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# A Comparative Study of the Effects of Hatha Yoga and Seated Meditation on Mood Elevation

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# A Comparative Study of the Effects of Hatha Yoga and Seated Meditation on Mood Elevation

## **Abstract**

**Objective:** The purpose of this study was to measure the extent to which a hatha yoga practice would improve mood as compared to a seated meditation practice.

**Methods:** This was an eighteen week, cross-over design study in which forty-four hatha yoga students, largely inexperienced with seated meditation, were randomly assigned to one of two groups. One group started with an eight week practice of hatha yoga, half an hour four times a week, and the other group practiced seated meditation. After eight weeks, all subjects stopped practicing for two weeks. Then they switched practices for another eight weeks. Both quantitative and qualitative measures were taken at the beginning of the study, after the first eight week practice, again after the two week break, and finally at the end of the study. The five quantitative measures used included a modified Positive and Negative Affect Schedule (PANAS-M), and the qualitative measures asked subjects to describe their mood, cognition, level of motivation and quality of life.

**Results:** The findings suggest that for this population, hatha yoga had a stronger effect than meditation on improving mood. After the first eight week practice period, only hatha yoga improved mood. Meditation was more effective at improving cognition. During the two week break, the subjects who had practiced hatha yoga first suffered bodily discomfort and mental unrest. Those practicing meditation did not seem to suffer. When subjects practiced seated meditation as a second practice, they too experienced an improvement in mood, and during the second practice period both groups experienced a significant improvement in quality of life.

**Conclusion:** These results demonstrate the efficacy of introducing more active people to a personal practice of seated meditation by first having them establish a hatha yoga practice. They also illustrate the powerful effect of hatha yoga on improving mood and the need for further research on the physiological effects of hatha yoga.

## **Keywords**

hatha yoga, seated meditation, mood, affect, physiology, positive psychology

## **Comments**

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# A Comparative Study of the Effects of Hatha Yoga and Seated Meditation on Mood Elevation

In fulfillment of the requirements for the  
Masters of Applied Positive Psychology Degree Program

University of Pennsylvania, Philadelphia

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## Positive Psychology and the Mindfulness Disciplines

Positive Psychology is the scientific study of optimal human functioning. It aims to “discover and promote factors that allow individuals and communities to thrive” (Sheldon, Frederickson, Rathunde & Csikszentmihalyi, 2000). Humankind has been engaged with this area of exploration throughout the ages. However, since WW2, psychology has been focused primarily on curing the ills of the human mind. In 1998, Martin Seligman brought attention to this “new” branch of psychology simply to restore the balance. He has been turning the world’s attention towards what is right, rather than what is wrong.

The natural tendency of the mind is for the attention to focus on that which creates discomfort. This tendency arises from a desire to *attenuate tension*. This so-called *zeigarnik effect* is the natural patterning of consciousness. The mindfulness disciplines train the attention. Rather than being slaves to the vagaries of the mind, practitioners of yoga and meditation begin the process of gaining mastery over its fluctuations. Rather than focusing primarily on what is wrong, we develop the capacity to first recognize that patterning and then consciously shift the attention towards what is right. Yoga is, by definition, “a technique to still the patterning of consciousness” (Patanjali, trans., 2003, p.3). According to William James (1897), this training of the attention is the foundation for cultivating a positive psychology:

The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of character, judgment, and will. No one is *compos sui* [master of himself] if he have it not. An education which should improve this faculty would be the education *par excellence*. But it is easier to define this ideal than to give practical instructions for bringing it about

The mindfulness disciplines are the very practical methods for moving towards this ideal. As such, they are the foundational practices for cultivating a positive psychology.

#### Abstract

The purpose of this study was to measure the extent to which a regular practice of hatha yoga improved mood as compared to a practice of seated meditation. There have been a number of studies that demonstrate meditation's effect of improving mood. The practice of meditation actually changes the structure of the brain. Hatha yoga is a discipline that similarly calls upon moment to moment mindfulness (non-judgmental observation of what is- sensations, thoughts and emotions). Like seated meditation, hatha yoga emphasizes breath awareness. However, it is a moving meditation. This study sought to determine whether mood would improve to the same extent when mindfulness was experienced with slow, deliberate movement as compared to when mindfulness was experienced in stillness.

This was an eighteen week, cross-over design study in which forty-four subjects were randomly assigned to one of two groups. One started with an eight week practice of hatha yoga, half an hour four times a week, and the other group did the same but practiced seated meditation. After eight weeks, all subjects stopped practicing their mindfulness discipline for two weeks. Then the subjects switched practices for another eight weeks so that those practicing hatha yoga began sitting for meditation and those sitting for meditation started the yoga practice. Quantitative and qualitative measures

were taken at the beginning of the study, after the first eight week practice, again after the two week break, and for the last time at the end of the study.

The results were mixed, but interesting. The findings suggest that for this population, hatha yoga had a stronger effect than meditation on improving mood. After the first eight week practice period, only hatha yoga improved mood. Meditation was more effective at improving cognition. During the two week break, those subjects practicing hatha yoga suffered bodily discomfort and mental unrest. Those practicing meditation did not experience these adverse symptoms. They experienced more of a carry-over effect. When subjects practiced seated meditation as a second practice with the hatha yoga base, they too experienced an improvement in mood, and both groups experienced a significant improvement in quality of life.

## Introduction

Hatha yoga is a systematic discipline which uses the body as a tool to quiet the mind. Through slow, deliberate movement, one comes to experience and understand the particular patterns and tendencies of the body and at the same time to understand the particular patterning of the contents of one's consciousness, one's mental and emotional landscape. It is a meditative discipline where the body is the object of attention so that the awareness is present-focused.

Seated meditation is also a discipline where one continually brings the attention back to the present. This can be achieved through body awareness and/or breath awareness, the awareness of sound or a repeated phrase. Like hatha yoga, it is a technique to quiet the mind, but it is achieved by stilling the body first. It is a more subtle practice than hatha yoga, and more difficult for many because of this. However, the aim of both practices is

to cultivate the ability to maintain a present-focus, to heighten levels of awareness of the attentional process, and to discipline the body/ mind. The objective of this study was to determine which practice would have a greater effect on elevating mood, hatha yoga, a moving meditation, or seated meditation.

Even though hatha yoga is similar to seated meditation in that mindfulness is elicited in the practitioner, hatha yoga has the added dimension of relaxing, opening and strengthening the body. However, the hypothesis of this project was that seated meditation would have as profound an effect on improving mood and increasing mental energy in the subject.

#### Background/ Literature Review

According to the Yoga Sutra, the first text that codified yoga into a systematic discipline sometime during the 2<sup>nd</sup> or 3<sup>rd</sup> c., the definition of yoga is "a technique to still the patterning of consciousness" (Patanjali, 2003, trans., p. 3) or to slow down the speed of thoughts, to quiet the mind. Yoga, therefore, is synonymous with meditation, its ultimate goal. The history of yoga likely goes back as far as the history of people. Shamanism, thought to be from 25,000 BCE or earlier, is about changing one's state of awareness to enter non-ordinary realms. The Proto-yogic ideas and practices of mindfulness, regulation of the breath, chanting and incantations, and shifts in states of consciousness can be traced back to 3,000-1,900 BCE in the Indus-Sarasvati civilization in what is now North India.

The practice of hatha yoga with its current emphasis on cultivating the body rather than concerning oneself with the metaphysical is a more modern phenomenon. It derives from what Georg Feuerstein, a noted yoga historian, describes as the Siddha cult, which



flourished during the 8<sup>th</sup> to 12<sup>th</sup> c. (Feuerstein, 1998, p. 508). Its aim was to cultivate an adamantine body that was capable of experiencing higher spiritual states. A siddha is “a spiritual alchemist who transmutes impure matter, the human body-mind, into pure gold, the immortal spiritual essence” (Feuerstein, 1998, p. 508). Siddha means “accomplished or “perfected.” This is part of the Tantric tradition or the left-handed path that uses the body-mind as a vehicle for liberation instead of simply stilling it as in the right-handed more ascetic path. Today many people practice hatha yoga, the body-based yoga, without any desire for psycho-spiritual change. The goal can be far more worldly than the original intent.

#### Brain physiology of mindfulness practices

The mindfulness practices, where we tune in to what is happening while it is happening without judgment or expectation, have been demonstrated to have beneficial effects on the physiology of the brain. When we attune to our own body and mind, the effects in the brain are the same as when another tunes in to us. This experience of attunement is a human need, one which is necessary for the healthy emotional development of a child. A child whose mother is able to consistently attune to his or her thoughts and emotions is able to develop a secure attachment style whereas a child lacking this experience becomes reactive in intimate connections with others (Siegel, 2007, pp. 201-7). Fortunately, these mindfulness practices enable us to re-pattern the neural circuitry so that we can connect more fully with our own thoughts and feelings and to those of the people around us.

The opposite of this experience is when we go on automatic pilot, moving through our lives without really connecting, without experiencing the life of the senses, the life of the mind and emotions in a fresh way. We “re-act,” conceiving of our experiences based on past conditioning, making sense of events based on what we already know to be true. This is what Daniel Siegel described as top-down processing in his book *The Mindful Brain* (2007). It is a useful skill to the extent that it frees us up to move more quickly and efficiently through the tasks set before us. However, if this is our only way of operating, then we become locked into experiencing the world according to our preconceived notions. There is no room to experience the freshness of life and open to new possibilities. We shut down and react based on our understandings of the past and because of the emotional charge of some of those events, we tend to repeat patterns over and over again. Mindfulness practices train the attention in order to enable us to experience our inner world and the world around us in a fresh way. They still the patterning of our consciousness. In this open, curious state, we are able to attune to ourselves and the world around us. The quality of attention is less eclipsed by preconceived notions of how things are. The intention is to live life more fully through this kind of training.

There are physiological changes in the brain that accompany mindfulness training, the training of the attention. In order to better understand the nature of those changes, it is important to get an understanding of the basic brain anatomy.

## Brain Anatomy

The *brainstem* is the reptilian part of the brain, the part that is responsible for the basic processes, heart-rate and respiration, whether we feel alert or sleepy, and the fight-flight-freeze response we experience when under extreme stress. There are those who would list the *hypothalamus* here as well (Vaillant, 2007), and its function is certainly involved with these basic processes, but in this paper it is classified as part of the limbic region.

