major depression found that fearful avoidance was negatively associated with remission and positively associated with time to stabilization (time to consistently obtain low-depressive symptom scores) among remitted individuals.

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See also

Anaclitic and Introjective Depression
Early Adversity
Internal Working Models
Maltreatment

References

Bowlby, J. (1980). *Attachment and loss: Vol. 3. Sadness and depression.* New York: Basic Books.

Dozier, M., Stovall-McClough, K. C., & Albus, K. E. (2008). Attachment and psychopathology in adulthood. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (2nd ed., pp. 718–744). New York: Guilford Press.

Mikulincer, M., & Shaver, P. R. (2007). *Attachment patterns in adulthood: Structure, dynamics, and change.* New York: Guilford Press.

Attention

Distractions constantly challenge our ability to stay on task—a “New E-mail Message” note appears on your computer screen as you attempt to work; a ringing cell phone distracts your driving. The ability to achieve and maintain goal-focused behavior in the face of distraction is critical for surviving and thriving in our world. This highlights the importance of attention, which is the ability to select what is most relevant for current task goals. Attention developed to help the brain solve a computational problem of information overload. For example, during perception of natural scenes, there is a multitude of incoming sensory input, which cannot all be fully analyzed by a limited-capacity perceptual system within the human brain. Under these circumstances, attention serves to restrict sensory processing in favor of the most relevant subset of items in order to ensure that the behavior of the organism is guided by the most relevant information.

Attention is a multidimensional system known to be dysfunctional in depression (Ingram, 1990). Therefore, understanding the computational structure and neuroanatomical basis of attention is a crucial step in treating attentional dysfunction associated with depression. Here, we review what is known about attention from this body of research and introduce our work investigating the influence of mindfulness training on the attention system. Our initial studies suggest that mindfulness training may improve attention by improving the ability to select information. We explore the hypothesis that these attentional effects may contribute to the efficacy of mindfulness-based clinical interventions in the treatment of depression relapse.

The Human Attention System

Attention comprises three functionally and neuroanatomically distinct cognitive networks. These networks carry out the operations of alerting, orienting, and conflict monitoring. Alerting consists of achieving and maintaining a vigilant or alert state of preparedness; orienting restricts processing to the subset of inputs that are relevant for the current task goals; and conflict monitoring prioritizes among competing tasks and resolves conflict between goals and performance. Two basic paradigms have been used to investigate attentional subsystems: the attentional spatial cuing paradigm and the flanker paradigm (see Fan, McCandliss, Sommer, Raz, & Posner, 2002, for an overview).

Attentional spatial cuing paradigms provide a means to behaviorally index attentional alerting and orienting. In this paradigm, participants sit at a computer and perform a visual computer task similar to a simple video game. They are to attempt to detect a target that is presented after either informative or neutral spatial cues. Informative cues provide spatial information regarding the target location with high probability. Neutral cues signal the imminent appearance of a target but provide no spatial information regarding its location. Neutral cues confer an attentional advantage when compared to no-cue trials. This advantage in performance is thought to be due to *alerting*. The neutral, so-called warning cue increases arousal signifying that a target is forthcoming. Comparisons of performance on trials with informative cues versus neutral cues assess orienting. Performance is typically fastest and most accurate for targets whose location had been correctly predicted by an informative cue (valid cue) and slowest and least accurate for targets whose location had been incorrectly predicted by the cue (invalid cue). The advantage in performance for valid relative to neutral cues, referred to as the validity effect, is due to orienting of spatial attention as directed by the cue prior to the target's appearance. The disadvantage in performance for invalid relative to neutral cues, referred to as the invalidity effect, is due to the cost of recovery of attention after orienting to the wrong location. The validity and invalidity effects have been used to further characterize the orienting subsystem as comprising attentional engagement at the cue location, disengagement when the cue location is misleading, and moving of attentional focus (often referred to as a spotlight) to the appropriate location after disengagement.

