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How the science of mindfulness can improve
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A focus on the present, dubbed mindfulness, can make you happier and healthier. Training to deepen your immersion in the moment works by improving attention

By Amishi P. Jha

NOW

BEING
IN
THE

Pulling into a parking spot at work, you realize you have no recollection of the drive that got you there. On reaching the bottom of a page in a book, you are frustrated that you have failed to understand what you just read. In conversation, you suddenly become aware that you have no idea what the person speaking to you has said.

These episodes are symptoms of a distracted mind. You were thinking about a vacation while reading a report or reliving a hurtful exchange with a friend instead of paying attention to the road or conversation. Whether the mind journeys to the future or the past, whether the thoughts that whisked

Photoillustration by Aaron Goodman

Modern mindfulness practices have their roots in customs that have been integral to Eastern cultures for millennia.



you away were useful, pleasant or uncomfortable, the consequences are the same. You missed the present, the experience of the moment, as it was unfolding. Your mind was hijacked into mental time travel.

Distinct from deliberate daydreaming, our mind gets offtrack in this fashion almost half the time, according to studies in which people report by smartphone what they are doing, feeling and thinking throughout the day. Such mental meandering is tied to negative mood. Chronic psychological stress, suffered by millions, may be built on a mind consumed by rumination, worry or fear about many topics. This type of diffused and unstable focus impairs performance, too. In moments that demand quick decisions and action, the consequences of diverted attention and perception could be deadly.

The opposite of a wandering mind is a mindful one. Mindfulness is a mental mode of being engaged in the present moment without evaluating or emotionally reacting to it. Hundreds of articles lay out evidence showing that training to become more mindful reduces psychological stress and improves both mental and physical health, alleviating depression, anxiety, loneliness and chronic pain [see box

on page 33 for a sample exercise]. More than 250 medical centers worldwide now offer mindfulness-based therapies for mood and other disorders.

Now findings from my laboratory and others have revealed a surprising mechanism for these benefits. Mindfulness training works, at least in part, by strengthening the brain's ability to pay attention. Although video games and medication can also sharpen focus [see "Brain Changing Games," by Lydia Denworth; *SCIENTIFIC AMERICAN MIND*, January/February 2013], mindfulness training uniquely builds the ability to direct attention at will through the sea of internal and external stimulation while also allowing for greater awareness of what is happening in the moment. Whether research findings in small groups of individuals can be scaled up to society at large remains to be seen. Yet the overarching message seems to be that the more people engage in such training, the happier and healthier we all will be.

Salve for Sadness

For millennia Eastern cultures have proffered various forms of what we now call mindfulness meditation as a solution to the conundrum of human suffering. Ancient texts detail precise training exercises to cultivate attention to ongoing perceptual experience rather than conceptual trains of thought. People have been engaging in mindfulness exercises ever since, claiming they improve mental clarity and calm and even promote longevity.

One broad category, referred to as focused attention practices, guides individuals to select a specific sensation, tied to breathing, for example, on which to focus. Instructions encourage the practitioner to notice when his or her mind goes astray and simply return attention back to his or her immediate sensations. Another type, called receptive or open-monitoring practices, coaches participants to watch what enters, then drops out of, consciousness moment by moment. Think of hearing the faint sound of a fire truck siren in the distance. The sound becomes louder as the truck approaches, then fainter again as it passes. You may notice that initially the siren is part of a vast sea of sounds, later that it is the most salient sound, only to fade into the background again. Thoughts, emotions and other sensations may similarly grow and diminish as we remain in a watchful monitoring mode. Many sages, beginning with Buddha Siddhartha Gautama, have advocated repeated engagement in these forms of meditation as a route to increasing mindfulness in daily life.

It was not until the late 1970s that research on mindfulness began to get traction in the psycholog-

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FAST FACTS

Pausing on the Present

- 1» Mindfulness is a mental mode of being engaged in the present moment without evaluating or emotionally reacting to it.
- 2» More than 250 medical centers worldwide now offer mindfulness-based therapies for mood and other disorders.
- 3» Mindfulness training works, at least in part, by strengthening the brain's ability to pay attention.



Learning to be more mindful, or aware of what is happening now, is an antidote to rumination, worry and fear—and their effects on mental health.

ical and medical sciences. At that time, biologist Jon Kabat-Zinn of the University of Massachusetts Medical School developed a secular outpatient program called Mindfulness-Based Stress Reduction (MBSR) that includes a manual for trainers. The eight-week program emphasizes two aspects of attention: the ability to voluntarily *focus* attention, narrowing our thoughts to keep out distractions, and to *monitor* ongoing thoughts, feelings and sensations—without getting caught up in them—a phenomenon called meta-awareness. Working together, focusing and monitoring prevent our mind from wandering without our knowledge and escaping our control.