The *cortex*, the outer part of the brain, is responsible for perception, planning and attention, the inhibition of actions, and empathic understanding. Jonathan Haidt (2006) presented the analogy of the rider and the elephant in his book *the Happiness Hypothesis*, where the rider referred to this controlled part of the brain and the elephant was everything else. According to Haidt, the rider is the advisor or the servant, not the King. (Haidt, 2006, p. 17). After all, how well can a rider control an elephant?

The *limbic region* is responsible for memory, attachment to caregivers, and emotions. It includes *the hypothalamus, the amygdala, the hippocampus, the insula and the bodily areas*. The *hypothalamus* governs body temperature, nutrition and hydration, rest and balance. It is the “master hormone regulator” governing the endocrine system (Siegel, 2007, pp. 34-5). Its classification as part of the limbic region is not consistent among researchers. Some consider it part of the limbic region and others not. In either case, its functioning is closely connected to that of the rest of the limbic region. The *amygdala* stores emotions and reactions to emotionally charged events. It is the part of the brain that determines what is dangerous or safe. When a situation is deemed unsafe, the frontal lobe goes “off line” (Van der Kolk, 2007). Then the neural activation pathway is directed to the hypothalamus which produces stress hormones that bring the body to a state of

fight-flight-freeze. This is the situation that Karen Reivich and Andrew Shatte called the “amygdala hijack” in their book *The Resilience Factor* (p. 93, 2002). When a situation is deemed safe, the neural pathway is instead directed to the *anterior cingulate cortex*, which is linked to making decisions well, empathy and emotion, and the *prefrontal cortex*, which is the seat of reasoning and forethought. The *hippocampus* processes the data to make sense of experiences within the time line of personal history. It gives us an awareness of our narrative and depends on language for processing information. An increase in stress suppresses hippocampus activity, which leads to memory distortion. The *insula* is the conduit where information passes to and from the outer cortex and the inner limbic system and is linked to empathy and maternal love.

The *middle prefrontal region* touches everything in the brain anatomically. It links the body, the brainstem, the limbic, cortical and social processes. Consequently, it is involved in *neural integration*, which is, in fact, the physiological outcome of attuned relationships. This creates the conditions for optimal functioning. Such integration balances sympathetic and parasympathetic activity that affects bodily regulation, emotional balance and response flexibility, empathy and insight, fear modulation, intuition and even morality (Siegel, 2007, pp. 42-44). Integration of the left and right brain balances the left brain’s linearity, logic, and detail-orientation with the right brain’s holistic, visuospatial, spontaneous emotion. It is the right brain that is associated with approach behaviors. Moreover, the whole map of the body is on the right side. The left brain is what shuts down when we are triggered into reactivity. This is why when we feel high levels of stress, we have difficulty organizing thoughts and sequencing. Creativity comes from the integration of left and right. Body-based mindfulness practices that relax

the nervous system may entail our linking the right hemisphere's integrated whole-body map with the word-based left-sided chatter at that moment, which would lead to the experience of neural integration. (Siegel, 2007, pp. 46-47).

The *resonance circuitry* (Siegel 2007, p. 165) includes the *mirror neuron system*, the *superior temporal cortex*, which activates in response to an organism's movement through space and is tuned in to intentional acts, the *insula cortex* and the *middle prefrontal cortex*. *Mirror neurons* allow us to take in the emotions and intentions of others and create those same experiences in ourselves. Resonance allows us to feel felt by another. This is the circuitry that has to do with empathy- interoception, interpretation and attribution (Siegel, 2007, p. 168). This is the circuitry that appears to develop from participating in mindfulness practices, according to Cahn and Polich's extensive review of studies (2006) and Sarah Lazar's recent work (2005, 2006).

### The Case for Neuroplasticity and the Implications for Mindfulness Training

Neuroplasticity is the term describing the way that neural connections change in response to what we experience. If we repeat an action over and over again, the neural pathways change so that that action becomes more and more accessible with less effort.

By the early 20<sup>th</sup> century, neuroanatomists began investigating "movement maps" of the brain. Scientists discovered the specific parts of the motor cortex that control various voluntary movements of the body. What they discovered was that people who engaged in precise habits of movement that involved, for example, the feet had larger clusters of neurons responsible for moving the foot muscles in the motor cortex than those who did not (Begley, 2007, pp. 28-29). Our brains change based on what we do. If we practice

hatha yoga, which involves precise movement of the whole body, we will have larger clusters of neurons throughout the motor cortex. If we engage in mindfulness practices on a habitual basis, heightening our sensitivity to physical sensations, thoughts, and emotions as they are in that moment, the neural pathways change, affecting both the attentional circuits and the social circuits to allow for greater attunement to self and others.

Our brains change not only based on what we do, but according to the input they receive. Back in 1895, Charles Sherrington and F.W. Mott showed that when monkeys were unable to feel their upper arm and lower leg, which had been deafferentated, when the somatosensory cortex was receiving no stimulation from these areas, the monkeys stopped using those limbs even though the motor nerves were intact (Begley, 2007, p. 29).

In 1988 Mortimer Mishkin and Tim Pons presented a paper with the results of a study of seven macaques where the researchers had damaged a part of each monkey's somatosensory cortex, specifically that region that registers input from the hand. Even though the nerves in the hand were intact, the monkeys could feel no sensations. What happened was that the brain area not being used by the monkey's hand was taken over by the foot in what is called "cortical re-mapping" (Begley, 2007, p. 42), a re-zoning process that happens in the brain. The cortex had gotten tired of waiting so it began picking up signals from another part of the body instead (Begley, 2007). The monkeys' feet became much more sensitive than they had been originally and took up more cortical space in the brain. This is why those who are blind develop excellent hearing or an exquisite sense of taste. This example of the neuroplasticity of the brain implies that what we pay attention

to, what we get feedback from, affects the very structure of the brain. More cortical space is devoted to what comes in causing us to become more sensitive to that stimulus. We may want to ensure that we expose ourselves to that which nourishes us. This is particularly significant when we think about the negativity bias of the media. It also explains our ability to adapt, to “make lemons out of lemonade.” In the experience of loss, over time, we adapt and become more sensitive to whatever else comes to fill the gap. Our very brains were designed to facilitate this process.

However, in a 1977 study where Edward Taub deafferentated both arms of monkeys, they began mutilating themselves, gnawing and tearing off fingers and chewing their limbs until they were raw. One can infer from this that the experience of fully feeling the body is required for healthy functional behavior. In fact, it may be the experience of *not* feeling which leads to the development of self-destructive behavior. Hatha yoga and body-based mindfulness practices, then, would seem to be an excellent antidote for a person who experiences a certain level of bodily dissociation. Such disciplines would bring such a person back into a healthy relationship with the body where s/he can feel and attune to its experience. This is likely why hatha yoga has been demonstrated to be helpful in managing and overcoming eating disorders (Boudette, 2006; Daubenmeier, 2003, 2005), where people are often dissociated from their bodies, experiencing them as objects rather than feeling them from the inside out.

In 1987 Edward Taub tested further implications of cortical re-mapping. He wanted to see if it would be possible to “coax a different region of the brain to assume the function of [a] damaged part” (Begley, 2007, p. 121). He looked at people who had suffered a stroke and lost the use of an arm. He had them undergo “constraint-induced

movement therapy” where they wore a sling on their good arm 90% of their waking hours for fourteen days straight. He found that when the part of the brain associated with the good arm received no signals, the subjects regained significant use of the arm they had assumed was useless. After ten days they could use the damaged arm to put on a sweater, unscrew a cap on a jar and pick up a bean in a spoon. Two years later they were still brushing their teeth, combing their hair, eating with a fork and spoon and picking up a glass (Begley, 2007, pp. 121-122). This was due to the neuroplasticity of the brain which had re-mapped itself so “the functions of the damaged region were assumed by a healthy region” (Begley, 2007, p.122).

There are further implications of the brain’s neuroplasticity for the practice of hatha yoga. According to neuroscientist Fred Gage, “...[V]oluntary exercise increases the number of neural stem cells that divide and give rise to new neurons [neurogenesis] in the hippocampus” (Begley, 2007, p. 66). Usually 50% of the new cells that reach the dentate gyrus of the hippocampus die, but in an environment that is enriched, many fewer new cells die. In Gage’s study published in 1999, the neurons of the mice who had access to a running wheel and could voluntarily exercise had more dendrites so they could receive more signals from other neurons. This physiology enables the brain to connect new facts with old, to retrieve memories, and to make connections between seemingly disparate facts. Forced exercise does not produce the same result. Voluntary exercise produces brain rhythms called theta waves, which are present when we pay close attention to something. They are not present when we are operating on automatic pilot. By contrast, in cases of depression, the dentate gyrus shrink. According to Gage, “Emerging evidence suggests that people who are suffering from depression are unable to recognize novelty”



(Begley, 2007, p. 70). This research suggests that the voluntary exercise hatha yoga provides, which involves attention to subtleties and the enhanced ability to feel, creates the conditions in the brain that lead to neurogenesis and neural integration, hence optimal functioning.

#### Further Implications of Neuroplasticity

This research suggests that if we are involved in unskillful behaviors, either physical or mental/ emotional patterns of movement or behavior that are compromising our well-being, we can create pathways to new patterns that are more skillful. Of course, the first step is cultivating awareness of those patterns. Mindfulness practices like meditation and hatha yoga are deliberate techniques dedicated to bringing them to our conscious attention. The research shows that time invested in these disciplines is not time wasted. Change is not only possible; with intent, it is the likely outcome.

George Vaillant's book *Adaptation to Life* is an account of what was, at the time of publication in 1977, a 35-year longitudinal study of 268 promising male graduates of Harvard University. He looked at the defense mechanisms that were operating in each of their lives and the consequences over time. Defense mechanisms operate on an unconscious level. Some are more mature or adaptive than others. For example, sublimation, altruism and humor are more adaptive mechanisms than suppression and denial. However, context and flexibility are important to consider. According to Vaillant:

If a defense is used in a rigid, inflexible way, if it is motivated more by past needs than by present and future reality, if it too severely distorts the present situation, if it abolishes rather than limits gratification, or if it dams rather than rechannels the

expression of feelings, then it is likely to be maladaptive (Vaillant, 1977, p. 85).

