

# Mindfulness: In mind? In Brain?

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## Introduction

There has been a surge of interest in mindfulness across all sectors of society as this ancient practice of *deliberately paying attention, moment by moment and without judgement* has moved out of monasteries and into the mainstream. With the possibility of improvements in emotional regulation and cognitive function, it is understandable why schools, mental and physical health teams, corporations, criminal justice, and a multitude of other settings are considering mindfulness training, not only for their clients/patients but also for their staff.

The level of acceptance of this training method in part derives from a growing evidence base, with research conducted on a variety of populations and assessed with standardized clinical measurements.<sup>1</sup> Much of this work has tested the standardized eight-week training interventions Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT). These have been trialled in the physical and mental health setting with promising results (Grossman et al., 2004; Fjorback et al., 2011). In the UK, MBCT is advocated by NICE as a treatment for those with chronic recurring depression, with some suggestion that it may be particularly helpful for those who additionally have some form of childhood trauma (Williams and Kuyken, 2012; Williams et al., 2014; Kuyken et al., 2015). As a research field, this area must still be considered as emerging, as the majority of work describes pilot feasibility studies with no or inadequate control groups. Despite this, the take-up and interest from the general public indicates that there is a need and an interest in a way to develop a deeper understanding of the mental habits and patterns that create suffering.

A further piece in the puzzle is the emergence of increasing number of neuroimaging studies which speak to the putative mechanisms of change occurring with this training (Holzel et al., 2011; Marchand, 2014). This work has captured the attention of cognitive neuroscientists, clinicians and the wider public as it provides a scientifically-based rationale for the practices. This may serve a function to support the 'why' behind the practices if they are conducted outside a spiritual context. It also opens up this work to those who may not be interested in spiritual issues and can allow discussion of concepts such as 'emotional regulation' or 'emotional tolerance' in settings where they otherwise may not be discussed. The removal of the spiritual and/or key Buddhist principles underlying mindfulness training as it is presented in its secular context is matter of on-going debate amongst mindfulness practitioners (Grossman and Van Dam, 2011).

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<sup>1</sup> See [www.mindfulexperience.org](http://www.mindfulexperience.org) for a summary of the research and to receive monthly updates

The imaging work to date spans a number of neuroimaging methods including PET and SPECT, DTI, fMRI (functional and structural) and EEG<sup>2</sup>. The following considers fMRI studies as this is the author's main area of expertise. The studies conducted have participants who might be very experienced monks (the so-called Olympic athletes of meditation), lay practitioners (those with a serious commitment to practice and (most often) Buddhism but who are living a 'normal' life), those who have undergone a mindfulness training program (naïve to meditation and mindfulness but then trained for eight weeks) and those with so-called 'dispositional' mindfulness (who without training score highly on scales of mindfulness). Individual brain scans have assessed structural changes in key regions of the brain (for example, the hippocampus), functional changes in regions associated with emotion and attention, and/or changes in connectivity between these regions. Participants may be required to lie still in the scanner and/or be prompted via experimental tasks to engage with emotionally provocative stimuli, attentional and other cognitive tasks. Typically in this work the sample sizes are small and there remain issues about appropriate control groups. Despite this, a convergence of findings suggest that it is possible to change the brain through mindfulness practices. This work raises the question of experience-dependent neuroplasticity, when the experience is an internally directed attentional focus<sup>3</sup>. Alan Wallace has described this as a 'voluntary evolution of consciousness'. Through this process of training our 'internal' attention, by means of some amazing (if still poorly understood) neural mechanisms, it is possible to improve on what we have.

Broadly speaking, the neuroimaging work has indicated changes in brain regions related to attention regulation; body awareness; emotion regulation (including reappraisal and exposure, extinction, and reconsolidation) and changes in perspective on the self (Holzel et al., 2011). Posner's tripartite model of attention (including orienting, alerting and executive attention, (Raz and Buhle, 2006; Posner and Rothbart, 2007) has been used as a model to understand the different aspects of attentional training that occur in the process of mindfulness training. In the early-stage focused attention training, the individual is asked to focus and sustain attention (using intention-derived voluntary attentional mechanisms) on a particular object – often the breath or the body. The individual is required to monitor when attention has been captured by something else (perhaps an external distraction like a sound or an internal distractor such as a thought, memory or image). Becoming aware that attention is no longer on the object but has instead been captured by a distractor is sometimes referred to as *the moment of mindfulness*. It is here that awareness of a discrepancy has occurred and now a choice is possible, to carry on thinking or remembering or re-orient the attention back to the object. The capacity to monitor the whole endeavour, and to take action when the intended object is no longer the object of attention, is called *executive attention*. This practice, which may appear to be boring or pointless, is in fact the foundation of what is required to

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<sup>2</sup> PET (Positron Emission Tomography) SPECT (Single-photon emission computed tomography), fMRI (Functional Magnetic Resonance Imaging), DTI (Diffusion Tensor Imaging).