In the past decade researchers have established that MBSR and similar techniques can be used to successfully treat a wide variety of illnesses. In 2011

graduate student Jacob Piet and professor of psychology Esben Hougaard of the University of Aarhus in Denmark published a meta-analysis (quantitative review) of six studies with a total of 593 patients, who were given mindfulness-based cognitive therapy to prevent relapse into depression. This technique, developed by psychologist Zindel Segal and his colleagues at the University of Toronto, is modeled after MBSR but emphasizes the idea that the negative thoughts that can spark a depressive episode are fleeting mental events. Their transitory nature means that patients can choose to attend to them or not.

After receiving mindfulness-based cognitive therapy, patients often report noticing that the experience of sadness fluctuates moment to moment and that negative thoughts lose their power over

■ After receiving mindfulness-based cognitive therapy, patients report noticing that negative thoughts lose their power over time.

By improving the ability to direct and monitor attention, mindfulness meditation could enhance people's performance in pursuits as diverse as sports and surgery.



time. Indeed, Piet and Hougaard report that depressed patients with three or more episodes of major depression who undertook this cognitive mindfulness training had significantly lower relapse rates than those given the usual care or a placebo. Mindfulness training in its various forms has similarly helped alleviate suffering from psychological illnesses such as anxiety, panic disorders and phobias.

Mindfulness exercises can ameliorate bodily ills as well—most notably chronic pain. Because these exercises can lessen psychological stress, they can reduce the emotional contribution to pain, which is often quite significant. In fact, one of MBSR's first clinical uses was for the treatment of chronic pain. In 1985 Kabat-Zinn and his colleagues enrolled 90 patients with chronic pain in his eight-week program, measuring their levels of pain, negative mood and anxiety before and after their participation.

The researchers saw significant reductions in these negative symptoms after the program ended but found no beneficial changes in 21 patients who received traditional treatment methods such as nerve blocks, physical therapy and antidepressants. Strikingly, the benefits from Kabat-Zinn's exercises were maintained for up to 15 months, and patients reported continuing the exercises on their own.

Recent data suggest that mindfulness training can also help with less severe, but still significant, psychological issues such as job-related burnout in medical professionals and teachers. Although the training may not reduce the number of job-related stressors, it helps to change a person's relation to these stressors and renew his or her sense of curiosity and connection with patients or students.

Social stressors, such as loneliness in elders, can also diminish with the practice of mindfulness. In 2012 psychologist J. David Creswell and his colleagues at Carnegie Mellon University assigned 20 people between the ages of 55 and 85 to participate in an MBSR course and another 20 such individuals to receive no therapy. Creswell's team found that self-reported loneliness, as assessed by a questionnaire, dropped among those receiving MBSR but remained unchanged in the others. Loneliness is not directly related to the number of social contacts

(The Author)

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a person has. In fact, programs to increase social engagement among older people do not necessarily lessen their feelings of disconnectedness. Mindfulness training may make loneliness less distressing by helping people recognize that, although they feel alone, their loneliness does not define them.

What is more, in Creswell's study this psychological improvement was accompanied by changes in immune function. The mindfulness course reduced blood levels of pro-inflammatory proteins, suggesting that this training may also lower the risk in older adults of inflammatory diseases such as lupus and rheumatoid arthritis. Other studies indicate that mindfulness training can relieve symptoms of ailments that stress can exacerbate, including psoriasis, dermatitis, fibromyalgia and irritable bowel disease.

Being mindful may even relate to a biological indicator of longevity. In a study published in 2012 psychologist Elissa S. Epel and her colleagues at the University of California, San Francisco, found that people who have a greater propensity toward mind wandering were found to have shorter caps, called telomeres, at the ends of their chromosomes than those whose minds were more often anchored in the present. Shorter telomeres are associated with a

Pennsylvania, psychologist Jason Krompinger, now at Harvard Medical School, and I set out to investigate this link by asking 34 medical and nursing students to perform a test of visual attention. They had to detect a target appearing at one of two locations on a computer screen. Sometimes they were told where and when the target would appear; other times they were either alerted only to when it would appear or given no warning at all. Then for eight weeks, half the subjects engaged in mindfulness exercises that required concentrated focus for 30 minutes a day. When they took the test again, these volunteers were 5 percent faster at responding during the trials in which they were told both where and when the target would appear, indicating that they were better at directing their attention to the cued location than the untrained participants, who showed no improvement. The results were the first hint that we were on the right track in linking mindfulness training with a person's ability to willfully orient his or her attention in space.