Using a mindfulness practice as a tool to develop more clarity and insight into our experience, we can better notice when we are getting stuck in a maladaptive behavior pattern. We can bring the unconscious to consciousness as we train the attention to be increasingly present, free from the trappings of the past. With intent, we can re-pattern our brains in order to let go of those behaviors which no longer serve our current situations and try out new behaviors, which are more adaptive.

#### The Research on Meditation, Changes in the Brain

One finding about the physiology of meditators' brains is that there seems to be greater activation in the left prefrontal cortex as compared to the right (Davidson et al., 2003). This physiology corresponds to improved mood and enhanced immune functioning. Studies from the early 1970s showed that damage to the left side of the prefrontal cortex left people unable to feel joy, feeling instead increased sadness. Lesions on the right side of the prefrontal cortex left people prone to laughter, even at inappropriate times (Begley, 2007, pp. 224-225). Another study conducted by Davidson (2004) showed that mindfulness practices "[enabled] individuals to regulate their emotions in a positive way with approach rather than avoidance (qtd. in Siegel, 2007, p. 32). In 2006, Davidson and his colleagues found that people with greater activation in the left prefrontal cortex felt that they had their lives under control. They experienced a sense of purpose and good relationships, and they accepted themselves for who they

were. People with greater activation in the right prefrontal cortex were discontented, unhappy, and felt as though their lives were out of control. (Begley, 2007, pp. 225-226).

Another study showed meditators to have increased thickness of both the middle prefrontal area and the insula, which was particularly enlarged on the right side (Lazar et al., 2005). To recall, these structures are part of what Siegel called the resonance circuitry. They enable us to interocept, to observe and reflect on our inner experience, and to interpret non-verbal signals from others, ie. quality of eye contact, tone of voice, posture, gestures, timing and intensity of responses. This research suggests that mindfulness meditation might alter the structures of the brain responsible for self-observation and empathy, the foundation for attunement.

Three studies of entering a mindful state of awareness of the breath (Brefczynski-Lewis, 2006; Lazar, 2006; Short, 2006) found that an area connected to mirror neurons, the superior temporal region, was activated with breath awareness. Lazar's (2006) later study showed that these areas were activated along with the middle prefrontal region. (Siegel, 2007, pp.180-181). These research findings have led Siegel to postulate that mindful awareness of the breath may activate the resonance circuits including the superior temporal areas, together with the insula and middle prefrontal regions of the brain. These are the areas of the brain involved with empathy, interoception and attunement to self and others. Moreover, prefrontal growth allows neurons from differentiated parts of the brain and body to connect. This allows for both logical and intuitive processing of events.

Additionally, in previous studies, meditation has been shown effective for regulating chronic pain (Journal of Behavioral Medicine, 1985), anxiety (Kabat-Zinn, Massion,

Kristeller, Peterson et al, 1992), stress reactivity (Goleman & Schwartz, 1976), psoriasis (Kabat-Zinn et al., 1998), and for alleviating discomfort among those living with HIV/AIDS (Brazier, Mulkins & Verhoef, 2006). Harte, Eifert and Smith (1995) compared the effects of running and meditation on beta-endorphin (beta-Ep), corticotrophin-releasing hormone (CRH), cortisol, and mood change in eleven elite runners and twelve highly trained meditators matched in age, sex and personality. Although the runners alone experienced elevations in beta-EP, there were significant increases in CRH among both runners and the meditators with no significant differences. CRH is associated with positive mood changes (Shapiro, Schwartz, & Santerre, 2005).

#### The Research on Hatha Yoga

There have been fewer studies of hatha yoga's effect on brain physiology as compared to the number of similar studies of the effects of seated meditation. This is a new area of research that is only beginning to be explored in more depth. However, Maria Baldwin's (1999) research showed that the practice of hatha yoga created more positive affect than cardiovascular and resistance training alone. Hatha yoga decreased vulnerability to stress among healthy exercising adults (Baldwin, 1999). A study of 113 psychiatric inpatients showed that their mood as measured on the Profile of Mood States (POMS) improved after taking a yoga class (Lavey et al., 2005). Michelson et al. (2005) found that women self-described as emotionally distressed who took yoga classes twice a week for three months improved on multiple depression symptom scales and on perceived well-being. Moreover, their salivary cortisol levels decreased significantly by the end of a single yoga class, where cortisol is an indicator of high levels of stress (cited

in Bernstein & Bullock, 2007). Woolery (2004) found that yoga classes improved mood among non-clinical subjects (cited in Bernstein & Bullock, 2007). In another study, Carlson, Speca, Patel and Goodey (2003) found that quality of life, mood, symptoms of stress and immune parameters in breast and prostate cancer outpatients improved when research participants took an eight-week mindfulness-based stress reduction meditation program that included relaxation, meditation, gentle yoga and daily home practice.

Studies have demonstrated yoga's effectiveness in managing disorders reflective of hyper-aroused physiological states, diabetes and insomnia. Innes et al (2005) reported the results from twenty-two randomized controlled trials looking at "yoga in relation to cardiovascular disease associated with insulin resistance in diabetes" (quoted in Bernstein & Bullock, 2007). All studies found significant improvements on measures of insulin sensitivity, lipid profiles, blood pressure, oxidative stress and cardiovascular function (cited in Bernstein & Bullock, 2007). Cohen (2004) found that a Tibetan form of yoga improved sleep among patients undergoing treatment for lymphoma (cited in Bernstein & Bullock, 2007). Khalsa (2004) also studied the effects of yoga on sleep quality. He looked at patients suffering from chronic insomnia. Just one yoga training session and practice suggestions which subjects followed for eight weeks led to improvements in "sleep efficiency, total sleep time, sleep onset latency, and wake time after sleep onset as measured by sleep diaries" (quoted in Bernstein & Bullock, 2007).

Other studies have shown yoga's effectiveness in managing pain symptoms. Both Sherman (2005) and Williams (2005) found that yoga led to significant improvements in back pain. The subjects in Sherman's (2005) study completed a twelve week yoga class and experienced the benefits even five months later (cited in Bernstein & Bullock, 2007).

Williams (2005) found that after a sixteen week yoga program, subjects' "pain intensity, functional disability and need for pain medication all decreased significantly" (quoted in Bernstein & Bullock, 2007). John (2007) found that a three month yoga treatment helped people suffering from migraines. They experienced less frequent headaches, less pain intensity, less need for medication, and lower depression and anxiety scores (cited in Bernstein & Bullock, 2007).

Just recently, Streeter et al. published a study (2007) that indicated elevated GABA (gamma-aminobutyric) levels among subjects who had practiced one hour of yoga. GABA is a primary inhibitory neurotransmitter. Its elevation suggests that yoga could be a useful treatment for depression and anxiety, disorders associated with low GABA levels. This last study marks the beginning of what is well needed now, research on the changes in brain function due to a hatha yoga practice. This is especially true given the attention seated meditation has drawn from such studies.

#### The Body as a Tool for Affecting Mental and Emotional Change

The primary distinction between hatha yoga and seated meditation is the movement component of hatha yoga. The mindful movements of hatha yoga are directed towards re-patterning the body to move in a more integrated, healthy, functional manner. Along this journey, hatha yoga practitioners become aware of the areas of the body that do not have access to a healthy range of motion. Through a systematic approach, hatha yoga practitioners begin to feel the shifts that lead to understanding and embodying greater freedom of movement. This experience of gaining flexibility, strength and balance to move towards physical alignment, hence comfort and ease, is the somatic equivalent of the goals set forth by Karen Reivich and Jane Gilham's (2007) Penn Resiliency Program.

This program is one intended to help middle school age children notice their habitual patterns and move towards more flexible, accurate thinking. The curriculum includes teaching students how to cultivate strength through assertiveness training, and balance so that they are not always thinking in one way. As such, a hatha yoga program could work as an effective complement.

What is important to understand is that the mind and body respond to one another. Whether it is classified as part of the limbic system or not, the hypothalamus is the master controller of the endocrine system. As we work with the body, consciously relaxing it, there are shifts in thinking patterns and emotional states that accompany that relaxation. As we tune in to the experience of the body, we are able to recognize and then move away from getting stuck in a physiological state often described as “the stress response” (Benson, 1975). This term describes what happens when the hypothalamus triggers the stress hormones, cortisol and epinephrine, to shift the body into a state of alert where heart rate, respiration and blood sugar increase, digestion, immune system and reproductive system functioning are compromised, and muscle tension or the tonus of the body increases. Without conscious attention, many people’s bodies and minds remain in the stress response instead of responding to a perceived threat with appropriate increased vigilance and then returning to a baseline relaxed state. What often happens is that we live in that heightened state of alertness, experiencing chronic stress, or we shut down and collapse, never rising to appropriate levels of engagement. These two experiences manifest as anxiety and depression, often described as two *sides of the same coin*. The reason such opposite reactions are seen as having the same cause is because in both cases, the reaction is due to the experience of being unable to pull away from an unskillful

thinking pattern. According to N.V. Raghuram at the Swami Vivekananda Yoga Anusandhana Samsthana, a yoga research and rehabilitation center in India, the culprit is the speed of the thoughts. The remedy then is to slow down the thinking (Raghuram, 2001). Both seated meditation and hatha yoga are disciplines to effect that end.

Through hatha yoga, we cultivate what Herbert Benson (1975) first described as the “relaxation response” in his book by that name. This is where we consciously relax the body by bringing attention to the breathing, drawing the breath deeper down into the belly and slowing the pace. We consciously relax the body part by part, what is called autogenic training. Under these conditions, experiences of well-being often spontaneously arise. This may be, in part, due to the fact that we are tuning in to the body, listening to and feeling it. Just as tuning in to the thoughts increases our ability to feel connected to self and to then to others, as happens in seated meditation, so too tuning into the body likely has the same effect. Moreover, the body is easier to control than the mind. It is less subtle and easier to get to know, to recognize its patterns and shift those patterns towards those which will bring well-being. Hatha yoga, is, therefore, more accessible to many people than seated meditation, and can be an easier discipline to which to commit.

