" and "object mode" [25,26].

To illustrate the difference between meta-awareness and experiential fusion, let us consider an example. Imagine that you are watching an enthralling movie. In one moment, you might be experientially fused with the movie, to the point when you are no longer consciously aware that you are sitting in a movie theater. In the next moment, you might suddenly become aware of your surroundings and the fact that you are viewing images on a screen. In both moments you may be attentive to the movie, but only in the second moment are you also aware of the process of watching the movie.

In this example, paying attention to the images and sounds that constitute the movie is a form of awareness. If someone tapped you on the shoulder and asked you what just happened in the movie, you could answer. However, if you were asked whether or not you were conscious of sitting in a movie theater in the moment before being asked, you would probably answer no. The awareness that you were watching a movie, in this case, would only be retrospective. Across a range of traditional and contemporary contemplative traditions, the absence of meta-awareness is viewed as an impediment to various forms of self-monitoring, self-regulation, and self-inquiry [27–29].

Experiential Fusion and the Training of Attention

The inability to regulate attentional processes has been linked to ADHD [30], addiction [31], and other forms of psychopathology [32,33], as well as to abnormalities in brain structure and function [34]. Experiential fusion in particular has received a great deal of attention in a number of contemporary therapeutic interventions. Although associated with overlapping constructs, including "cognitive distancing," "cognitive defusion," and "decentering," reversing states of experiential fusion through the cultivation of meta-awareness is considered to be especially important in the cultivation of mental health [26,35–38].

Clinical studies have shown that a diminished ability to step back and observe one's internal processes of thinking and feeling plays an important role in a variety of psychiatric conditions, including depression [39] and anxiety [40]. In one recent study, authors found that decreases in psychological processes related to experiential fusion were found in patients undergoing treatment for depression who received training in mindfulness-based cognitive therapy but not in control groups, and that these changes were associated with positive changes in depressive symptomology [41]. Similar findings have been found in relation to the treatment of addiction [42]. A study on smoking cessation, for example, demonstrated that mindfulness practice attenuated cigarette smoking, in particular by altering the relationship between addictive craving and the behavior of smoking [43].

As recently reviewed, mindfulness-related practices have been shown to train many of the attentional processes described above and to induce functional and structural changes in attention-related networks in the brain [9,44]. For instance, there is growing evidence that attentional stability increases with mindfulness training, as measured by reduced response

time variability and EEG brain response variability during continuous performance tasks [7,45]. Similarly, intensive meditation training has been shown to reduce both behavioral and EEG markers of attentional blink, a phenomena that reflects the propensity for attention to become fused with a perceptual target [46]. This effect is also modulated by different forms of meditation, with enhanced reductions in attentional blink in relation to open monitoring meditation relative to focused attention practices [47] (see Box 1). Reducing experiential fusion with emotional experiences should facilitate the regulation of emotions by decreasing their perseveration. This prediction is in line with findings that expert meditators exhibited less amygdala activity in response to negative emotional stimuli relative to controls [48]. A similar effect was found when patients with anxiety disorders underwent a training in mindfulness meditation [49].

One avenue through which meta-awareness might impact well-being lies in its relationship to mind wandering. Mind wandering has been found to consume as much as 50% of our waking life and is tied to our sense of well-being [50]. If training in attentional forms of meditation does strengthen meta-awareness, we might expect this to impact both the incidence and impact of mind wandering. Recent studies have indeed found that meditation training alters patterns of task-unrelated thought, showing that even brief trainings in mindfulness meditation decrease the behavioral indicators of mind wandering [51,52]. Although meta-awareness and self-referential processes are difficult to operationalize, a few recent studies seem to indicate that brain regions associated with self-referential processing [53–55], such as the medial prefrontal cortex and the posterior cingulate cortex, may be down-regulated by mindfulness-related practices [56,57]. In one of these studies, this pattern was linked to enhanced coupling between these midline regions and attentional brain networks associated with executive function, such as the dorsolateral prefrontal cortex and the dorsal anterior cingulate cortex [57]. In the other, this pattern was linked to a decreased coupling between the medial prefrontal cortex and an interoceptive region, the insular cortex [56]. It was speculated that these patterns reflected decreased self-referential thought and enhanced present-centered awareness [56,57]. These interpretations require further investigation, particularly because mind-wandering recruits multiple brain regions, some of which may also play roles in attention and interoception [54]. It is also unclear how meta-awareness affects one's ability to use the constructive aspects of mind wandering more effectively, and how activation patterns in brain regions associated with self-referential thought change when periods of mind wandering coincide with meta-awareness.

The Constructive Family: Reappraisal, Perspective Taking, and Self-Schema

The style of practice that we refer to as the ‘constructive family’ includes a variety of meditation practices that strengthen psychological patterns that foster well-being. We propose that one avenue through which these practices may affect well-being is by targeting maladaptive self-schema and replacing them with more adaptive conceptions of self. In cognitive psychology, latent beliefs and conceptions about the self, referred to as self-schema, are thought to underlie and inform thoughts and emotions [58] and to impact patterns of brain function [59]. In contrast to attentional practices, which often focus on

simply monitoring cognitive and affective patterns, constructive meditations involve systematically altering the content of thoughts and emotions. Some constructive practices are designed to cultivate qualities like patience and equanimity that safeguard the mind from the stressors of daily life. Others aim to bring about a restructuring of priorities and values and a reorienting of the mind toward what is truly meaningful in life. Still more address interpersonal relationships by nurturing pro-social qualities like kindness and compassion (see Box 2 and Table 1).

The wide variety of practices in this family, as well as their individual complexity, makes identifying core cognitive mechanisms challenging. Nevertheless, a number of processes appear to be central to a broad spectrum of constructive meditations. Two mechanisms that appear to be especially important in this family are cognitive reappraisal and perspective taking. Cognitive reappraisal refers to the process of changing how we think about situations and events in such a way that our response to them is altered [60]. Reappraisal is an important strategy in the regulation of emotion [61] and recruits brain regions related to cognitive control, including the dorsomedial, dorsolateral, and ventrolateral prefrontal cortex, as well as the posterior parietal cortex [62]. In a study of reappraisal in those with social anxiety disorder (SAD), for example, results showed that the use of reappraisal reduced negative affect in both patients with SAD and healthy controls, but that in healthy controls different patterns of activity in regulatory brain regions were associated with reduced amygdala activity compared to SAD patients [63].

The second core process that we propose to be central in many constructive meditations is that of perspective taking, the act of considering how oneself or another would feel in a particular situation [64]. Perspective taking is especially important as a contributor to the experience of social emotions [65]. As a critical component of healthy interpersonal relationships, for instance, it is found to be diminished in psychopaths [66] and also a central mediator in reducing intergroup prejudice [67]. Imaging studies indicate that there is no single neural mechanism related to perspective taking, but rather that differences in perspective (imagining oneself experiencing pain versus another experiencing pain, for example) recruit different brain networks [65].