Flanker paradigms provide a means to behaviorally index conflict monitoring by selectively manipulating the presence or absence of response competition while keeping other task demands constant. In this simple visual computer task, a target is to be identified by a two-alternative forced-choice method (e.g., determine if the arrow "<" is left or right facing). The target is surrounded by task-irrelevant flankers that are either of the same response category (<<<) as the target or of another response category (><>). Responses in trials in which the flanking stimuli indicate a different response than the central stimulus (incongruent condition) are significantly slower than those in trials in which all stimuli indicate the same response (congruent condition). Longer response times are attributed to the need for greater conflict resolution and monitoring during incongruent relative to congruent trials.

Recently, the Attention Network Test (ANT) has been devised to identify behavioral and neural indices of alerting, orienting, and conflict monitoring during a single task (Fan et al., 2002). The task manipulates attentional cuing (valid, neutral, and no-cues) as well as the type of target (congruent or incongruent flanker). Alerting is indexed by subtracting performance measures on neutral cue trials from no-cue trials. Orienting is indexed by subtracting performance measures on spatial cue trials from neutral cue trials. Conflict monitoring is indexed by subtracting performance measures on congruent from incongruent target trials. Our studies of the effects of meditation training on attention use this task (see below).

Attention With Mindfulness Training

While the attention system developed over evolutionary history as a means of solving information overload from the external environment, mindfulness or meditation practices may have developed over human history as a means of solving the overload suffered by the fragile internal environment of our mental landscape as it becomes easily flooded by sensations, thoughts, emotions, and memories.

Numerous meditation texts distinguish between two disparate forms of attention, described as *concentrative* and *receptive*, that can be trained (see Lutz, Slagter, Dunne, & Davidson, 2008, for a review). One meditation practice used to cultivate concentrative attention begins with instructions to maintain attention on the breath. If attention wanders from the breath, it is to be gently returned. Another meditation practice involves instruction to experience the present moment without orienting, directing, or limiting attention in any way. Practitioners are to be receptive to any stimulus (e.g., sounds, lights, tactile sensations, thoughts, memories, emotions) that engages attention while keeping awareness neutral and unreactive. This exercise is used to cultivate receptive attention. Thus, while attention to the present moment of experience is a critical aspect of meditation instruction, in general, the particular way in which this instruction guides practitioners to attend can differ across meditation exercises.

There are two dimensions along which meditation texts distinguish concentrative and receptive attention: (a) the aperture of attentional focus and (b) the intensity of attentional focus. Concentrative practices direct subjects to hold a very narrow focus on the contents of attention. Examples across meditation traditions include a repeated sound, an imagined image, or a specific body sensation such as the breath. These types of practices emphasize the narrowing of attention and are sometimes described as single-pointed practices, in that attention is to be focused very closely on a specific focus or a single point. Receptive practices, in contrast, direct subjects to hold a very broad aperture of attentional focus. For example, instruction may direct one to attend to "all sounds" without specifying the particular sound on which attention should be focused. The concept of an attentional aperture is akin to cognitive psychological discussion of the attentional "zoom lens" in which the spatial extent of attention is thought be modulated intentionally (see Eriksen & St. James, 1986). The second dimension of attention described in mindfulness texts is the intensity of the attentional focus. Some traditions encourage a more intense focus on the object of the meditation, while others emphasize an effortless engagement of attention. Typically, concentrative practices have a narrow attentional aperture and a higher intensity of focus. Concentrative training is associated with facilitated ease of attentional engagement. In contrast, receptive attention has the features of having a broad attentional aperture, akin to keeping attention ready for some unspecified event, and having low intensity of focus, which results in a less-intense engagement and greater ease of disengagement from a stimulus. Importantly, each of these dimensions is considered to be along a continuum.