In yoga philosophy, the practice of *asana* or posture is described as a preparation for meditation (Patanjali, trans. 1990, pp. 125, 152-154) because it is difficult to quiet the mind when the body is crying for attention due to discomfort. In addition, hatha yoga starts the process of slowing us down until we feel ready to sit still without undue agitation. It is for this reason that there is typically a ten minute period of lying on the



back in stillness at the *end* of a hatha yoga session. As one research participant described:

I think that the activity of yoga (eg. concentrating on alignment and being mindful of body position) allows the body to use mental energy to achieve the pose, and for me, personally, it is that focus that makes yoga so engaging and ultimately, restorative. During yoga practice, one's mind can focus on the physical position of the body, and it is then easier to be distracted from the mental chatter that is more persistent when seated for meditation.

This observation is accurate and articulates exactly why hatha yoga is a preparation for seated meditation.

Although there are few studies which have directly considered the effects of hatha yoga, there has been a good deal of research documenting the fact that physiology not only reflects but influences affect. Among many are studies by Strack, Martin, and Stepper (1988) and by Robert Sossignan (2002) which both demonstrated that facial expression influenced mental and emotional experience. The “facial feedback hypothesis” or self-perception theory describes the phenomenon that when we smile, we consequently feel happy and when we frown, we consequently feel agitated. James Laird's research (2003) focused not only on facial expressions but also postures associated with happiness, sadness or anger. The physiology did indeed lead to stronger corresponding emotions. Sandra Duclos, James Laird, Eric Schneider, Melissa Sexter, Lisa Stern, and Oliver Van Lighten had previously had the same finding in their 1989 study, “Emotion-Specific Effects on Facial Expressions and Postures on Emotional Experience.” In Simone Schnall and James Laird's 2003 study, subjects adopted and maintained facial expressions and postures that expressed either happiness, anger or sadness. They held the postures four minutes, relaxed for two minutes, and repeated the

posture again a total of four times over the course of half an hour. The emotions that the subjects felt corresponded to the physical behavior they expressed. Moreover, the subjects' moods endured for ten minutes beyond the practice period and led to mood-congruent memories. This research has a direct bearing on the benefits of a discipline like hatha yoga, where we mindfully attend to the experience of the body in various held poses. The body's expression in the poses likely leads us to experience various positive mind-states.

In fact, through the practice of hatha yoga, one could easily experience the body as a living metaphor. There is a standing balance pose called *Natarajasana* or Dancing Shiva, where we fold one lower leg in towards the back of the thigh and hold the foot. Then we press that foot into the hand to open the back knee and open the chest. We take the free arm forward and up, pressing out from the shoulder through to the heel of the hand. Shiva is the Hindu god of destruction and represents that aspect of the life cycle where experiences fall apart before the next phase of creation. In this pose, we have the physical experience of balancing in a pose where everything is falling apart underneath the standing foot and we dance on top. In *Virabhadrasana I* or Warrior I, we look ahead towards our target with an open heart, an expansive chest, but we're grounded, quite literally, through the back leg. In inverted poses, we turn everything upside down to see from a fresh perspective. In *Urdhva Dhanurasana* or Upward-facing Bow pose we literally turn ourselves inside out to open the heart.

One yoga practitioner, a research subject in the study, wrote that she "fell in love" with yoga gradually. At first yoga was a reprieve from the hectic pace of work. Then she became engaged with the challenge of learning the poses, and finally she learned the

physical experience of “finding comfort within the discomfort.” Similarly, she learned how forcing was counter-productive, that she could and should refrain from giving the pose more energy than it deserved. Since these are approaches to living that extend beyond the practice of the poses, this woman’s experience is an example of how the physical experience of the body influences the mental and emotional life of the yoga practitioner.

Candace Pert, a research professor at the Department of Physiology and Biophysics at Georgetown University Medical Center, has been involved with the molecular research that explains why a body-based approach effects positive mental and emotional change. Her career has focused on neuropeptides. Peptides are ligands, or molecules that bind to receptors on the surface of cells. They are made of strings of amino acids. The following is an analogy Pert used to describe the function of peptides: “If the cell is the engine that drives all life, then the receptors are the buttons on the control panel of that engine, and a specific peptide (or other kind of ligand) is the finger that pushes that button and gets things started” (Pert, 1997, p. 25). Some of the well-known neuropeptides, or peptides which have receptors in the brain, include oxytocin from the pituitary, insulin from the pancreas, vasoactive intestinal peptide (VIP) from the gut and gonadotrophin-releasing hormone from the hypothalamus (Pert, 1997, p. 71). The interesting finding that Pert (1997) presented in her book *Molecules of Emotion* (1997) is that the peptides from the endocrine system also appear in the cortex, the limbic system and the emotional brain. Moreover, Pert cited Ed Blalock’s (1982) discovery that the immune system cells also secrete peptides, such as endorphins (Pert, 1997, p. 180), the same chemicals that we conceive of as controlling mood in the brain. Hence the three separated areas of

neuroscience, endocrinology, and immunology and their various organs- the brain, the glands, spleen, bone marrow and lymph nodes- are all joined in a “network of communication” (Pert, 1997, p. 184). The brain is integrated with the rest of the body at a molecular level. This is why when we have a feeling or a motivational drive, there is an emotional component and a physiological component. When we are thirsty, we breathe off less moisture, we excrete less urine, and our minds direct us to get something to drink. (Pert, 1997). The whole system of body and mind works together. According to Pert, the neuropeptides and their body-wide receptors are the “physiological substrates of emotion, the molecular underpinnings of what we experience as feelings, sensations, thoughts, drives, perhaps even spirit or soul” (Pert, 1997, p. 130). Pert’s theory is that of an “an organismwide information system linking the brain and glands with the immune, digestive, and autonomic nervous system” so that there is really “no distinction between the mind and the body” (Pert, 1997, p. 196).

It is this physiological understanding that led to Deb Shapiro’s (2006) book *Your Body Speaks Your Mind* and Louise Hay’s (1988) *Heal your body: The Mental Causes for Physical Illness and the Metaphysical Way to Overcome Them*. Both writers understood the body as an instrument of expression of what is happening in the mind. They discuss how there are often mental and emotional underpinnings for physical symptoms we experience. Pert cited studies by researchers like David Spiegel of Stanford who showed that being able to express emotions like anger and grief could improve survival rates in cancer patients (Pert, 1997, p. 192). As Pert explained, “[E]motional expression is always tied to a specific flow of peptides in the body...[Consequently,] the chronic suppression of emotions results in a massive disturbance of the psychosomatic network”

(Pert, 1997, p. 192). In her book *Your Body Speaks Your Mind*, Deb Shapiro alluded to a scene from Woody Allen's film *Manhattan* where his girlfriend announced she was leaving him for another man. Woody Allen did not respond and Keaton wanted to know why he was not angry. "I don't get angry," Allen replied. "I grow a tumor instead" (Shapiro, 2006, p.17). As Dan Siegel wrote in *The Mindful Brain*:

A range of studies suggest that our bodily state directly shapes our affects which all interact to influence our reasoning and decision-making. Having aversive reactions to our own bodily inputs- or trying to avoid awareness of them- leads to a restricted access of the hub to any points on the rim... We become inflexible... In such a nonintegrated state, the individual is susceptible to patterns of rigidity or outbursts of chaos... (Siegel, 2007, p. 298).

All the body-based psychotherapies stem from the understanding that by attuning to our bodies, we can better understand our minds since the body plays out what the mind can not accept. Pierre Janet (1859-1947), a predecessor of Sigmund Freud and Wilhelm Reich, was the first body-psychotherapist. He studied respiratory patterns in neurosis and worked with massage and the re-education of movement. He understood that psychological analysis was a psycho-physical process. His work was neglected until the more recent research into post-traumatic stress disorder (Boadella, 1997). According to Bessel Van der Kolk (2007), currently a leading voice in the field of PTSD, the frontiers of trauma treatment are all body-based: EMDR, tapping and, of course, hatha yoga.

Reich, himself, was a pioneer in exploring how physiology reflects our psychology. His work and the body-oriented psychotherapies which followed from his work are based on how we can use the body as a tool to better understand and help heal psychological issues since the mind and body are inseparable. In his book *The Language of the Body*, Alexander Lowen (1958), who was a student of Reich, explained that "analysis from

below can circumvent the defense which the ego erects against an attack upon itself” (Lowen, 1958, p. 12). In other words, what is repressed and unavailable at the level of the conscious mind, leading to mental and emotional patterns which may be stuck in place but not appropriate to our current situations, can be worked with more easily on the level of the body. According to Reich, “[T]he character and the muscular attitude [are] functionally identical.’ [T]hey serve the same function energetically (quoted.in Lowen, 1958, p. 14). Releasing the muscular holding patterns frees up the energy and brings back the memories that led to the initial repression. If we accept this as true, the conscious breathing practices, the relaxation and the slow, mindful movements of hatha yoga help to dissolve the energy that holds in place unskillful thinking and feeling patterns.

This understanding lays the foundation for many forms of body work and therapies that emphasize a dual psychological and somatic intervention: Alexander Lowen’s bioenergetics, the Alexander technique, Gestalt body work, the structural integration of I. Rolf and the Feldenkais method (Moss & Paul, 1999). Like these interventions, the practice of hatha yoga creates the conditions where one tunes into the experience of the body. It is essentially a moving meditation with an emphasis on mindfulness- of body and mind. As such, it is another modality of working with the thoughts and emotions through the body.

Additionally, hatha yoga has physical benefits that contribute towards a sense of well-being. The practice keeps the spine supple. We move it through its range of motion, forward-bending, back-bending, side-bending and twisting. The forward-bending poses and twists massage and stimulate various organs. The backward-bending poses facilitate

easy breathing and counter the habitual slouching posture many of us tend to assume. The inversions stimulate the endocrine system and allow the lymphatic fluids and blood in the lower extremities to drain back down towards the heart. Shoulderstand, one of the inversions, stimulates the vagus nerve, one of the cervical nerves, which wanders into all the major organs. Finally, the practice is one where we slow down and relax the body. Of all the physical benefits, this is of most significance. As the literature suggests, the physical well-being that comes from the hatha yoga practice leads to emotional and mental well-being as well.

The literature suggests that we benefit a great deal from practicing mindfulness. The cutting edge research looking at the effects of seated meditation is exciting. What is necessary is further research on the effects of hatha yoga to determine whether the effects are as profound when the mindfulness is wedded to conscious movement.