In constructive meditation practices, cognitive reappraisal and perspective taking are hypothesized to be important mechanisms used to target maladaptive or neutral psychological processes and replace them with more adaptive patterns. One common example is the transformation of empathy into compassion (see Box 3). Hearing a crying baby on an airplane, for example, might first elicit a feeling of distress followed by aversion. This experience can be transformed by taking the perspective of the baby's mother, thereby triggering a sense of warmth and compassion, and also by reinterpreting the sound of the baby's cries, viewing the experience as an opportunity to cultivate kindness and concern rather than an impediment to one's own well-being. By systematically cultivating compassion in this manner, responding to aversive stimuli with altruistic concern may eventually become automatic. Such changes may thus be studied within the framework of habit formation, which is associated with various facets of physical and psychological well-being [68].

To date, constructive meditation practices have received less attention than other forms of meditation in scientific research, though a few studies have begun to explore practices related to this family, including the cultivation of compassion [69,70] and imagination-based meditations [15]. The precise role that reappraisal and perspective taking play in constructive styles of meditation is therefore not yet known, nor is it clear how these processes relate to the recruitment of specific brain networks. Nevertheless, investigations of the cultivation of compassion, a widely practiced style of meditation in this family, provide useful information regarding the cognitive and neural mechanisms of constructive meditations. Preliminary findings indicate that this practice may affect the regulation of emotion and corresponding brain networks (see Box 3). Though further work is needed to clarify the role of reappraisal and perspective taking in other forms of constructive meditation, these data suggest one possible mechanism through which specific forms of meditation may impact well-being.

Deconstructive Family: Self-inquiry and Insight

The group of meditations that we refer to as the ‘deconstructive family’ aims to undo maladaptive cognitive patterns by exploring the dynamics of perception, emotion, and cognition and generating insights into one's internal models of the self, others, and the world. We propose that a central mechanism in the deconstructive family is *self-inquiry*, which we define as the process of investigating the dynamics and nature of conscious experience. Though self-inquiry has received little attention as a subject of scientific research, various forms of inquiry are employed across a range of contemplative traditions [71–73]. Self-inquiry may involve discursive analysis or a direct examination of conscious experience, and often involves explorations of self-related processes (see Box 4 and Table 1). Discursive analysis might entail identifying the assumptions that underlie the reification of a particular object or experience and subsequently thinking about and questioning the logical consistency of these assumptions. If you are anxious, for example, you might identify the fearful assumptions that underlie the emotion and then inquire into the rational basis for your beliefs. Another approach would be to directly examine your experience, for example by dissecting the feeling of anxiety into its component parts and noticing how the thoughts, feelings, and physical sensations that comprise the emotion are constantly changing. In the context of Buddhist meditation, this process of inquiry is often applied to beliefs about the self, though it can similarly be applied to the nature and dynamics of perception, to the unfolding of thoughts and emotions, or to the nature of awareness.

In the deconstructive family, self-inquiry is practiced in order to elicit insight. Insight has been framed as a shift in consciousness, often sudden, that involves a feeling of knowing, understanding, or perceiving something that had previously eluded one's grasp [74]. Scientific studies of this phenomena have focused on the burst of understanding that can occur in relation to solving simple mathematic or semantic problems [75]. Research has found that this form of insight is linked to hemispheric differences in the brain, with recent studies demonstrating that facilitatory direct current stimulation of the right frontal-temporal cortex along with inhibitory stimulation of the corresponding region in the left hemisphere greatly enhanced insight-based problem solving capacity [76,77]. To date, the scientific study of insight has not investigated forms of insight that may arise through self-inquiry, nor

has there been a systematic investigation of the relationship between insight and well-being. This is an area that calls for future research, especially since a variety of meditative traditions hold that specific forms of insight, such as insight into the nature of the self, are of particular importance when it comes to the cultivation of well-being [27,71,78].

In Buddhist meditation practice, insights that would ordinarily be fragile and fleeting are systematically stabilized and integrated with one's experience, first in formal meditation and subsequently in daily life. The heightened awareness of present-moment experience cultivated through attentional meditations and the self-inquiry carried out in deconstructive meditations are thus considered important, though distinct, processes [79]. To give an example of the relationship between these two processes, consider the feeling of being overcome by anger. When your sense of self is fused with the presence of anger (i.e., the feeling “I am angry”), the arising of anger is not seen clearly, but instead forms the lens through which you view experience. Attentional family practices train the capacity to recognize the occurrence of anger and other states of mind, enabling one to notice the presence of angry thoughts, physiological changes, and shifts in affective tone. This process of sustained recognition allows for the investigation of the experience of anger, an approach taken with deconstructive meditations. With this added element, one is not merely sustaining awareness of the experience of anger, but also investigating its various components, inquiring into its relationship with one's sense of self, and/or uncovering the implicit beliefs that inform the arising of anger and then questioning the validity of these beliefs in light of present-moment experience (see Box 4). This investigation of conscious experience is said to elicit an experience of insight, a flash of intuitive understanding that can be stabilized when linked with meta-awareness. Thus, meta-awareness sets the stage for self-inquiry and allows for the stabilization of the insight it generates while nevertheless being a distinct process.

To date, only one study has investigated the relationship between meditation training and insight. Though the form of meditation used in the study was not deconstructive in nature, results showed that short-term meditation training increased creative problem solving relative to training in progressive muscle relaxation [80]. This difference, moreover, was linked to heightened activation in a variety of brain regions, including the right cingulate gyrus, insula, putamen, and inferior frontal gyrus, and the bilateral middle frontal gyrus, inferior parietal lobule, and superior temporal gyrus [80]. Further study is needed to determine if specific forms of meditation, and deconstructive meditations in particular, enhance the capacity to arouse and sustain insight, and also to investigate the psychological and biological correlates of insight experiences. Thus, studying the relationship between different forms of meditation and well-being calls for a more comprehensive account of the varieties of insight, their neural correlates, and the conditions and interventions that may facilitate their occurrence.

