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Empirical explorations of mindfulness: Conceptual and methodological conundrums

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Abstract

This commentary reflects on the articles in this Special Issue. The appearance of this group of articles in this Journal underscores the important idea that a major target of mindfulness practice is on emotion. Transformation in trait affect is a key goal of all contemplative traditions. This commentary addresses several key methodological and conceptual issues in the empirical study of mindfulness. The many ways in which the term “mindfulness” is used in the articles in this Special Issue are noted and they include its reference to states, traits and independent variables that are manipulated in an experimental context. How the term “mindfulness” is conceptualized and operationalized is crucial and for progress to be made it is essential that we qualify the use of this term by reference to how it is being operationalized in each context. Other methodological issues were considered such as the duration of training and how it should be measured, and the nature of control and comparison groups in studies of mindfulness-based interventions. Finally, the commentary ends with a consideration of the targets within emotion processing that are likely to be impacted by mindfulness. This collection of articles underscores the substantial progress that has occurred in the empirical study of mindfulness and it is a harbinger of a very promising future in this area.

Keywords

mindfulness; meditation; emotion; affective neuroscience

The very fact of this Special Issue of *Emotion* on Mindfulness and Emotion is a testament to two important facts: first is that there is a sufficiently large corpus of serious scientific interest to warrant this number of premier journal pages; second is the implicit recognition that a major target of mindfulness practices is emotion. Although research on meditation has been occurring for several decades, it is only very recently that serious attention has been paid to the impact of meditation on emotional processes. For much of its history, the research work on meditation has been more narrowly focused on changes in basic biological processes without direct behavioral measures, or focused on changes in attention and related cognitive processes that were once assumed to be the primary targets of meditation practice.

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The contemplative traditions from which commonly taught meditation practices have arisen are clear in identifying affective qualities as central targets of the contemplative practices (see Lutz et al., 2007 for review). Kindness, compassion and equanimity are all regarded as qualities that can be cultivated and enhanced through mental training. Indeed the cognitive changes that are also hypothesized to occur with mental training, such as improvements in certain components of attention, are viewed in these traditions as building blocks and tools to facilitate the most important types of transformation, which are in the emotional realm (Dalai Lama & Ekman, 2008). It is thus very fitting that a Special Issue on Mindfulness appear in a journal devoted to the scientific study of emotion.

This brief commentary will address several conceptual and methodological issues in the scientific study of mindfulness and emotion. Included will be a discussion of mindfulness as a state, a trait and an intervention; duration of training; nature of control groups; heterogeneity among types of meditation practice; cognition-affect interactions in meditation effects; and finally implications of basic research and directions for the future.

Mindfulness: State, trait, intervention

In the collection of articles in this Special Issue, the term “mindfulness” is used and operationalized in many different ways. In one of the articles in this Special Issue (Way et al., this issue), mindfulness is operationalized as a trait measured by the Mindful Attention Awareness Scale (Brown & Ryan, 2003) that asked participants to rate items such as “I find it difficult to stay focused on what’s happening in the present” (reverse scored). Variations on this measure were then examined in relation to measures of brain function. This strategy assumes that individuals differ in a dispositional quality of mindfulness. These individual differences are presumed to have arisen through a complex interaction of genetic predisposition, environmental circumstances and explicit training.

In other articles in this Special Issue, some sort of training that included mental exercises designed to strengthen mindfulness were used and participants were tested before and after this training. In some cases (e.g., Farb et al., this issue; Goldin & Gross, this issue), the training consisted of Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990), close variants of MBSR (e.g., Jha et al., this issue) or Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams & Teasdale, 2002). In other cases, very short-term training was implemented (8 minutes; Erisman & Roemer, this issue) in the context of the experiment itself. In the case of the 8-minute training, mindfulness can be best viewed as a state, not unlike that which would occur in response to a phasic elicitor of emotion. And finally in other cases (Grant et al., this issue; Perlman et al., this issue), long-term practitioners of a meditation have been tested to assess the putative impact of the cumulative training on both behavioral and neural measures. In these latter studies, the length of training varies considerably from approximately 2000–45,000 lifetime hours of practice. In each of these cases, the term “mindfulness” has been used to refer to quite different types of processes. While it is not unreasonable to infer that mindfulness was operative in some form in each of these very different cases, it is also crucial that we not assume that mindfulness as operationalized in each of these cases is the same. In fact, it may be very different. In previous research from my laboratory (Brefczynski-Lewis, et al., 2007), we demonstrated

that even among long-term practitioners, those with very long-term training (>34,000 lifetime hours) showed a different profile of brain activity during a meditation practice compared with those with somewhat less training (<34,000 lifetime hours). In this study it appeared that the most highly experienced experts were performing an attentional focusing task using fewer neural resources. We interpreted this finding as reflecting less effort required for the task.