### Purpose of Study

Clearly, there is a connection between what we do and how we feel. Mindfulness practices heighten our experience of this truth. Classically and in a spiritual context, mindfulness is meant to be practiced in stillness. However, there are many body-based disciplines that foster mindfulness through movement like hatha yoga. This study seeks to contribute to the literature by exploring the impact of conscious movement on affect as compared to stillness within the field of the meditative arts.

The primary objective was to determine whether hatha yoga or seated meditation would elicit greater improvements in scores from baseline to endpoint on the Positive and Negative Affect Schedule (PANAS) measure of mood.

Secondary questions included:

1. Would individuals experience an elevation in mood when they shifted from attending a yoga class once or twice a week to having an additional personal home practice four times a week?
2. Would the level of previous experience with yoga and meditation impact how much subjects' moods changed during the course of the study?
3. Would individuals vary in their experience of the benefits of the two practices or would there be a consensus with regard to the practice which improved mood more?
4. Would changes in the physical body based on a regular practice of hatha yoga affect the way people felt?
5. Would either or both practices increase the level of mental energy as described by Patrick O'Connor (2006): mood, cognition, motivation and quality of life?
6. Which practice would be more effective at raising levels of optimism?
7. Which practice would be more effective in bringing about a more internal locus of control in the practitioner?
8. Which practice would be more effective in raising levels of self-efficacy?
9. Which practice would be more effective in increasing the quality of life of the practitioner?

## Method

### Participants and Recruitment

The target population was a group of forty-four of the co-primary investigator's yoga students ranging in age from twenty-eight to seventy-four. There were four men and forty women who had been practicing yoga with the Co-PI for anywhere from less than one to five years. Twenty-seven remained in the study until the end, two men and twenty-five women. Seventeen did not because of a failure either to follow-through with the practice or to take the measurements when required. Although data regarding



ethnicity was not collected, there were two African Americans and the rest of the subjects were Caucasian. Each subject freely chose to join this study because s/he was interested in cultivating a personal home practice. None of the subjects was suffering from any mental, emotional or physical disability at the time the study began.

#### Previous experience with hatha yoga and meditation

The subjects varied in their previous experience of yoga and meditation. Of the thirty-one subjects who remained in the study long enough to respond to the questions about prior practice which were distributed ten weeks into the study, some were beginners with a year or less than a year of hatha yoga practice (n = 6) and others had over nine years of experience (n=5). The average was between three and four years of hatha yoga practice. Most of the subjects had been attending yoga classes once or twice a week (n=25), and twelve had practiced yoga outside of classes on their own. Of these subjects, only three had done so more than twice a week. Most had no experience with a home practice (n=19).

Most subjects were completely inexperienced with seated meditation (n=24). Two subjects had over nine years of experience, but including them, the average was less than one year of meditation practice. Only four had a personal practice of seated meditation and only two had had one where they practiced three or more times a week. (See Appendix C, *History of Prior Yoga and Meditation Practice*)

This was a convenience sample. The justification for determining the sample size was simply getting as many students with sufficient motivation to follow through with the home practice as possible. Their motivation was the key factor to the success of the

research study. An eighteen-week study is a long commitment to a personal practice for those who are new to it, so this was the best way of ensuring follow-through. In addition, these were subjects who would understand and appreciate the instructions on the CDs that guided them through the practice because they were familiar with the Co-PI's particular way of instructing. Additionally, all were healthy with the ability to sustain a current home practice.

### Study Design

This was a mixed method experimental study comparing the effects of two types of yoga practice, the practice of seated meditation and the practice of hatha yoga on mood, optimism, locus of control regarding one's state of health, self-efficacy with regard to the practice's ability to affect quality of life, and mental energy as described by Patrick O'Connor (2006): mood, cognition, motivation and quality of life.

The forty-four subjects who chose to participate in this study took a modified PANAS test measuring their level of positive and negative affect at the outset on day one of the study. The following adjectives were added to the end of the PANAS for subjects to rate how they were feeling: *serene, refreshed, content, relaxed*. Subjects also took the Life Orientation Test-Revised (LOT-R) measuring optimism, the multidimensional health locus of control (form A) (HLC) scale, the Self-Efficacy test, and the Medical Outcomes Study Short Form-12 (SF-12) measuring quality of life. In addition, they wrote a one page summary describing their mental energy as defined by Patrick O'Connor (2006):

mood, cognition, level of motivation and quality of life. Subjects received a CD with guided instructions for both the seated meditation and the hatha yoga practices and they also received a log to record the frequency and duration of their practice sessions and a hand-out describing an appropriate attitude towards the hatha yoga practice to ensure that they would understand how to work in a way that would keep them safe from injury.

(See Appendices D & E)

Twenty-four of the subjects started with a thirty-minute home practice of seated meditation at least four times a week. Twenty subjects started with a thirty-minute home practice of hatha yoga. Subjects were randomly assigned to one of the two groups. Participants had CDs with instructions guiding them through the experience which they could choose to use or not. They committed to practicing at least four times a week for eight weeks.

During this time, subjects filled out a weekly time sheet noting which days they practiced and for how long. They also kept a journal, which they updated weekly, analyzing their mood, cognition, level of motivation and quality of life and whether they felt this had anything to do with their personal practice.

After eight weeks, subjects met with the Co-PI (Cohen) again. They brought their weekly logs and their weekly journals. They wrote one page summaries describing how they felt the mindfulness discipline they practiced affected them- their mood, cognition, level of motivation and quality of life and whether or not and to what extent they thought it had to do with their personal practice. They also noted the frequency and duration of their practice each week. At that time, the subjects took the same battery of tests that they took on day one of the study.

Then the subjects took two weeks off from a personal practice of any mindfulness discipline. We met again at the end of this two week break and the subjects took the same battery of tests they had taken on day one and after eight weeks of the first practice. They also wrote another one page summary describing their mood, cognition, level of motivation and quality of life. In addition, the subjects filled out a sheet describing their previous experience with yoga and meditation prior to the commencement of the study.

At this point, the subjects switched practices so that those practicing seated meditation began practicing the hatha yoga sequence and those practicing hatha yoga began the seated meditation. They continued filling out the time sheets and responding to the weekly journal prompts as they had during the first part of the study.

After another eight weeks, at the end of eighteen weeks, the subjects wrote up another one page summary similar to the first, describing their mood, cognition, level of motivation and quality of life and how they felt the mindfulness practice they had been working with during this second half of the study had affected them as compared to the first practice. Again, they took the battery of tests, the same tests they took on day one of the study, after eight weeks of the first practice and after the two week break on day one of the second practice.

In designing the study, the Co-PI's notion was that practicing one mindfulness technique for eight weeks and then the other for another eight weeks would provide sufficient time for subjects to discern a difference in mood, locus of control, self-efficacy, and mental energy when comparing the effects of the two practices. Because individuals differ, what was of interest was exploring how each individual experienced the two

practices side by side with a two week break between practices. However, the fact that the subjects started the second practice with a base of having already practiced a mindfulness discipline for eight weeks compromised the clarity of the results at the end of the study. What was interesting was analyzing the different effects that sequencing had on the subjects in each of the two groups.

#### Measures:

1. Modified Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS lists twenty adjectives, ten reflecting positive affect and ten reflecting negative affect. The following adjectives were added to the end of the test: *serene, content, refreshed, relaxed*. Respondents rated their experiences of each item in terms of how they had been feeling over the past four weeks at the outset of the study, over the past eight weeks at the end of each eight week practice period, and at the end of two weeks after the two week “time off” period between the practice of each mindfulness discipline. They used their weekly journal writings to inform their responses. For this measure, a 5-point scale (*1= very slightly or not at all, 5= extremely*) was used to rate whether a subject was feeling a particular way (*ie. proud, nervous, irritated, alert*) Alphas ranged between .83 and .93 at the different time points.
2. The Medical Outcomes Study Short-Form-12 (SF-12; Ware, JE, Kosinski, M., and Keller, SD, 1996). This is an inventory that asks twelve questions about

respondents' experiences of their physical and mental health and how this affects their general functioning and quality of life. There are five subscales assessing health perceptions (1 item), physical health (2 items), role functioning due to both physical health (2 items) and mental health (2 items), pain (1 item), mental health (3 items), and social functioning (1 item). The Health Perceptions subscale asks respondents to rate their beliefs about their health: "*In general, would you say your health is:*" by using a 5-point Likert-type scale (*1=excellent, 5=poor*). The Physical Health subscale asks respondents to assess their ability to perform various physical tasks (e.g. "*Does your health now limit you in these activities? If so, how much?*") Moderate activities such as *moving a table, pushing a vacuum cleaner, bowling, or playing golf* are listed here. Responses range from *2= yes, limited a lot* to *0= no, not limited at all*. The Role Functioning subscales ask participants if they have had problems with their work or other regular daily activities first as a result of their physical health and then as a result of emotional problems. Respondents answer either *1=yes* or *0=no*. The Pain subscale consists of one item asking, "*How much did pain interfere with your normal work (including both work outside the home and housework)?*" Response choices range from *1= not at all* to *5=extremely*. The Mental Health subscale asks how participants have been feeling. (e.g. *Have you felt calm and peaceful?*) Response choices range from *1= All of the time* to *6=none of the time*. The Social Functioning subscale consists of one item, "*How much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?*" Responses range from *1=all of the time* to *5=*

- none of the time.* According to Cronbach's reliabilities, alphas ranged from .78 to .82 at the different time points.
3. Life Orientation Test-Revised Optimism test (LOT-R; Scheier, Carver, & Bridges, 1992). This measure consists of ten items. It was developed to assess differences in generalized optimism versus pessimism. The instructions ask respondents to rate whether they agree or disagree (*A= I agree a lot; E= I DISagree a lot*) with statements like the following: "*In uncertain times, I usually expect the best.*" According to Cronbach's reliabilities, alphas ranged from .88 to .92 at the different time points.
  4. Self-efficacy test. (Bandura, 1977) This measure comprises of one question, "*How confident are you that you can improve your well-being with your personal practice?*" Respondents choose among the options of *1= very confident* to *5=not at all confident*.
  5. Multidimensional Health Locus of control (form A) test (HLC; Wallston, BS, Wallston, KA, Kaplan, GD, & Maides, SA, 1976). This measure consists of eighteen items. Each is a statement about the respondent's medical condition with which the respondent can either agree or disagree (*e.g. If I get sick, it is my own behavior which determines how soon I get well again.*) Respondents choose from *1=strongly disagree (SD)* to *6=strongly agree (SA)*. According to Cronbach's reliabilities, alphas ranged from .70 to .80 at the different time points.