Self-related Processing and the Brain

As noted above, inquiring into the nature of the self is an important practice in a variety of contemplative traditions, including both Buddhist meditation and Greco-Roman contemplative exercises [27,78]. One of the most compelling aspects of our sense of self is

the ongoing personal narrative that weaves together the various aspects of our lives into a coherent, unified experience. This inner interpreter has been linked to activity in the left cerebral hemisphere in split brain patients [81] and to activity in the medial prefrontal cortex and posterior cingulate cortex in brain imaging research [82–84]. The narrative self can be contrasted with the first person subjective experience that is not extended in time. This aspect of selfhood has been referred to as the “minimal self” [85] and “minimal phenomenal self” [86] and has been hypothesized to be instantiated in cortical activity in regions related to interoception, such as the anterior insula [87–89], in the temporo-parietal junction [90], as well as in the hypothalamus, brainstem, and other subcortical regions associated with homeostatic functioning [91].

As there is still a paucity of empirical evidence relating to deconstructive meditation practices and their impact on neural processes, this is an area that calls for more intensive study in the future. Some data highlight the possibility of using meditation to willfully manipulate core aspects of identity [57,92,93], though it is not clear whether insight into the nature of experience disrupts rigid and/or maladaptive self-related processes, nor is it clear how alterations of these processes might be instantiated in the brain. Nevertheless, there does appear to be some overlap between the insights that are said to arise in forms of meditation that explore the nature of the self and recent research in the arena of cognitive neuroscience, which suggests that self-processing in the brain is not instantiated in a particular region or network, but rather extends to a broad range of fluctuating neural processes that do not appear to be self-specific [94,95]. Future studies may explore this convergence by using contemplative practices, and specifically those from the deconstructive family, to probe the malleability of self-related processes, their instantiation in the brain, and their relationship to both suffering and well-being.

Concluding Remarks and Future Directions

Scientific research on the effects of meditation is in the very early stages. Though preliminary findings suggest that meditation and other forms of mental training may produce demonstrable changes in subjective experience, behavior, patterns of neural activity, and peripheral biology, rigorous studies are still needed to uncover the precise mechanisms that underlie these changes. In particular, randomized trials, active control groups, and longitudinal studies that examine within- and across-subject changes over time, as well as across-practice comparisons, will be especially important in determining the efficacy of meditation training paradigms. In addition, subjective, behavioral, and clinical correlates of meditation-related neural changes are needed to assess the impact of different styles of meditation.

The framework presented here highlights the need to expand the scope of scientific research to include a broad range of meditation practices. In the same way that the study of mindfulness meditation has provided a unique window into the training of specific forms of attention, and the impact of attentional training on emotion regulation, learning and memory, and various forms of psychopathology, other forms of meditation may similarly yield important insights into the regulation of self-related processes and their import for well-being, health, and peripheral biology.

It is important to note that here we have explored these families through the lens of cognitive neuroscience and clinical psychology, focusing our attention on the primary cognitive mechanisms and phenomenological targets of specific forms of meditation. If, however, we are to fully understand these practices, it will also be important to study the wider context within which these practices are engaged. This context includes, but is certainly not limited to, issues of ethics (see Box 2), embodiment, inter-personal dynamics, cultural setting, and the role that belief and expectation play in shaping subjective experience. In providing this framework, inadequate though it may be, we hope to spur further discussion about the nature of contemplative practice and how scientific study of meditation may help us better understand the causes and conditions of human flourishing.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Support for our research described here was provided by NCCIH NIH P01AT004952, ERC Consolidator Grant (BRAINandMINDFULNESS, 617739), and several gifts to the Center for Investigating Healthy Minds at the University of Wisconsin-Madison (CIHM_UW). RJD is Founder and President of the Center for Investigating for Investigating Healthy Minds, Inc., (CIHM, Inc) a non-profit corporation associated with CIHM-UW. CJD is Chairman of Tergar International, a non-profit organization that coordinates a global network of meditation centers.

Glossary of Terms

Attentional Family	A class of meditation practices that strengthen the self-regulation of various attentional processes, especially the ability to initiate and sustain meta-awareness. Some forms of meditation in this family involve a narrowing of attentional scope, while others involve releasing attentional control and bringing awareness to whatever enters the field of consciousness.
Cognitive Reification	The experience of thoughts, emotions, and perceptions as being accurate depictions of reality, and in particular the implicit belief that the self and objects of consciousness are inherently enduring, unitary, and independent of their surrounding conditions and circumstances. In the Buddhist tradition, cognitive reification is a primary target in deconstructive styles of meditation.
Constructive Family	A family of meditation practices that allow one to cultivate, nurture, or strengthen cognitive and affective patterns that foster well-being. Practices in this family may aim to promote healthy interpersonal dynamics, to strengthen a commitment to ethical values, or to nurture habits of perception that lead to enhanced well-being. Perspective taking and cognitive reappraisal are important mechanisms in this style of meditation.
Experiential Fusion	An automatic process whereby one becomes absorbed in the contents of consciousness, leading to a diminished capacity to monitor and/or

	regulate psychological processes. In attentional styles of meditation this process is systematically undermined through the cultivation of meta-awareness and the regulation of attention. Experiential fusion is also indirectly undermined in the constructive and deconstructive families.
Deconstructive Family	A family of meditation practices that employs self-inquiry to foster insight into the processes of perception, emotion, and cognition. Deconstructive meditation practices may be oriented toward the objects of consciousness or toward consciousness itself.
Insight	A shift in consciousness that is often sudden and involves a feeling of knowing, understanding, or perceiving something that had previously eluded one's grasp. In deconstructive meditation practices, insight is often elicited through self-inquiry and pertains to specific self-related psychological processes that inform well-being.
Meta-awareness	Heightened awareness of the processes of consciousness, including the processes of thinking, feeling, and perceiving. Along with the regulation of the scope and stability of attention, the cultivation of meta-awareness is an important objective in attentional styles of meditation practice. It is also strengthened indirectly in the constructive and deconstructive families.
Mindfulness	A term that is defined differently in Buddhist and contemporary contexts, but which often refers to a self-regulated attentional stance oriented toward present-moment experience that is characterized by curiosity, openness, and acceptance. In some traditional Buddhist contexts, mindfulness is equivalent to the psychological process that we refer to here as meta-awareness.
Perspective Taking	The process of considering how one or another would think or feel in a particular situation.
Re-appraisal	The process of changing how one thinks or feels about situations and events in such a way that one's response to them is altered.
Self-inquiry	The investigation of the dynamics and nature of conscious experience, particularly in relation to thoughts, feelings, and perceptions that pertain to one's sense of self. Self-inquiry may be an important mechanism in deconstructive meditations due to its role in facilitating insight.
Self-schema	Mental representations of the self that synthesize information from sensory, affective and/or cognitive domains. Constructive styles of meditation often involve developing and/or strengthening adaptive self-schema.