We then separately tested the effects of the open-monitoring approach on attention by recruiting another 17 individuals with previous experience in mindfulness training to participate in a one-month intensive mindfulness retreat. The retreat in-

■ Mindfulness training can relieve symptoms of ailments that stress can exacerbate such as psoriasis and fibromyalgia.

shorter life span for an organism. As a result, the authors suggested in their paper that "a present attentional state may promote a healthy biochemical milieu and, in turn, cell longevity."

Finding Focus

As mindfulness training was gaining traction as a wellness-promotion and stress-reduction tool in the early 2000s, I began to consider, from a cognitive perspective, how it might work. As late as 2007 my field—cognitive neuroscience—had yet to weigh in on what is happening in the brain when people practice mindfulness. I wondered if my own expertise on the brain bases of attention might be able to fill the gaps in our understanding. After all, there were striking parallels between current theories of distinct brain systems supporting attention and accounts from ancient texts describing practices to cultivate calm focus and open, accepting curiosity of events as they unfold.

Physician Michael Baime of the University of

cluded receptive, open-monitoring practices in addition to focusing exercises. At the end of the month, the participants had improved their ability to detect the target when there was no warning. Their responses were 7 percent faster than other groups receiving only concentrated exercises or no training, suggesting that open-monitoring practices tune bottom-up attention, making people more aware of what is going on around them. Since this study, experiments from various research teams have found similar benefits on attention from these two types of mindfulness exercises.

Mindfulness training can tune our ability to attend to tactile as well as visual stimulation. In 2011 psychologist Catherine Kerr and her colleagues at Harvard enrolled eight people in an eight-week MBSR course, requiring 45 minutes of daily practice. The researchers then flashed a word on a computer screen denoting a body part—say, "hand" or "foot"—that might soon be getting a light, barely detectable tap. While the participants watched the



Amishi P. Jha and Brigadier General Walter Piatt review brain-wave recording procedures, along with a memory test military service members take before and after mindfulness training.

words and felt the taps, Kerr and her colleagues measured ongoing seven- to 10-hertz magnetic signals at the scalp from neurons representing the hand in the somatosensory cortex, a region of the brain that registers sensations from various body parts. Among the participants who took the course, but not in eight untrained individuals, the researchers saw greater signal power in the hand area of the brain after seeing “hand” compared with “foot,” reflecting an increased readiness of neurons to fire, a brain signature of attention. This anticipatory activity, before the hand was tapped, suggests that MBSR tunes people’s ability to generate high-resolution representations of their hand or other body parts at will, sharpening body awareness.

These results may help explain how MBSR may alleviate the psychological impact of chronic pain. If a person can willfully direct attention to specific body parts that are experiencing pain, he or she may notice subtle fluctuations in sensations at those locations, to the point where the idea of pain as a monolithic “thing” may fall apart into ever changing sensations. As a result, the pain may become less distressing. Similar mechanisms tied to attention may be at play for psychological and social stressors. In these cases, present-moment focus and monitoring of sadness, say, or loneliness, may help minimize the perceived significance of these forms of suffering.

Recently my colleagues and I have connected mindfulness training to both a sharpening of focus and improved mood. In a study published in 2010 we tested 51 U.S. marines, 34 of whom engaged in mindfulness exercises involving focused attention developed by Elizabeth A. Stanley, a professor of security studies at Georgetown University. We asked marines to remember letters that appeared on a computer screen before and after simple math problems, which they were supposed to solve. This task assessed their working memory, the ability to hold and manipulate selected information over a few to several seconds. Working memory, akin to a mental white board, works hand in hand with attention, which puts the information onto the board and keeps distractions off of it.

People with higher working memory capacity—think of a bigger whiteboard—are better able to regulate mood and prevent their minds from getting offtrack. Unfortunately, working memory capacity shrinks under stress, which marines experience as they prepare for military deployment. Indeed, we found that marines who did not receive mindfulness training had lower working memory capacity, more itinerant minds and worse mood at the end of the eight weeks than they did when the study began. Marines who engaged in mindfulness exercises for 12 minutes or more every day, however, kept their working memory capacity, focus and mood stable over the eight weeks. The more an individual practiced, the better he or she fared, with those who practiced the most showing improvements in memory and mood by the end of the study. These results are in line with other findings that suggest that better control of attention is the most effective way to regulate mood.