A very important question left unresolved by the articles in this Special Issue and in need of future study is the question of whether participants can reliably report on the quality and/or magnitude of their mindfulness. In simple terms, are questionnaire-based self-reports of mindfulness valid? The posing of this question immediately raises the further question of how one would go about validating such a self-report instrument. What are objective measures of mindfulness? Here some of the behavioral studies of mind wandering, a state roughly opposite to mindfulness, undertaken by Schooler and his colleagues might be valuable (see Smallwood & Schooler, 2006 for review). In these studies, behavioral, electrophysiological and hemodynamic signals of mind wandering have been measured (e.g., Smallwood et al., 2008; Christoff et al., 2009). It is not at all clear the extent to which self-report measures of dispositional mindfulness relate to objective measures of mind-wandering. This question needs to be addressed in future research. Whatever answer is obtained to this question will be informative. If it is found that the self-report measures of dispositional mindfulness are strongly associated with objective measures of mind-wandering, then we can have more confidence in their use as individual difference measures as exemplified in the Way et al., (this issue) report. If it is found that the dispositional measures of mindfulness are not strongly associated with behavioral and/or biological measures of mind-wandering, then we must be cautious in their use as dispositional measures of mindfulness. It also suggests that selecting participants on the basis of objective measures of mind-wandering might be helpful as a research strategy to identify individual variation in trait levels of mindfulness. Of course, it necessary to establish that the behavioral and biological measures of mind-wandering are stable over time, something that has not yet been systematically examined.

Duration of training

The duration of mindfulness training examined in the articles in this Special Issue range considerably from minutes to years. Relatedly, the intensity of training varies tremendously. It is thus potentially problematic to assume that the effects of these variable length training periods is only quantitative. It would be ideal to examine longitudinal changes at different points in the training among the same participants. Such a strategy would permit the disentangling of subject selection effects from actual training effects. Subject selection variables would presumably operate in some studies since long-term training is something that might only be undertaken by an individual who is different to begin with. Unless we had measures at different points along the continuum of training, we could not disentangle training effects from the study of those individuals who are likely to persist in such training. None of the studies in this Special Issue prospectively compare different lengths of training. However a number of studies do examine relations between reports of length of training and various behavioral and biological indices. Of particular interest are the findings reported by

Grant et al. (this issue) where they showed that length of training was associated with variations in gray matter density in several different brain regions. In the Jha et al. (this issue) report, these investigators reported that the more time participants reported practicing, the less degradation in working memory capacity occurred over time in a highly stressful circumstance (pre-deployment to Iraq in military personnel).

An issue of methodological and conceptual import is how best to capture the quantity and quality of non-class time practice or training in these studies. While participants can be expected to provide reasonably accurate reports of the times of their formal practice periods, as was discussed above in the section on mindfulness, it is not clear the extent to which participants can accurately provide self-reports on the quality of practice. Moreover, it is frequently the case that periods of practice can occur quire informally. For example, a practitioner might well remember to attend non-judgmentally to thoughts and feelings as they arise in a stressful situation to facilitate a more adaptive response to the challenge. It is likely that this would not be counted as a practice period when the participant was asked to tally the minutes of practice and yet, such periods of practice in the real world may have effects as if not more important than those occurring in response to formal practice.

Control and comparison groups

A distinction between control and comparison groups in studies that use a meditation-based intervention is warranted. A comparison condition implies a condition during which participants are given another intervention that is structurally comparable to the mindfulness intervention. Ideally, participants would be randomly assigned to condition and the conditions would be matched on the many non-specific factors that have been found to produce beneficial change (e.g., Baskin et al., 2003). Included among these non-specific effects is the confidence of the therapist or teacher in the effectiveness of the intervention that is being taught and the professional training of the teacher. In studies of meditation to date, this form of comparison condition has been very rarely used (for an exception see Grossman et al., 2007). If we ultimately wish to attribute the changes observed in studies of mindfulness-based interventions to the active ingredient of mindfulness per se rather than the many non-specific factors (e.g., positive expectations; confidence of the teacher, etc.) it is imperative to utilize comparison conditions that permit such a rigorous comparison. The state of research in this area is still in its infancy but as we move forward it will be increasingly important to use rigorous comparison conditions to which participants are randomly assigned. Of course, in studies of long-term practitioners, this is not possible but these studies need to be supplemented with longitudinal studies in less experienced individuals where changes over time can be tracked.