Citations

1. Diener E, et al. Subjective well-being: Three decades of progress. Psychol. Bull. 1999; 125:276–302.
2. Ryff CD. Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychother. Psychosom. 2014; 83:10–28. [PubMed: 24281296]
3. Leiberg S, et al. Short-term compassion training increases prosocial behavior in a newly developed prosocial game. PLoS One. 2011; 6:e17798. [PubMed: 21408020]
4. Hoge, E. a., et al. Loving-Kindness Meditation practice associated with longer telomeres in women. Brain. Behav. Immun. 2013; 32:159–63. [PubMed: 23602876]
5. Goyal M, et al. Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. JAMA Intern. Med. 2014; 174:357–68. [PubMed: 24395196]
6. Teasdale JD, et al. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. J. Consult. Clin. Psychol. 2000; 68:615–623. [PubMed: 10965637]
7. MacLean, K. a, et al. Intensive meditation training improves perceptual discrimination and sustained attention. Psychol. Sci. 2010; 21:829–839. [PubMed: 20483826]
8. Davidson RJ, et al. Alterations in Brain and Immune Function Produced by Mindfulness Meditation. Psychosom. Med. 2003; 65:564–570. [PubMed: 12883106]
9. Tang Y-Y, et al. The neuroscience of mindfulness meditation. Neuroscience. 2015; 16:213–225. [PubMed: 25783612]
10. Sedlmeier P, et al. The psychological effects of meditation: a meta-analysis. Psychol. Bull. 2012; 138:1139–71. [PubMed: 22582738]
11. Lutz A, et al. Attention regulation and monitoring in meditation. Trends Cogn. Sci. 2008; 12:163–9. [PubMed: 18329323]
12. Austin JH. Zen and the brain: mutually illuminating topics. Front. Psychol. 2013; 4:784. [PubMed: 24187544]
13. Travis F. Transcendental experiences during meditation practice. Ann. N. Y. Acad. Sci. 2014; 1307:1–8. [PubMed: 24673148]
14. Josipovic Z. Neural correlates of nondual awareness in meditation. Ann. N. Y. Acad. Sci. 2013 DOI: 10.1111/nyas.12261.
15. Kozhevnikov M, et al. The enhancement of visuospatial processing efficiency through buddhist deity meditation. Psychol. Sci. 2009; 20:645–653. [PubMed: 19476594]
16. Nash JD, Newberg A. Toward a unifying taxonomy and definition for meditation. Front. Psychol. 2013; 4:1–18. [PubMed: 23382719]
17. Travis F, Shear J. Focused attention, open monitoring and automatic self-transcending: Categories to organize meditations from Vedic, Buddhist and Chinese traditions. Conscious. Cogn. 2010; 19:1110–8. [PubMed: 20167507]
18. Holzel BK, et al. How Does Mindfulness Meditation Work? Proposing Mechanisms of Action From a Conceptual and Neural Perspective. Perspect. Psychol. Sci. 2011; 6:537–559. [PubMed: 26168376]
19. Vago DR, Silbersweig D. a. Self-awareness, self-regulation, and self-transcendence (S-ART): a framework for understanding the neurobiological mechanisms of mindfulness. Front. Hum. Neurosci. 2012; 6:296. [PubMed: 23112770]
20. Lutz A, et al. Investigating the Phenomenological Matrix of Mindfulness-related Practices from a Neurocognitive Perspective. Am. Psychol. 2015 in press.
21. Jha A, et al. Mindfulness training modifies subsystems of attention. Cogn. Affect. Behav. Neurosci. 2007; 7:109–119. [PubMed: 17672382]
22. Hasenkamp W, et al. Mind wandering and attention during focused meditation: a fine-grained temporal analysis of fluctuating cognitive states. Neuroimage. 2012; 59:750–60. [PubMed: 21782031]
23. Tang Y-Y, et al. Short-term meditation training improves attention and self-regulation. Proc. Natl. Acad. Sci. U. S. A. 2007; 104:17152–6. [PubMed: 17940025]

24. Smallwood J, et al. The lights are on but no one's home: Meta-awareness and the decoupling of attention when the mind wanders. Psychon. Bull. Rev. 2007; 14:527–533. [PubMed: 17874601]
25. Wells, A. Emotional disorders and metacognition: Innovative cognitive therapy. John Wiley & Sons Ltd; 2000.
26. Hayes SC. Acceptance and Commitment Therapy, Relational Frame Theory, and the Third Wave of Behavioral and Cognitive Therapies. Behav. Ther. 2004; 35:639–665.
27. Hadot, P. Philosophy as a way of life: Spiritual exercises from Socrates to Foucault. Blackwell; Oxford: 1995.
28. Gethin R. On some definitions of mindfulness. Contemp. Buddhism. 2011; 12:263–279.
29. McCracken LM, et al. Decentering, rumination, cognitive defusion, and psychological flexibility in people with chronic pain. J. Behav. Med. 2014; 37:1215–25. [PubMed: 24838420]
30. Castellanos FX, et al. Characterizing cognition in ADHD: Beyond executive dysfunction. Trends Cogn. Sci. 2006; 10:117–124. [PubMed: 16460990]
31. Waters AJ, et al. Attentional bias to drug cues is elevated before and during temptations to use heroin and cocaine. Psychopharmacology (Berl). 2012; 219:909–921. [PubMed: 21833505]
32. Van Bockstaele B, et al. A review of current evidence for the causal impact of attentional bias on fear and anxiety. Psychol. Bull. 2014; 140:682–721. [PubMed: 24188418]
33. Cohen R, et al. Impairments of attention and effort among patients with major affective disorders. J. Neuropsychiatry Clin. Neurosci. 2001; 13:385–395. [PubMed: 11514646]
34. Castellanos FX, Proal E. Large-scale brain systems in ADHD: Beyond the prefrontal-striatal model. Trends Cogn. Sci. 2012; 16:17–26. [PubMed: 22169776]
35. Linehan M, et al. Dialectical Behavior Therapy for patients with borderline personality disorder and drug-dependence. Am. J. Additictions. 1999; 8:279–292.
36. Segal, ZV., et al. Mindfulness-based cognitive therapy for depression. Guilford Press; 2012.
37. Kabat-Zinn, J. Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness. Bantam; 2013.
38. Butler AC, et al. The empirical status of cognitive-behavioral therapy: a review of meta-analyses. Clin. Psychol. Rev. 2006; 26:17–31. [PubMed: 16199119]
39. Lo CSL, et al. Decentering Mediates the Effect of Ruminative and Experiential Self-Focus on Negative Thinking in Depression. Cognit. Ther. Res. 2014; 38:389–396.
40. Hoge, E. a., et al. Change in Decentering Mediates Improvement in Anxiety in Mindfulness-Based Stress Reduction for Generalized Anxiety Disorder. Cognit. Ther. Res. 2014 DOI: 10.1007/s10608-014-9646-4.
41. Bieling PJ, et al. Treatment-specific changes in decentering following mindfulness-based cognitive therapy versus antidepressant medication or placebo for prevention of depressive relapse. J. Consult. Clin. Psychol. 2012; 80:365–372. [PubMed: 22409641]
42. Brewer JA, et al. Craving to Quit: Psychological Models and Neurobiological Mechanisms of Mindfulness Training as Treatment for Addictions. Psychol. Addict. Behav. 2012; 27:366–379. [PubMed: 22642859]
43. Elwafi HM, et al. Mindfulness training for smoking cessation: Moderation of the relationship between craving and cigarette use. Drug Alcohol Depend. 2013; 130:222–229. [PubMed: 23265088]
44. Fox KCR, et al. Is meditation associated with altered brain structure? A systematic review and meta-analysis of morphometric neuroimaging in meditation practitioners. Neurosci. Biobehav. Rev. 2014 DOI: 10.1016/j.neubiorev.2014.03.016.
45. Lutz A, et al. Mental training enhances attentional stability: neural and behavioral evidence. J. Neurosci. 2009; 29:13418–27. [PubMed: 19846729]
46. Slagter, H. a., et al. Mental training affects distribution of limited brain resources. PLoS Biol. 2007; 5:1228–1235.
47. Van Vugt MK, Slagter H. a. Control over experience? Magnitude of the attentional blink depends on meditative state. Conscious. Cogn. 2014; 23:32–39. [PubMed: 24322326]
48. Brefczynski-Lewis, J. a, et al. Neural correlates of attentional expertise in long-term meditation practitioners. Proc. Natl. Acad. Sci. U. S. A. 2007; 104:11483–8. [PubMed: 17596341]