Several groups of researchers have found that these improvements in performance correspond to tractable changes in brain structure and function. In the brain, a network of regions, including certain

(Further Reading)

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- ◆ **Attention Regulation and Monitoring in Meditation.** A. Lutz, H. A. Slagter, J. D. Dunne and R. J. Davidson in *Trends in Cognitive Sciences*, Vol. 12, No. 4, pages 163–169; April 1, 2008.
- ◆ **Examining the Protective Effects of Mindfulness Training on Working Memory and Affective Experience.** A. P. Jha et al. in *Emotion*, Vol. 10, No. 1, pages 54–64; February 2010.
- ◆ **Mindfulness-Based Stress Reduction, Mindfulness-Based Cognitive Therapy, and Zen Meditation for Depression, Anxiety, Pain, and Psychological Distress.** W. R. Marchand in *Journal of Psychiatric Practice*, Vol. 18, No. 4, pages 233–252; July 2012.
- ◆ **Mindfulness for Beginners: Reclaiming the Present Moment—and Your Life.** J. Kabat-Zinn. Sounds True, 2012.
- ◆ Learn how to meditate with a smartphone app: www.getsomeheadspace.com
- ◆ For guided practices and MBSR courses, see the University of Massachusetts Center for Mindfulness in Medicine, Health Care, and Society: www.umassmed.edu/cfm

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Capturing Attention



sections of the prefrontal and parietal cortex (at the front and top surface of the brain), support voluntary or top-down selective attention. Meanwhile other parts of the prefrontal and parietal cortex, together with the insula, form a network that monitors what is happening in a bottom-up fashion. In 2012 neuroscientist Eileen Luders and her colleagues at the University of California, Los Angeles, reported that certain parts of this bottom-up network—prominently the insula—are more intricately and tightly folded in people who have engaged in mindfulness training for an average of 20 years compared with otherwise similar untrained individuals. The additional folds are very likely to indicate more efficient communication among neurons in these regions, which may underpin better bottom-up attention.

Cultivating Consciousness

Attention is almost certainly not the only way mindfulness training works. Mindfulness techniques are most likely to alter and strengthen many other brain networks and processes. Several studies suggest, for example, that such exercises shift the mind from a narrative mode of viewing the self, in which the central character in the story is you, to a more experiential view, in which you observe the unfolding of your thoughts, feelings and sensations over time. Other studies indicate that emotional changes or the calming of stress-induced physiological symptoms may drive psychological improvements. Whether better attention relates to these other suggested mechanisms is not yet clear.

Whatever the mechanism, efforts to become more mindful could make a considerable dent in human suffering. Working mindfulness practices into your daily routine can bring benefits similar to those of physical exercise. As an antidote to an ambling mind, negative mood and stress, such mental workouts can help virtually everyone live a happier, healthier and more fulfilled life. Students or athletes who want to boost their performance, for example, and parents, teachers or caregivers wishing to be more attentive to others' needs may all find mindfulness training useful. Such training may be particularly essential, however, for people such as soldiers, surgeons and air traffic controllers whose ability to control and monitor their attention may be a matter of life or death.

As we learn to grab a hold of our own attention, we gain control of our own happiness and health. Perhaps the time is *now* for us all to consider cultivating greater awareness of our moment-to-moment experiences and the contents of our consciousness. **M**

Mindfulness, a focus on the present moment without judgment, has proven benefits for health and happiness. Engaging in daily mindfulness workouts can help you assume this mental mode more often in your daily life. The following 10- to 15-minute mindfulness exercise is designed to train two types of attention: concentrative focus, a narrowing of your attention, and open monitoring, a broad awareness of sensations and surroundings.

Here's what to do:

- » Sit in an upright, stable position, hands resting on your thighs or cradled together.
- » Lower or close your eyes, whichever is more comfortable for you.
- » Attend to your breath, following its movement throughout your body.
- » Notice the sensations around your belly as air flows into and out of your nose or mouth. You have been breathing all day—all of your life—and in this moment, you are simply noticing your breath.
- » Select one area of your body affected by your breathing and focus your attention there. Control your focus, not the breathing itself.
- » When you notice your mind wandering—and it will—bring your attention back to your breath.
- » After five to 10 minutes, switch from focusing to monitoring. Think of your mind as a vast open sky and your thoughts, feelings and sensations as passing clouds.
- » Feel your whole body move with your breath. Be receptive to your sensations, noticing what arises in the moment. Be attentive to the changing quality of experience—sounds, aromas, the caress of a breeze ... thoughts.
- » After about five more minutes, lift your gaze or open your eyes.

—Scott Rogers, director of Programs and Training, Mindfulness Research and Practice Initiative, University of Miami