## Other Study instruments

1. CD recordings with instructions guiding subjects through a hatha yoga practice and a seated meditation practice. The hatha yoga sequence was simple and straightforward. Its intent was to keep the subjects keenly aware of the experience of the body and the breath. The movement was slow and deliberate and there were pauses between poses. The sequence included an initial period of body and breath awareness and a closing relaxation with body awareness cues at the end. The meditation CD guided the subjects' attention to the experience of the body as well- the posture, the breath, what the subject might see behind the closed eyes, what the ears could hear, even the content of the thoughts in the mind.
2. Prior yoga and meditation practice sheet. This was a questionnaire that asked students about their prior history with both yoga and seated meditation practice in terms of duration or number of years they had been practicing, and frequency (times/ week) both in terms of class experience and personal practice. For responses pertaining to duration of practice in terms of years, subjects could choose from 0, 1-2, 2-3, 4-5, 7-8 or 9+. For responses pertaining to frequency of practice (times/ week), subjects could choose from 0=*never* to 4=*daily*.
3. Weekly log for subjects to record how much time they spent practicing each day.



4. Weekly directed journal writing instructions asking subjects to describe their mood, cognition, level of motivation, quality of life and whether they experienced this as having any relationship to their personal practice.

#### Group modifications

Changes were made for only one person who had a knee injury and consequently required a modified hatha yoga practice. The Co-PI (Cohen) made a separate CD for that subject.

Data analysis looked at the results of ANCOVA to determine whether engaging in hatha yoga and seated meditation led to changes in mood, and also optimism, locus of control around health, perceptions of health and self-efficacy across time. Group means in scores were compared using student t-tests to a  $p \leq .10$  significance level on the following measures: PANAS, LOT-R, HLC, SF-12, and Self-Efficacy. This research presents ps, ts and ds in the spirit of exploration.

Overview of Statistical Analysis: Time 1 to Time 2, the first eight weeks of practice

Hatha yoga was better than seated meditation at increasing positive affect scores on the modified PANAS, which means that hatha yoga improved mood more than seated meditation. There was a significant change experienced by those practicing hatha yoga,  $t(14)=1.81$ ,  $p=.09$ , and  $d=.97$ . Those practicing seated meditation experienced no significant change in mood. (See table 1)

The results for both hatha yoga and seated meditation were strong on the HLC test as might be expected on a scale that measures subjects' perception that they have control

over their own well-being. These mindfulness disciplines are, by definition, techniques which are designed to empower individuals to care for their well-being, and the subjects have self-selected to participate in the study because of an implicit belief that they have some control. However, the results for seated meditation were in the wrong direction,  $t(9) = -2.14$ ,  $p = .06$ ,  $d = 1.43$ . (See table 3) By contrast, for the hatha yoga practitioners,  $t(14) = 1.73$ ,  $p = .10$  and  $d = .92$ . (See table 1) Looking at the results of the two practices side by side, *between subjects*, hatha yoga was the superior intervention,  $t(23) = 2.87$ ,  $p = .009$ ,  $d = 1.20$ , a significant difference. (See table 5)

The self-efficacy test measured the extent to which subjects felt that they could improve their well-being with their personal practice. There were no significant improvements in the results after eight weeks practice of either discipline. However, after practicing hatha yoga, subjects' scores reflected no significant change. By contrast, those practicing seated meditation had worse results on the self-efficacy measure after the eight week intervention,  $t(12) = -2.55$ ,  $p = .02$ , and  $d = 1.47$ . (See table 3) This means the subjects actually *lost* confidence in their ability to use the practice to improve their well being after practicing seated meditation. Comparing the two practices side by side, *between subjects*, hatha yoga led to significantly better results here with  $t(28) = 2.28$ ,  $p = .03$  and  $d = .86$ . (See table 5)

### The Qualitative Measures

These measures looked at mood, cognition, level of motivation and quality of life as described by the subjects. The writing was coded by a 3<sup>rd</sup> person who had no contact with any of the research subjects. The results for the hatha yoga practice reflected no

change. However, the seated meditation practice had a significant impact on improving cognition, far greater than that demonstrated by hatha yoga. Here seated meditation seemed to be the superior intervention. Looking at cognition, for seated meditation,  $t(8)=2.00$ ,  $p=.08$ , and  $d=1.41$ . (See table 8) Although the sample size was small, this was the strongest finding from this part of the study.

#### Summary of results from time 1 to time 2 after the first eight week practice

In sum, hatha yoga proved to be the superior intervention as measured by several of the quantitative measures, the modified PANAS, the HLC and the self-efficacy measure. Those practicing hatha yoga experienced an improvement in mood and a greater feeling of control over their health. Those practicing seated meditation felt less control over their health and lost confidence in their ability to improve their well-being with their practice. However, they also experienced an improvement in cognition.

#### Time 1 to Time 2: The subjects' anecdotal reports describing the effects of the hatha yoga practice

There were many positive effects that the subjects described as being attributable to the hatha yoga practice. More than a few subjects mentioned being more aware of their needs and what they needed to do to find more happiness in life. A number were motivated to make positive changes, often in terms of improving diet and exercise patterns. One or two recognized the need to simplify, another not to push herself so hard, both in her practice and in her life. Many mentioned feeling calmer, more serene, more grounded, with the experience of less upset.

Mental clarity improved for a number of subjects. Several felt they were better able to think and plan, to focus their attention on a task at hand. One subject recognized that her ability to feel more relaxed had helped her memory to improve. She could concentrate better.

One subject described a lessening of sluggishness, both physical and mental and a “renewed, calm confidence.” From various subjects, there was mention of a “lightened mood,” a reduction in anxiety, and a sense of feeling more empowered. Another subject lowered her dosage of medication for depression and noticed that the practice enhanced lovemaking. One mentioned the experience of disrupted sleep patterns’ evening out so that this subject woke up well rested for several weeks at a stretch. Another woman noticed how her body started to crave the practice. Yet another mentioned improved muscle tone and the loss of a few pounds. There was recognition of the difficulty of carving out time, but even with the “antsy-ness” that might have accompanied the practice, the subject who used this term (*antsy*) conceded that she always felt better after practicing. The ability to pull away from obligations for this thirty minute period of time and spend time with the body felt “uplifting and kind” to one subject. Another appreciated the “permission to notice the body when all is well,” and yet another subject mentioned her feeling that if she had practiced, then at the end of the day she always had something to be thankful for.

The subjects’ anecdotal reports describing the effects of the seated meditation practice

Of the twenty-four subjects who started the meditation practice, only sixteen remained at the end of the eight week meditation practice period. Although many subjects experienced resistance to sitting down to practice, almost all of those who did

experienced some of the beneficial effects. One mentioned feeling less reactive, calmer, happier. Another says she was “not as upset as [she] would have expected.” One subject described having more perspective. Another noticed she was less judgmental of herself. She was accepting her limits and pushing less. One subject mentioned the “awareness of [her] behavior and mood as it [was] unfolding.” Several described their ability to make positive changes with respect to adjusting their diet and/ or their exercise routine. More than one began to consciously dedicate more time to spend with family and friends.

One woman wrote about her blood pressure’s being unexpectedly normal. She was uncertain whether this was due to the practice or having some of the stressors in her life resolve themselves. Several subjects mentioned the ability to sleep through the night. Others wrote that they did not think they were “doing it well.” However, they would relax during this time period and looked forward to it. On the other hand, there were those who felt frustrated at not being able to control their minds. One subject who has a tendency towards introspection and depression found the practice difficult. She was looking forward to the hatha yoga practice, which she already knew she would like.

#### Overview of Statistical Analysis: Time 2 to Time 3, the two week break between practices

Those subjects who practiced seated meditation for the first eight weeks of the study generally felt better even during the two weeks that they were not practicing. By contrast, those who practiced hatha yoga for the first eight weeks suffered during the two week break, and their anecdotal reports provide more clarity regarding the particular reasons behind this. For those practicing meditation, optimism as measured by the LOT-R rose significantly,  $t(7) = 2.05$ ,  $p = .08$  and  $d = 1.55$ , as did subjects’ sense that they

were in control of the state of their health as measured by the HLC test,  $t(5) = 2.62$ ,  $p = .047$ , and  $d = 2.34$ . (See table 14) Most of the results from the qualitative data were insignificant here. The exception was quality of life, which decreased significantly when subjects stopped meditating,  $t(7) = -1.87$ ,  $p = .10$  and  $d = 1.41$ . (See table 14)

The results from the subjects who had just completed eight weeks of hatha yoga before discontinuing the practice distinguished themselves from those of the subjects who had practiced seated meditation first. The effects were most significant with respect to positive affect and locus of control regarding their sense of control over their health. When they stopped the practice for two weeks, subjects experienced a significant decrease in positive affect as measured by the PANAS,  $t(15) = -2.45$ ,  $p = .03$  and  $d = 1.26$ , and by the modified PANAS,  $t(14) = -2.43$ ,  $p = .03$  and  $d = 1.30$ . (See table 13) Of all of the results from all of the quantitative measures, the decrease in positive affect was of the largest effect size. Subjects' notion that they were in control of their health as measured by the HLC decreased significantly,  $t(15) = -1.94$ ,  $p = .07$  and  $d = 1.00$ . (See table 13) The qualitative results were consistent with these findings. Subjects' cognition decreased significantly,  $t(11) = -2.60$ ,  $p = .02$  and  $d = 1.57$ , as did their quality of life,  $t(11) = 1.37$ ,  $p = .04$  and  $d = 1.37$ . (See table 13) In their summaries, subjects described physical discomfort, mental speed and a sense of deprivation as some of the symptoms that contributed to these results.

#### Summary of results from time 2 to 3 after two weeks off from the practice

In sum, there was a distinction between the experiences of those who practiced hatha yoga first and those who practiced seated meditation after discontinuing the practice for two weeks. Those who had practiced hatha yoga suffered in all respects, including

cognition and quality of life. They felt less positive affect and less of a feeling of control over their own health. Those who had practiced seated meditation first, a smaller sample since many had dropped out of the study, may have experienced some carry-over effects from the power of the practice. Their optimism and their locus of control concerning their health increased significantly during the time off. Their quality of life, however, worsened, as measured by the qualitative measures.