The affective targets of meditation

Each of the articles in this Special Issue show that mindfulness interventions, experience in mindfulness meditation practice or dispositional mindfulness is associated with different types of affective reactions. For example, reactivity to negative self-beliefs, sad film clips and physical pain were all examined while behavioral and/or biological measures were obtained. In general, decreased reactivity in select brain regions in the mindfulness

practitioners was observed in most studies, though some also found increased reactivity in brain regions associated with visceral and somatosensory representations (e.g., Farb et al., this issue). Hargus et al. used a content rating system to examine the impact of mindfulness training on meta-awareness in patients with suicidal depression. High levels of meta-awareness would be revealed when patients clearly do not strongly identify their selves with their thoughts. A suicidal thought would be experienced as "depression talking" rather than a fundamental component of the self. Hargus et al. (this issue) found that eight weeks of mindfulness-based cognitive therapy significantly increased meta-awareness defined in this way. This latter study suggests an important target of mindfulness training on emotion. Mindfulness training can be hypothesized to change an individual's relationship to his or her emotions so that they are not viewed as fundamental constituents of self, but rather as more fleeting phenomena that appear to the self. This finding has important implications for searching for the neural correlates of at least this component of mindfulness' effect on emotion. We would not necessarily expect mindfulness training to alter the neural circuitry of emotional responding in response to a challenge per se, but rather we might expect a change in the connectivity between emotion circuits and those used for the representation of self. We would predict decreased connectivity between emotion processing and self-relevant processing regions. Similarly in response to pain we might expect decreased connectivity between pain matrix regions (i.e., brain circuits consistently identified as activating in response to pain), particularly the sensory components of pain, and self-related circuitry. These hypothesized differences in connectivity might be a neural reflection of the altered relationship to emotions that a person might experience with mindfulness training.

A crucial distinction in both the neuroscience and psychophysiology literature on emotion is the distinction between emotional reactivity and emotion regulation (see e.g., Jackson et al., 2003; Ochsner and Gross, 2005; Urry et al., 2006). Uninstructed emotion regulation is often studied as the natural recovery of certain physiological systems after the offset of an elicitor of negative emotion. Excessive identification with the negative emotion should result in a perseveration or lingering of the negative affect, following the offset of the acute elicitor. We might thus expect that the largest temporal region during which a transformation in the affective reaction might occur is in the post-stimulus recovery period following the offset of a negative stimulus. In other words, meditation training should speed the recovery following the offset of a negative stimulus. This is an issue that needs further study and there are no systematic studies of this question in the meditation literature. There are some hints from some of the articles in this Special Issue that the circuitry of reactivity itself may be transformed through mindfulness practice, though whether these effects are more associated with automatic recovery versus reactivity per se is difficult to disentangle with the paradigms that were used.

It should be noted that there are forms of meditation other than mindfulness meditation that involve the explicit cultivation of positive affect (see e.g., Lutz et al., 2007). Such forms of meditation include loving-kindness and compassion practices. Based upon other data on the neural bases of positive affect and its regulation (Davidson, Fox & Kalin, 2006) we would predict that these forms of meditation might directly activate circuits specifically associated with positive affect including regions in the ventral striatum and orbital frontal cortex. These forms of meditation might also strengthen certain intentions and aspirations. Based upon

recent research on self-control in the face of affective conflict, (Hare et al., 2009) we would expect increases in activation in dorsolateral regions of the prefrontal cortex with this form of meditation training. Whether these regions overlap with those that are cultivated in mindfulness practices is an interesting and important question and one that has not been addressed.

Summary and conclusions

Research on mindfulness is entering a new era and coming into the mainstream. The group of articles in this Special Issue exemplifies research on the impact of mindfulness on, or the relation between mindfulness and, different components of emotion processing and emotion regulation. Affective processes are a key target of contemplative interventions. The long-term consequences of most contemplative traditions include a transformation of trait affect. After all, if change was not enduring and did not impact everyday life, it would be of little utility. This brief commentary highlights several important conceptual and methodological issues that are central to research on mindfulness, particularly as it is applied to transforming emotion. The term “mindfulness” has been used to refer to an extraordinarily wide of phenomena in this group of articles, ranging from mindfulness as a state, to mindfulness as a trait and finally mindfulness as an independent variable, i.e., something this is manipulated in an experiment. It is imperative that we always qualify our use of this term by the methods we use to operationalize the construct. The measurement of mindfulness and the duration of its training, and the development of adequate comparison conditions against which to compare mindfulness training remain as important issues for further study. Moreover additional research attention on the potential targets within the emotion domain of contemplative practices is required. Great progress has been in this research area and we have much to look forward in the future.

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