49. Goldin P, Gross J. Effect of Mindfulness Meditation Training on the Neural Bases of Emotion Regulation in Social Anxiety Disorder. Emotion. 2010; 10:83–84. [PubMed: 20141305]
50. Killingsworth MA, Gilbert DT. A wandering mind is an unhappy mind. Science. 2010; 330:932. [PubMed: 21071660]
51. Mrazek MD, et al. Mindfulness and mind-wandering: finding convergence through opposing constructs. Emotion. 2012; 12:442–8. [PubMed: 22309719]
52. Levinson DB, et al. A mind you can count on: validating breath counting as a behavioral measure of mindfulness. Front. Psychol. 2014; 5:1–10. [PubMed: 24474945]
53. Mason MF, et al. Wandering minds: the default network and stimulus-independent thought. Science. 2007; 315:393–5. [PubMed: 17234951]
54. Fox KCR, et al. The wandering brain: Meta-analysis of functional neuroimaging studies of mind-wandering and related spontaneous thought processes. Neuroimage. 2015
55. Christoff K, et al. Experience sampling during fMRI reveals default network and executive system contributions to mind wandering. Proc. Natl. Acad. Sci. U. S. A. 2009; 106:8719–24. [PubMed: 19433790]
56. Farb, N. a S., et al. Attending to the present: mindfulness meditation reveals distinct neural modes of self-reference. Soc. Cogn. Affect. Neurosci. 2007; 2:313–22. [PubMed: 18985137]
57. Brewer, J. a, et al. Meditation experience is associated with differences in default mode network activity and connectivity. Proc. Natl. Acad. Sci. U. S. A. 2011; 108:20254–9. [PubMed: 22114193]
58. Beck AT. The Current State of Cognitive Therapy. Arch. Gen. Psychiatry. 2005; 62:953–959. [PubMed: 16143727]
59. Disner SG, et al. Neural mechanisms of the cognitive model of depression. Nat. Rev. Neurosci. 2011; 12:467–77. [PubMed: 21731066]
60. Gross JJ. Emotion Regulation in Adulthood: Timing Is Everything. Curr. Dir. Psychol. Sci. 2001; 10:214–219.
61. Webb TL, et al. Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. Psychol. Bull. 2012; 138:775–808. [PubMed: 22582737]
62. Buhle JT, et al. Cognitive Reappraisal of Emotion : A Meta-Analysis of Human Neuroimaging Studies. 2013 DOI: 10.1093/cercor/bht154.
63. Goldin PR, et al. Neural Mechanisms of Cognitive Reappraisal of Negative Self-Beliefs in Social Anxiety Disorder. Biol. Psychiatry. 2009; 66:1091–1099. [PubMed: 19717138]
64. Lamm C, et al. The neural substrate of human empathy: effects of perspective-taking and cognitive appraisal. J. Cogn. Neurosci. 2007; 19:42–58. [PubMed: 17214562]
65. Ruby P, Decety J. How Would You Feel versus How Do You Think She Would Feel ? A Neuroimaging Study of Perspective-Taking with Social Emotions. J. Cogn. Neurosci. 2004; 16:988–999. [PubMed: 15298786]
66. Decety J, et al. An fMRI study of affective perspective taking in individuals with psychopathy: imagining another in pain does not evoke empathy. Front. Hum. Neurosci. 2013; 7:489. [PubMed: 24093010]
67. Pettigrew TF, Tropp LR. How does intergroup contact reduce prejudice? Meta-analytic tests of three mediatorsy. Eur. J. Soc. Psychol. 2008; 38:922–934.
68. Lally P, Gardner B. Promoting habit formation. Health Psychol. Rev. 2013; 7:S137–S158.
69. Mascaro JS, et al. Compassion meditation enhances empathic accuracy and related neural activity. Soc. Cogn. Affect. Neurosci. 2013; 8:48–55. [PubMed: 22956676]
70. Klimecki OM, et al. Differential pattern of functional brain plasticity after compassion and empathy training. Soc. Cogn. Affect. Neurosci. 2014; 9:873–879. [PubMed: 23576808]
71. Maharshi, R. Be as you are: The teachings of Sri Ramana Maharshi. Arkana; 1985.
72. Karr, A. Contemplating Reality: A Practitioner's Guide to the View in Indo-Tibetan Buddhism. Shambhala Publications; 2007.
73. Buddhaghosa. The Path of Purification. Buddhist Publication Society; 2011.