Time 2 to Time 3: The subjects' anecdotal reports describing the effects of the two week break

These reports reflecting Patrick O'Connor's (2006) framework of mental energy were collected mainly to determine a new baseline for the subjects as they began the second practice. However, it was interesting to read their reactions to having two weeks off from a personal practice.

Two week break after the hatha yoga practice

Many subjects resented the disruption to their practice. They had appreciated the time set aside for themselves, the routine and the regularity of it, the sense of accomplishment they had derived. Their description of their experience of the break in routine ranged from "frustration" to a "deep feeling of deprivation" and a "feeling of emptiness." One wrote that she was "itching to get back to the practice." Several experienced physical discomfort. Three experienced back pain and one described "many aches and pains." More than one subject experienced stiffness as the body began to tighten.

A common refrain that subjects wrote about was that the pace of life had changed for the worse. One subject stated, "I feel like I can't catch up with myself." Another noticed that she was "propelled forward with activity. She was "looking forward to completing

things as opposed to enjoying the process.” Another described the same experience as “slipping back into the usual frenetic pace, squeezing stuff in.” She felt more “hectic and agitated. Another wrote, “Days fly by and I don’t take ‘my time.’” One subject noticed she was not taking proper breaks and another recognized that the practice had “kept [her] on track with attentiveness to [her]self.”

It was no surprise, then, that these subjects felt a difference in mood. One wrote that she was more upset by everything. Another described not feeling as content. Instead she felt more irritable and upset. Another wrote that she was not as ‘up’ as when [she] was practicing. One woman noticed that she was “reverting to old mood patterns where [she] would feel good for a couple of days and then not and then good and then not, for no tangible reasons.” Another used the word “sporadic” to describe her mood states. She noticed she was “not really relaxed,... more like a yo-yo.”

There was a repeated thread regarding the experience of being more scattered mentally, more forgetful, less mindful. One used the words to describe her experience as, “fuzzy thinking developing.” Three others mentioned being less focused. However, one subject found that her level of organization and open mindedness to learn and focus persisted throughout the two week break.

Finally, many felt less energy, were more tired, even the two subjects who wrote of having embarked on a walking routine to replace their practice during this two week period.



## Two week break after the meditation practice

It is important to note here that there were fewer subjects in this pool as compared to those practicing hatha yoga since so many who started with meditation dropped out of the study (n=8). However, although several mentioned the relief of not “having to” practice, three subjects noticed a change in their sleeping habits. They were less successful in sleeping through the night. Additionally, several mentioned being less in control of emotions, being less able to “let go” of schedules and deadlines. Another described this agitation as “the awareness of dropping balls and trying to beat the clock and squeeze in more.” Another wrote of more frequent feelings of stress and worry, being preoccupied with work. One woman wrote of a situation where her co-worker asked if she was okay. She didn’t seem like herself. Yet another woman wrote that she was happy not to have to practice, but she missed it. Several others mentioned that they were feeling good throughout the two weeks off, but recognized that the weather was also improving, which had contributed to their good mood.

Analysis of the results from time 3 to time 4, Hatha Yoga as the second practice compared to hatha yoga as the first practice:

In comparing the results of those who practiced hatha yoga as the first intervention to those of the subjects who practiced hatha yoga as the second intervention, one must consider that eight of the subjects who started the study with the meditation practice dropped out before beginning the hatha yoga practice. The pool of subjects who completed the measures at the end of the second hatha yoga practice was extremely small (n=9 or less), so the results were tenuous and it was more difficult to get significant findings. There were no significant findings from the quantitative measures. On the

qualitative measures, however, the small sample size did not preclude significant findings. Subjects in this pool still showed improvements in both mood, where  $t(8) = 2.80$ ,  $p = .023$  and  $d = 1.98$ , and in quality of life,  $t(8) = 4.26$ ,  $p = .003$ , and  $d = 3.01$ . (See table 9) In fact, these last results were the strongest found in the entire study.

In comparing these results to those of the subjects who practiced hatha yoga as the first intervention, both groups experienced an improvement in mood. The distinction was that this improvement showed up in the quantitative measures but not the qualitative measures for the first group, whereas the second group had the opposite experience. In addition, the first group improved their sense that they were in control of their own health as measured by the HRC. However, the second group did not get a reading on this measure due to insufficient data. Finally, it was only the second hatha yoga group, those with the meditation base, that experienced an improvement in quality of life. Subjects who practiced hatha yoga appeared to have benefited from having practiced seated meditation first. However, the results are tenuous due to the small sample size.

#### Analysis of the Results from Time 3 to Time 4: Seated Meditation as the Second Practice compared to Seated Meditation as the First Practice

Those who practiced seated meditation with the base of having already practiced hatha yoga for eight weeks fared better on the quantitative measures than those who started practicing seated meditation at the beginning of the study. Those who had the hatha yoga base experienced a much more marked increase in positive affect from the seated meditation practice as measured by the modified PANAS,  $t(14) = 2.44$ ,  $p = .03$  and  $d = 1.30$ . (See table 4) By contrast, those who practiced seated meditation first experienced no significant improvement in mood. Also of note is the fact that those practicing seated

meditation first experienced a decrease in their confidence that they could improve their well-being with their practice according to the self-efficacy measure,  $t(12) = -2.55$ ,  $p = .02$  and  $d = 1.47$ . (See table 3) That finding did not surface among the second group of subjects practicing seated meditation. Similarly, those in the first group of those practicing seated meditation experienced a reduction in their sense of control over their health as measured by the HRC,  $t(9) = -2.14$ ,  $p = .06$  and  $d = 1.43$ . (See table 3) Again, there was no such drop among those in the second group of subjects practicing seated meditation.

From the results of the qualitative measures, those who practiced seated meditation with the hatha yoga base experienced significant improvements in both motivation,  $t(10) = 2.61$ ,  $p = .026$ , and  $d = 1.65$ , and quality of life,  $t(10) = 3.63$ ,  $p = .005$ , and  $d = 2.30$ . (See table 10) The sole improvement experienced by those meditating in the first group was an improvement in cognition,  $t(8) = 2.00$ ,  $p = .08$  and  $d = 1.41$ . (See table 8)

In sum, those practicing seated meditation with the hatha yoga base felt better than those who meditated without having had this base. They felt more positive affect, more of a sense that they could improve their well-being with their practice, more in control of their health, more motivated, and more satisfied with their quality of life. By contrast, those experiencing seated meditation first did not experience any significant improvements in mood. They did, however, improve their cognition.

Analysis of the results from time 3 to time 4: Comparing the hatha yoga practice and the seated meditation practice when experienced as a second intervention

Results from the Quantitative Measures

This section analyzes the level of improvement in terms of change from the second baseline measurements taken at time 3, the start of the second intervention, to time 4 marking the end of the study. The most interesting finding from comparing the results of the subjects who practiced hatha yoga second to the results from those who practiced seated meditation second was that hatha yoga no longer showed itself to be the superior practice. During the first half of the study, the subjects who had practiced hatha yoga had better results. They experienced improvements in mood and in the sense of control they felt they had over their health. Seated meditation, by contrast, led to mixed results, where subjects lost confidence in their ability to improve their well-being with the practice, and had less of a sense of control of their health. However, they experienced improved cognition.

During the second half of the study, the quantitative measures showed an improvement in positive affect as measured by the PANAS-M only among those practicing seated meditation,  $t(14) = 2.44$ ,  $p = .03$  and  $d = 1.30$ . (See table 4) The qualitative measures showed significant improvements from the hatha yoga practice in mood,  $t(8) = 2.80$ ,  $p = .023$  and  $d = 1.98$  and in quality of life,  $t(8) = 4.26$ ,  $p = .003$  and  $d = 3.01$ . (See table 9) Those practicing seated meditation experienced improvements in motivation,  $t(10) = 3.63$ ,  $p = .005$  and  $d = 2.30$ , and in quality of life,  $t(10) = 3.63$ ,  $p = .005$  and  $d = 2.30$ . (See table 10)

This seems to suggest that when the meditation practice was preceded by hatha yoga, and when the hatha yoga practice was preceded by meditation, there was an “evening out” effect between the two groups. There was less distinction between the results of the two groups. It is possible that it took some time for the effects of the seated meditation

practice to take hold for this population, a population that was familiar with hatha yoga and relatively inexperienced with seated meditation, and it may be that the base of hatha yoga helped those sitting for meditation to commit to the practice and to more fully experience the effects.

The subjects' anecdotal reports from the end of the study, a preference for yoga

In discussing their experiences after taking the measures on the last day of the study, the overwhelming majority of subjects said they preferred the yoga practice. They experienced less resistance to having to carve out the time. Most looked forward to the practice and felt much better afterwards. Many discovered that their bodies "needed" yoga. They felt stiffness without a regular yoga practice, and in one case a great deal of body pain. One woman attributed the yoga practice to alleviating her depression. Many want to continue the personal practice with a blend of the two mindfulness disciplines, starting their practice with hatha yoga and then moving to seated meditation. They sensed the hatha yoga would help them settle down to sit more easily.

Impact of the sequence of interventions on commitment to the practice

Several subjects who practiced hatha yoga as the first intervention said that they felt this base had helped them to establish a seated meditation practice when the time came. Since overcoming resistance to sitting for meditation was a major factor in subjects' ability to comply with the study's requirements, this was important. For this study's subject pool, a group of people familiar with hatha yoga and mostly new to meditation, it was not surprising that they reported far more resistance to the seated meditation practice. It was difficult for many to make the time to "do nothing." In fact, eight of the ten

participants who dropped out of the study during the first half of the study were practicing seated meditation. Only sixteen of the twenty-four subjects who started with seated meditation as the first intervention were still part of the study to begin the hatha yoga practice ten weeks later.

The subjects who started with the hatha yoga practice and moved to the seated meditation practice afterwards suffered from body stiffness and pain when they discontinued the hatha yoga. Many then struggled with resistance to sitting for meditation. Four reported some irregularity in their seated meditation practice. However, only two were dropped from the study. One was dropped for not completing the measures and writing the summaries and the other because she missed a few weeks of practicing while traveling and wanted to begin the meditation practice again. Compliance with the meditation practice was better for those who had practiced hatha yoga first.