In our recent work (Jha, Krompinger, & Baime, 2007) we examined the influence of meditation training on the functioning of specific attentional subsystems. Participants receiving meditation training in the form of participation in an 8-week mindfulness-based stress reduction (MBSR) course or a 1-month meditation retreat (attended by experienced meditators) performed the Attention Network Test before and after training. Their performance was contrasted with the performance of control subjects who were also tested at two time points. We investigated two main hypotheses: (a) We hypothesized that prior experience with, and training in, concentrative meditation techniques would correspond to greater efficiency in the functioning of voluntary top-down attentional selection. Positive support for this hypothesis was observed on two counts. First, retreat participants, who were experienced with concentrative meditation prior to training, demonstrated better conflict monitoring (reduced flanker interference), compared to meditation-naïve subjects. Second, after meditation training, MBSR participants improved in their orienting performance relative to control participants. Since both conflict monitoring and orienting are forms of voluntary attentional selection, our results suggest that concentrative meditation may indeed alter functioning of voluntary response- and input-level selection processes. (b) We hypothesized that prior experience with concentrative meditation may allow for the emergence of receptive attention after training. Receptive attention corresponds to attentional readiness and alerting. We found that after training, not only did retreat participants differ in their alerting performance compared to control and MBSR participants, but the magnitude of their alerting scores after training was correlated with prior meditation experience. Greater experience corresponded with reduced alerting scores, indicating that attention was in a more readied state when no warning about target onset was provided. Thus, our results suggest that meditation training improves performance on specific conditions of the attention network test.

Attention, Mindfulness Training, and Depression

In recent years, a dysregulation of the attention system has been increasingly identified as a hallmark of clinical depression. Specifically, the attentional focus of depressed individuals tends to be inordinately self-related, and this self-focus may play a role in prolonging depressive symptoms such as rumination (Ingram, 1990). Rumination is also strongly associated with depression (Nolen-Hoeksema, 2000) and mindfulness trains individuals to refocus their attention in a manner that may counteract the tendency toward rumination (Ramel, Goldin, Carmona, & McQuaid, 2004). A related finding is that patients with depression appear to focus their attention on items in the environment with a negative emotional valence. These pieces of evidence have resulted in a focused effort to treat symptoms of depression with techniques designed to improve components of the attention system.

Mindfulness-based cognitive therapy (MBCT) has already been shown to reduce relapse and recurrence of depressive episodes in certain depressed populations (for a review see, Ma & Teasdale, 2004, and Segal, this volume). MBCT combines techniques from MSBR courses along with elements of cognitive behavioral therapy. As reviewed above, mindfulness-based techniques are known to modulate different aspects of the attention system, suggesting that the therapeutic effects of MBCT may arise from its ability to improve attention so that it is directed analytically at the self to improve awareness of negative thinking patterns. Future research on the interface of attention, mindfulness-training, and depression will better reveal the correspondence between changes in attentional engagement and disengagement tied to specific mindfulness-based techniques that might result in the best clinical outcomes.

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See also

Memory Processes
Mindfulness-Based Cognitive Therapy
Rumination
Self-Focused Attention

References

Eriksen, C. W., & St. James, J. D. (1986). Visual attention within and around the field of focal attention: A zoom lens model. *Perception and Psychophysics, 40*, 225–240.

Fan, J., McCandliss, B. D., Sommer, T., Raz, A., & Posner, M. I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience, 14*, 340–347.

Ingram, R. E. (1990). Self-focused attention in clinical disorders: Review and a conceptual model. *Psychological Bulletin, 107*, 156–176.

Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive Affective and Behavioral Neuroscience, 7*, 109–119.

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Cognitive-emotional interactions: Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences, 12*, 163–169.

Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: Replication and exploration of differential relapse prevention effects. *Journal of Consulting and Clinical Psychology, 72*, 31–40.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504–511.

Ramal, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The effects of mindfulness meditation on cognitive processes and affect in patients with past depression. *Cognitive Therapy and Research, 28*, 433–455.

Attention Deficit Hyperactivity Disorder

Children, adolescents, and adults diagnosed with attention deficit hyperactivity disorder (ADHD) have considerably higher rates of comorbidity with certain other psychiatric