74. Kounios J, Beeman M. The cognitive neuroscience of insight. Annu. Rev. Psychol. 2014; 65:71–93. [PubMed: 24405359]
75. Bowden EM, Jung-Beeman M. Aha! Insight experience correlates with solution activation in the right hemisphere. Psychon. Bull. Rev. 2003; 10:730–737. [PubMed: 14620371]
76. Chi RP, Snyder AW. Facilitate insight by non-invasive brain stimulation. PLoS One. 2011; 6
77. Chi RP, Snyder AW. Brain stimulation enables the solution of an inherently difficult problem. Neurosci. Lett. 2012; 515:121–124. [PubMed: 22440856]
78. Harvey, P. The Selfless Mind: Personality, Consciousness, and Nirvana in Early Buddhism. Routledge; 2004.
79. Gethin, R. The Foundations of Buddhism. Oxford University Press; 1998.
80. Ding X, et al. Short-term meditation modulates brain activity of insight evoked with solution cue. Soc. Cogn. Affect. Neurosci. 2014 DOI: 10.1093/scan/nsu032.
81. Gazzaniga MS. Forty-five years of split-brain research and still going strong. Nat. Rev. Neurosci. 2005; 6:653–659. [PubMed: 16062172]
82. Denny BT, et al. A meta-analysis of functional neuroimaging studies of self- and other judgments reveals a spatial gradient for mentalizing in medial prefrontal cortex. J. Cogn. Neurosci. 2012; 24:1742–52. [PubMed: 22452556]
83. Lemogne C, et al. Negative affectivity, self-referential processing and the cortical midline structures. Soc. Cogn. Affect. Neurosci. 2011; 6:426–33. [PubMed: 20519253]
84. Brewer, J. a, et al. What about the “Self” is Processed in the Posterior Cingulate Cortex? Front. Hum. Neurosci. 2013; 7:647. [PubMed: 24106472]
85. Gallagher S. Philosophical conceptions of the self: implications for cognitive science. Trends Cogn. Sci. 2000; 4:14–21. [PubMed: 10637618]
86. Blanke O, Metzinger T. Full-body illusions and minimal phenomenal selfhood. Trends Cogn. Sci. 2009; 13:7–13. [PubMed: 19058991]
87. Seth AK. Interoceptive inference, emotion, and the embodied self. Trends Cogn. Sci. 2013; 17:565–573. [PubMed: 24126130]
88. Critchley H, Seth A. Will studies of macaque insula reveal the neural mechanisms of self-awareness? Neuron. 2012; 74:423–6. [PubMed: 22578492]
89. Craig ADB. How do you feel--now? The anterior insula and human awareness. Nat. Rev. Neurosci. 2009; 10:59–70. [PubMed: 19096369]
90. Ionta S, et al. Multisensory Mechanisms in Temporo-Parietal Cortex Support Self-Location and First-Person Perspective. Neuron. 2011; 70:363–374. [PubMed: 21521620]
91. Damasio, A. Self comes to mind: Constructing the conscious brain. Random House; 2012.
92. Lutz A, et al. Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. Proc. Natl. Acad. Sci. U. S. A. 2004; 101:16369–73. [PubMed: 15534199]
93. Josipovic Z, et al. Influence of meditation on anti-correlated networks in the brain. Front. Hum. Neurosci. 2011; 5:183. [PubMed: 22287947]
94. Legrand D, Ruby P. What is self-specific? Theoretical investigation and critical review of neuroimaging results. Psychol. Rev. 2009; 116:252–82. [PubMed: 19159156]
95. Gillihan SJ, Farah MJ. Is self special? A critical review of evidence from experimental psychology and cognitive neuroscience. Psychol. Bull. 2005; 131:76–97. [PubMed: 15631554]
96. Bishop SR. Mindfulness : A Proposed Operational Definition. Clin. Psychol. Sci. Pract. 2004; 11:230–241.
97. Shapiro SL, et al. Mechanisms of Mindfulness. J. Clin. Psychol. 2006; 62:373–386. [PubMed: 16385481]
98. Kabat-Zinn J, et al. The clinical use of mindfulness meditation for the self-regulation of chronic pain. J. Behav. Med. 1985; 8:163–190. [PubMed: 3897551]
99. Dreyfus G. Is mindfulness present-centred and non-judgmental? A discussion of the cognitive dimensions of mindfulness. Contemp. Buddhism. 2011; 12:41–54.
100. Dunne J. Toward an understanding of non-dual mindfulness. Contemp. Buddhism. 2011; 12:71–88.

101. Sharf RH. Is mindfulness Buddhist? (and why it matters). Transcult. Psychiatry. 2014
102. Olendzki A. The construction of mindfulness. Contemp. Buddhism. 2011; 12:55–70.
103. Eifring, H., editor. Meditation in Judaism, Christianity and Islam. Bloomsbury Academic; 2015.
104. Salzberg, S. Lovingkindness: The Revolutionary Art of Happiness. Shambhala; 2002.
105. Kang Y, et al. The nondiscriminating heart: lovingkindness meditation training decreases implicit intergroup bias. J. Exp. Psychol. Gen. 2014; 143:1306–13. [PubMed: 23957283]
106. Rinpoche, YM. Turning Confusion into Clarity: A Guide to the Foundation Practices of Tibetan Buddhism. Snow Lion Publications; 2014.
107. Lingpa, J. Deity, Mantra, and Wisdom: Development Stage Meditation in Tibetan Buddhist Tantra. Snow Lion Publications; 2007.
108. Ricard, M. Altruism: The power of compassion to change yourself and the world. Little, Brown and Company; 2015.
109. Singer T, Klimecki OM. Empathy and compassion. Curr. Biol. 2014; 24:R875–R878. [PubMed: 25247366]
110. Batson CD, et al. Distress and Empathy : Two Qualitatively Distinct Vicarious Emotions with Different Motivational Consequences. J. Pers. 1987; 55:19–39. [PubMed: 3572705]
111. Jackson PL, et al. How do we perceive the pain of others? A window into the neural processes involved in empathy. Neuroimage. 2005; 24:771–9. [PubMed: 15652312]
112. Preston SD, Waal F.B.M. De. Empathy : Its ultimate and proximate bases. Behav. Brain Sci. 2002; 25:1–72. [PubMed: 12625087]
113. Keltner, D.; Goetz, JL. Compassion.. In: Baumeister, RF.; Vohs, KD., editors. Encyclopedia of Social Psychology. Sage Publications; 2006. p. 159-161.
114. Klimecki OM, et al. Functional neural plasticity and associated changes in positive affect after compassion training. Cereb. cortex. 2013; 23:1552–61. [PubMed: 22661409]
115. Fredrickson BL, et al. Open hearts build lives: positive emotions, induced through loving-kindness meditation, build consequential personal resources. J. Pers. Soc. Psychol. 2008; 95:1045–62. [PubMed: 18954193]
116. De Vignemont F, Singer T. The empathic brain: how, when and why? Trends Cogn. Sci. 2006; 10:435–41. [PubMed: 16949331]
117. Fan Y, et al. Is there a core neural network in empathy? An fMRI based quantitative meta-analysis. Neurosci. Biobehav. Rev. 2011; 35:903–11. [PubMed: 20974173]
118. Weng HY, et al. Compassion training alters altruism and neural responses to suffering. Psychol. Sci. 2013; 24:1171–80. [PubMed: 23696200]
119. Lutz A, et al. Regulation of the neural circuitry of emotion by compassion meditation: effects of meditative expertise. PLoS One. 2008; 3:e1897. [PubMed: 18365029]
120. Buchanan TW, et al. The empathic, physiological resonance of stress. Soc. Neurosci. 2012; 7:191–201. [PubMed: 21777106]
121. Cosley BJ, et al. Is compassion for others stress buffering? Consequences of compassion and social support for physiological reactivity to stress. J. Exp. Soc. Psychol. 2010; 46:816–823.
122. Pace TWW, et al. Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial stress. Psychoneuroendocrinology. 2009; 34:87–98. [PubMed: 18835662]
123. Pace TWW, et al. Engagement with Cognitively-Based Compassion Training is associated with reduced salivary C-reactive protein from before to after training in foster care program adolescents. Psychoneuroendocrinology. 2013; 38:294–9. [PubMed: 22762896]
124. Emmanuel, SM., editor. A Companion to Buddhist Philosophy. Wiley-Blackwell; 2013.
125. Buddhaghosa, B. The path of purification: Visuddhimagga. Buddhist Publication Society; 1991.
126. Roberts, PA. Mahamudra and Related Instructions: Core teachings of the Kagyu Schools. Wisdom Publications; 2011.