<sup>3</sup> A short video on neuroplasticity can be found at <https://www.youtube.com/watch?v=ELpfYCZa87g>

later on - to be able to notice when we are in the grip of a strong negative thought or emotion and be able to choose how to respond. This is the freedom that can be obtained with practice.

One stimulus that often grabs our attention and triggers unhelpful habits is a strong emotion felt in the body. A recent study has mapped the bodily signature of different emotions (Nummenmaa et al., 2014), showing that individuals are able to identify distinct regions of the body where there are increases and decreases in sensation. This ability to detect emotions in the body has been ascribed to the right anterior insula (Craig, 2009), a region that is also known to be larger in those who practice various types of meditation (Luders et al., 2012) in a manner that is positively correlated with years of meditation practice. Those who have trained in mindfulness may find this unsurprising since a key part of the practice is training in the ability to stay with, tolerate and even investigate (in a gentle and curious way) how emotions are expressed in the body. Continual practice in this allows for an increasingly refined understanding of the subtleties of different emotions and their time course – the ultimate training in self-awareness and emotion regulation.

In the clinical setting, we meet individuals who for various reasons have developed habits of reacting to strong emotions that are unhelpful. This might include the avoidance seen in those who use drugs or alcohol to numb or dull emotional pain, or distractions such as keeping busy or caring for others so as not to face what is otherwise difficult. Through the practice of mindfulness, individuals are initially supported in staying with the present moment experience of the emotion, engaging with it, or ‘turning towards’ the experience in the body as way to gain confidence that the emotion *can* be tolerated. During this process, the mental habits that have been practiced over the years are revealed. They are considered as ‘once-helpful’ behaviours that developed within a system where adaptive ways of coping were not modelled or taught. Through a mindfulness practice, these habits are observed in a non-judgemental way and new habits are encouraged.

Research by Farb et al. (2007) suggests that prior to mindfulness training, the experience of strong emotions, triggering a response in the right insula cortex, is strongly correlated with activity in the medial prefrontal cortex, an area related to self-referential processing. In the grip of a strong emotion, it can be ‘all about me’ and we have little space to think about others (an experience we can all relate to when we are stressed!). Following mindfulness training, Farb’s work shows that this correlation is reduced and instead a stronger correlation is found between the insula and the lateral prefrontal cortex. This region has been implicated when we are able to name and label emotions (Lieberman et al., 2011) a function which is known to down-regulate limbic reactivity. Thus with mindfulness, the present moment engagement with the felt sense of the emotion in the body, perhaps with some additional labelling or ‘noting’ of experience, allows us to reduce the ‘it’s all about me’ processing during strong emotions and allows a new way of responding. Possibly this new way also means that even when we are feeling strong emotions, we are able to stay connected to others.

This latter point is particularly relevant when considering ways in which to support health care, educational and other staff who work in environments where strong emotions are part of the job and poor emotion regulation or the development of unhelpful strategies for managing emotions may impact on performance. Recent work by Grepmaier et al. (2007) has suggested that for those staff working in the in-patient psychiatric setting, just practicing meditation for themselves (not as an intervention for patients) had an impact on the patients' symptom scores. Mindfulness training for staff is thus as important as it is for the patients.

Studies exploring the neural correlates of compassion have also implicated the right anterior insula as a structure that is active when those with high levels of compassion (monks) are provoked by negative emotional stimuli (Lutz et al., 2008). This work indicates that meditation training does not dampen our emotional response; rather it may increase it, allowing those who meditate to be more attuned to their own and others' emotions. What is different, however, is the reduction in reactivity – the need to get away from the emotion (or to hold onto it). When emotions can be managed in this way, with openness, curiosity and kindness, a new type of emotional intelligence and freedom is possible. This is an aspiration not just for 'patients' but for us all.

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