Box 1. Forms of Attentional Meditation

In both traditional and clinical contexts, the capacity to sustain a heightened awareness of thoughts, behaviors, emotions, and perceptions is thought to be a central feature of mindfulness meditation [18,20,28,96–98]. Though there is considerable discussion concerning the exact nature of mindfulness practice and its relationship to the construct of mindfulness in traditional Buddhist frameworks [28,99–102], there is general agreement that the cognitive process that we refer to here as meta-awareness plays a central role across a broad spectrum of meditation practices. Following our prior categorization [11], here we propose two main categories of attentional meditation, along with two new subcategories that allow for a more nuanced discussion of different styles of practice in this family.

Focused attention (FA) practices involve a narrowing of attentional scope and the cultivation of one-pointed concentration on a single object [11,48]. The presence of meta-awareness distinguishes the attentional stability achieved through this form of meditation from other forms of absorption, such as the stable attentiveness that occurs when one is engaged in an engrossing conversation or playing an interesting game. **Open monitoring** (OM) practices similarly involve the cultivation of meta-awareness, but they do not involve selecting a specific object to orient one's attention. Rather, attentional scope is expanded to incorporate the flow of perceptions, thoughts, emotional content, and/or subjective awareness. OM meditation can be further divided into **object-oriented open monitoring**, which involves directing one's attention to whatever thoughts, percepts, and sensations enter the field of awareness, and **awareness-oriented open monitoring**, referring to the sustained recognition of the knowing quality of awareness itself. Both forms of open monitoring meditation are similar in many ways to practices discussed below in the context of the deconstructive family. What distinguishes them from deconstructive forms of meditation is that their primary objective is the stabilization of meta-awareness in relation to a particular attentional configuration. As we will see below, in the deconstructive family a similar configuration of attention may be employed, but for different purposes (such as the cultivation of insight into the nature of sensory experience, for example).

Box 2. Ethics and Forms of Constructive Meditation

The cultivation of virtuous qualities is a common pursuit in many contemplative and philosophical traditions [27,79,103]. The constructive family of meditation is one important method that allows for this cultivation. While practices in this family necessitate the presence of meta-awareness, and also serve to strengthen and sustain meta-awareness, the approach taken in this family is markedly different from practices in the attentional family, insofar as this style of practice involves actively changing cognitive and affective content, as opposed to simply observing or noting the presence of thoughts, emotions, and perceptions.

Though there are many different styles of constructive meditation, we have identified three important subgroups, which we refer to as the relationship orientation, values orientation, and perception orientation. The **relationship orientation** emphasizes nurturing harmonious relationships with others. In Buddhist meditation, this style of practice often involves the extension of kindness and compassion first to specific individuals, and eventually to all beings [104]. This subgroup of meditation may impact specific psychological factors, by decreasing in-group bias, for example [105], and thereby enhance important dimensions of well-being such as positive relationships and meaning in life [2].

Practices in the **values orientation** subgroup involve the integration of ethical frameworks or values into one's ongoing perspective. One common practice in this subgroup is the contemplation of one's own mortality, which is found in Buddhist practice as well as in Greco-Roman philosophy. In Platonic philosophy, for example, contemplations of death functioned to bring the individual into contact with a sense of self that transcends the boundaries and needs of the physical body [27], while in Buddhism contemplating the fragility and fleeting nature of life is often intended to re-orient the mind toward what is truly meaningful in life [106].

Practices that involve a **perception orientation** aim to alter perceptual habits as a way to induce shifts in implicit self-schema. A common practice in Tibetan Buddhism, for example, is the so-called “development stage” [107], a form of meditation that aims to alter both the perception of sensory objects as well as the subjective perspective itself. This perceptual shift may instantiated by imagining oneself to be the embodiment of compassion, for instance, and viewing other individuals and one's environment from that perspective. Preliminary data suggests that this practice may enhance one's ability to access heightened visuospatial processing resources [15].

Box 3. Empathy, Compassion, and the Brain

One of the most widely studied practices in the constructive family is the cultivation of compassion. Compassion training is held to alter core self-related processes, initiating a shift from self-oriented cognitive, affective, and behavioral patterns to patterns that are oriented toward the well-being of others [108]. In the field of psychology, empathy is characterized as the ability to understand or resonate with another's emotional state [109–112] and compassion as a concern for the suffering of another accompanied by the motivation to help [109,113]. In the absence of compassion, empathic distress can lead to negative affect [64,114], while compassion is associated with well-being and positive emotions [114,115].

Research into the neural correlates of empathy have found that similar regions, including the insula, the anterior and mid-cingulate cortices, and the supplementary motor area, are activated across various forms of empathy [111,116,117]. By way of contrast, compassion is linked to regions associated with reward, positive affect, and feelings of affection, such as the ventral striatum and medial orbitofrontal cortex [70,114]. Studies of compassion training have also found increased activation in regions associated with executive function, including the dorsolateral prefrontal cortex [118] and the anterior cingulate cortex [70,119]. Though further research is required to determine the unique roles that each of these regions plays in the development of compassion, these preliminary findings suggest that cultivating compassion strengthens multiple networks, each of which may affect distinct psychological processes and thereby contribute to well-being in different ways.

Empathy and compassion also affect the peripheral biology of the human body. Perceiving stress in another individual has been linked to elevated cortisol levels, a relationship that is more robust in those with high trait empathy [120], whereas compassion has been linked to lower levels of cortisol reactivity [121]. Preliminary studies of compassion training have found associations between the amount of time spent engaging in compassion training and inflammatory biomarkers, with more compassion training leading to decreased levels of both C-reactive protein and interleukin (IL)-6 [122,123]. These findings suggest that the mind can be trained to orient itself toward the well-being of others and that this shift from self- to other-orientation impacts both the brain and the peripheral biology of the body, and in particular the way the body responds to environmental stressors. Further research is required to elucidate the precise mechanisms through which these states affect the body, and also to investigate how changes in peripheral biology reciprocally impact psychological processes and the relationship between these processes and well-being.

Box 4. Cognitive Reification and Forms of Deconstructive Meditation

The deconstructive family represents a range of meditation practices that employ self-inquiry to elicit insight into in the nature and dynamics of conscious experience. We have identified three subgroups of the deconstructive family: object-oriented insight, subject-oriented insight, and non-dual-oriented insight. **Object-oriented insight** practices employ self-inquiry to investigate the objects of consciousness. This may involve, for example, investigating physical sensations and noting how they are constantly changing [102]. **Subject-oriented insight** practices involve inquiries into the nature of thought, perception, and other cognitive and affective processes. In this style of practice one may, for instance, dissect thoughts and emotions into their component parts [72]. **Non-dual practices** are designed to elicit an experiential shift into a mode of experiencing in which the cognitive structures of self/other and subject/object are no longer the dominant mode of experience. These practices often emphasize the importance of releasing attempts to control, direct, or alter the mind in any way and also serve to undo the reification of a witnessing “observer” that is separate from the objects of awareness [14,100]. The goal of all three styles of practice in the deconstructive family is not simply to maintain awareness of different aspects of experience, as we find with the attentional family, but rather to gain direct, experiential insight into the nature and dynamics of experience.

Though deconstructive meditations are used to inquire into many facets of conscious experience, the nature of the self is a topic of inquiry in a broad range of contemplative and philosophical practices. To give two important examples, examining the self is linked to the highest good in ancient Greek philosophy [27] and as the key to undoing the cycle of suffering in Buddhism [78]. In Buddhist meditation, the primary target of many self-inquiry practices is cognitive reification, the implicit belief that thoughts, emotions, and perceptions are accurate depictions of reality [124]. Deconstructive practices in this tradition are especially concerned with the view that the self is enduring and unitary, since a reified sense of self is believed to be the primary cause of suffering and states of discontent [78]. Buddhist deconstructive practices, therefore, often involve exploring the experience of subjectivity by inquiring into the various components that comprise the self, for example [125], or by examining the relationship between the self as agent or observer and the objects it interacts with [126].

Outstanding Questions

1. How do the various forms of training found in the three families interact with one another? Is there an optimal sequence or does it depend on the individual? What are the order effects of individual practices?
2. To what extent do the effects of specific meditations rest on the frameworks, beliefs, and worldviews that underlie these practices?
3. How do self-schema arise over the course of ontogeny, what function do they serve, and how are they related to different facets of well-being?
4. Is meta-awareness distinct from related constructs such as psychological distancing and introspection? How does it relate to other forms of attention, such as ordinary attentiveness? What are its neural and behavioral markers?
5. How does meta-awareness mediate changes in other processes, such as emotion regulation, executive function, and the unlearning of habits?
6. How do compassion training and other constructive family practices affect specific self-related processes? How might changes in these processes enhance different domains of well-being?
7. How are insight and/or cognitive reification effectively measured in behavior, in the brain, and in peripheral physiology?

Highlights

- Specific mechanisms and targets of different forms of meditation are proposed.
- We present a model of attentional, constructive, deconstructive meditations.
- Meta-awareness, experiential fusion, self-schema, self-inquiry, and insight are discussed.

Table 1

Typology of Meditation Practices and Related Clinical Interventions

This typology groups commonly practiced forms of meditation and meditation-based clinical interventions into subcategories of each of the three families. Please note that while many practices contain elements of all three families, categorizations in this framework are based on the primary mechanisms of individual practices. Given the complexity of each practice listed here, we present this system as an initial step in the long process of studying the diversity of meditation practices. See supplementary materials for descriptions of individual practices and relevant citations.

Attentional Family	**Constructive Family**	**Deconstructive Family**
Focused Attention (FA) • Jhana Practice (Theravada) • Breath Counting (Zen) • Body Awareness Practices (Zen/Tibetan) • Shamatha/Calm Abiding with Support (Tibetan) • Mantra Recitation (various traditions)	Relationship Orientation (C-R) • Loving-kindness and Compassion (Theravada, Tibetan) • Bodhichitta/Bodhisattva Vow (Tibetan/Zen) • Centering Prayer (Christian) • CCARE Compassion Cultivation Training (Clinical) • Cognitively-based Compassion Training-Compassion component (Clinical)	Object-oriented Insight (OO-I) • Mindfulness-based Cognitive Therapy - Cognitive Component (Clinical) • First and Second Foundations of Mindfulness (Theravada, Tibetan) • Vipassana/Insight (Theravada) • Analytical Meditation (Tibetan) • Koan Practice (Zen)
Open Monitoring (Object-orientation: OM-O) • Cultivation of Attention (Greco-Roman Philosophy) • Choiceless Awareness (Tibetan) • Mindfulness-based Stress Reduction (Clinical) • Dialectical Behavior Therapy-Mindfulness Component (Clinical) • Mindfulness-based Cognitive Therapy-Mindfulness Component (Clinical) • Acceptance and Commitment Therapy-Mindfulness Component (Clinical)	Values Orientation (C-V) • The Six Recollections (Theravada) • The Four Thoughts (Tibetan) • Contemplations of Mortality (Theravada, Tibetan, Zen, Greco-Roman philosophy) • Well-being Therapy (Clinical)	Subject-oriented Insight (SO-I) • Cognitive Behavior Therapy (Clinical) • Third and Fourth Foundations of Mindfulness (Theravada, Tibetan) • Mahamudra Analytical Meditation (Tibetan) • Dzogchen Analytical Meditation (Tibetan) • Koan practice (Zen)
Open Monitoring (Subject-orientation: OM-S) • Shamatha/Calm Abiding without Support (Tibetan)	Perception Orientation (C-P) • Development stage (Tibetan) • Meditation on Foulness (Theravada)	Nondual-oriented Insight (NO-I) • Muraqaba (Sufi) • Mahamudra (Tibetan) • Dzogchen (Tibetan) • Shikantaza (Zen) • Self-inquiry (Advaita Vedanta)