#### The anecdotal benefits of seated meditation

As the measures have shown, for those able to overcome the resistance, the meditation practice was not without benefit. Some of the most profound effects happened to subjects during the meditation practice period. Perhaps this is because this group of subjects was already familiar with hatha yoga. They simply increased the frequency of their practice. The meditation was new to most (n=24). It could have been the novelty and it could have been that the impact of meditation was a bit more subtle, but more profound.

Two women who had had consistent long-term difficulty with insomnia were able to sleep through the night. One of these women who practiced seated meditation first was able to stop taking sleep medication during this time. When she was practicing hatha yoga afterwards, she found it necessary to return to the sleep medication she had been taking prior to the study. The other woman described the improved ability to sleep through the night while practicing hatha yoga as taking longer to come, as she wrote, “in the fourth week or so.” She described this improvement as being “less pronounced” compared to the effects she experienced from the seated meditation practice. Another two subjects reported that the practice helped them whenever they had difficulty falling asleep and that doing the practice improved their sleep.

There was another subject who had a health problem that pre-dated the study. It persisted throughout the hatha yoga portion, which was, for her, the first practice, so much so that she was scheduled for surgery two weeks after the study finished. However, during the course of the eight weeks of her meditation practice, she began to improve dramatically. On the last day of the study, the surgery was cancelled. She had been getting acupuncture treatments concurrently. According to this subject, “Although I can’t prove this, I do believe that *both* [the acupuncture and the meditation] contributed to my overall improvement.” In fact, this woman also lost twenty lbs. during this eighteen week study, eight lbs. during the hatha yoga practice and another twelve lbs. during the seated meditation. In addition, she felt more focused, disciplined and happy. She was one of two women in the study who experienced significant weight loss. The other lost eighteen lbs. over the course of the study.

There was another woman who had a more unusual experience with seated meditation, which is not as uncommon as one might expect. She had a vision, the image of a person. She also had the regular experience of spontaneous effortless retention of the breath at the end of the exhale before the inhale, an experience which leads to a deep stilling of the mind. This subject did, in fact, find seated meditation extremely relaxing and interesting.

There was a strong consistency in how subjects described their experiences of themselves during the seated meditation practice. They described a shift in perspective that involved accepting things as they were, the ability to let go, the ability to “see the big picture,” and a certain calm or serenity during the course of their day. Several subjects noticed it while preparing to go away on vacation. Others noticed this changed perspective while at work. A good number described the improved ability to pay attention to what they were doing while they were doing it, to focus. Several decided to make shifts in their lives- to dedicate more time to their own well-being or to explore and learn new things or spend more time with friends and family. Moreover, there were several who experienced less resistance to practicing meditation as compared to hatha yoga.

#### End of Study Results

From the first half of the research study, the major finding was that the hatha yoga practice led to greater improvements than the seated meditation practice in experiencing positive affect and a sense of control over one’s own health. Seated meditation led to less confidence in the practice, less of a sense of control over health, but improved cognition.



This could have to do with the fact that the meditation practice was new to many subjects in the study (n= 24).

A significant distinction between the hatha yoga and the seated meditation practice was that subjects suffered physically, mentally, and emotionally when they practiced hatha yoga first and then discontinued the practice for two weeks. This contrasted with the experience of those who had practiced seated meditation first. This group seemed to have experienced a carry-over effect both during the two week break between practices and during the hatha yoga practice that followed.

In addition, both those practicing seated meditation with the hatha yoga base and those practicing hatha yoga with the seated meditation base experienced greater benefits when they had the base of a previous practice. This was particularly notable when subjects practiced hatha yoga before seated meditation. The improvements experienced from the seated meditation practice were significantly greater than those experienced by the subjects who practiced seated meditation first on measures of positive affect, motivation and quality of life. Those who practiced hatha yoga with a seated meditation base distinguished themselves from those who practiced hatha yoga first on the qualitative measures with improvements in mood and quality of life.

Limitations/ Specific implications for future studies:

Small Sample Size

This study started with forty-four subjects, twenty-four practicing seated meditation and twenty practicing hatha yoga. By the end of the study, twenty-seven subjects remained. It would be interesting to have another study with a larger pool of subjects.

## Cross-over Study Design

This study looked at subjects who all practiced both hatha yoga and seated meditation with a two week break between practices. Therefore, subjects started the second practice with a base that was already elevated compared to what it would have been at the beginning of the study. They were not starting from a clean slate. The “base” measurements were taken on day one of the second part of the study after a two week break (week 10). Subjects’ experience of the second practice was impacted by their having already experienced the first.

This *limitation* led to extremely interesting results. The cross-over design illuminated the positive effect of introducing yoga practitioners to seated meditation by first having them commit to a personal hatha yoga practice, then introducing them to a seated meditation practice. Not only did this help subjects with compliance to the seated meditation practice, but the benefits the subjects experienced from the seated meditation practice were significantly greater when they had the base of hatha yoga first. In sum, the design made the study more difficult to parse, but richer and far more interesting.

## Implications for further study

Because this subject pool was a group that was familiar with and liked hatha yoga but was largely inexperienced with seated meditation, it would be interesting to compare the results of this study to one introducing longtime seated meditation practitioners to a personal practice of hatha yoga. It would also be interesting to compare the results of this study to another where there would be two additional groups, one which would practice seated meditation for eight weeks, take a two week break and then practice seated

meditation again for eight weeks, and the other which would practice hatha yoga for eight weeks, break for two weeks and practice hatha yoga again for eight weeks. The meditation- meditation group's presence would clarify whether the marked improvements experienced by those practicing seated meditation after first practicing hatha yoga were due to the power of the hatha yoga practice. It would answer the question of whether this group would have experienced these same improvements with a base of seated meditation just as well. The addition of the hatha yoga-hatha yoga group would be a comparison group to compare with the subjects practicing hatha yoga with the base of seated meditation.

#### Lack of Neutral Control Group

Even in considering exclusively the data from the first half of the study, where neither group had experienced a previous intervention, there was no control group. It would be feasible to have an *out of time* control group whose subjects could practice an activity that was not a mindfulness discipline, ie. reading a book or doing aerobic activity. However, there would be inconsistency with regard to other outside influences such as time of year, weather, current events, all of which could contribute to subjects' experience of their mood. A further study with a control group could be implemented to correct for this design flaw.

#### Issue of compliance

At the outset, there were fifty-five interested research subjects who planned to participate in the study. Of those, forty-four began the study on day one. During the first eight weeks of the study, ten research participants dropped out of the study due to

the difficulty of committing to a thirty minute practice four times a week. Of the ten who dropped the study, eight of those participants were practicing seated meditation. This difficulty of committing to the seated meditation practice could have been the result of the fact that most of the research participants were hatha yoga students with far less of a background in seated meditation. They were selected from among those students who had been attending a regular hatha yoga class with the Co-PI.

Another six subjects were dropped during the second half of the study. Four were practicing hatha yoga at the time, which suggested that compliance to the seated meditation practice was less of an issue when it was practiced as the second intervention. However, four of the sixteen subjects who practiced seated meditation second reported irregularity in their seated meditation practice.

#### Subject pool

All of the subjects were students in the Co-PI's hatha yoga classes. As such, they had already demonstrated interest and had experience with the practice of hatha yoga. Most had very little experience with seated meditation. This made compliance to the seated meditation practice more difficult, especially in the cases where seated meditation was the first practice.

#### Implications of research for the field

The evidence suggests that hatha yoga did, in fact, improve mood more than seated meditation for this particular population of subjects. In considering the research in the field, Maria Baldwin (1999) previously demonstrated the finding of improved mood from

hatha yoga in her study of healthy exercising adults. Both Lavey et al. (2005), who studied psychiatric inpatients, and Woolery (2004) found improvements in mood among the subjects they studied. Michelson et al. (2005) also found improvements in depression symptoms and well-being among subjects who were self-diagnosed as being emotionally distressed. Most recently, Streeter et al. (2007) demonstrated elevated gamma-aminobutyric levels (GABA) in the brain among those who had practiced one hour of yoga. The elevated GABA levels suggested that yoga would be helpful for treating depression and anxiety disorders. The findings of the current study are consistent with these findings.

Moreover, back in 1995, Harte, Eifert and Smith (1995) found among those who had a regular practice of seated meditation increases in corticotrophin-releasing hormone, which is associated with positive mood changes. More recently, there have been a number of studies of the physiological changes in the brain that accompany seated meditation and contribute to improved mood. Cases in point include Richard Davidson's work showing greater activity in the left prefrontal cortex than the right (2003; 2004; 2006) among those practicing seated meditation, and Sarah Lazar's recent studies which suggest that seated meditation activates the resonance circuitry in the brain responsible for our ability to tune into our experience of ourselves and others (2005; 2006). The findings from the last half of the current study are consistent with these findings.

The current study, psychological rather than biological in nature, seeks to contribute to the literature on the beneficial effects of mindfulness-based disciplines by demonstrating that hatha yoga improves mood, and also locus of control regarding one's health and quality of life at least as much as and perhaps even more than seated meditation. In

addition, its practice significantly enhances the benefits derived from the seated meditation practice. These results are interesting when one considers the relative dearth of research studies examining the effects of hatha yoga on brain physiology. Most of the current research of this sort has been focused on the effects of seated meditation. Streeter's (2007) study is an exciting beginning towards amending this disparity.

The need for such studies is clear when we consider Candace Pert's (1997) work on neuropeptides. If her work is accurate and the mind and body are together part of one integrated organism, then we can mindfully attune to and start to re-pattern our state of consciousness by directly addressing the body or the mind to the same effect. Changes in brain physiology would result in either case.

The discipline of hatha yoga is more accessible to many people. It feels good to open the body and feel its shifts. It can be more difficult to still oneself for seated meditation. The effects can feel more subtle. It is also important to note that, according to the philosophical tradition, hatha yoga is a preparation for seated meditation (Patanjali, trans., 1990). Through hatha yoga, we turn the attention to the lens through which we experience the world, the body/ mind. This reining in of the attention begins the process of stilling the mind. Moreover, it is popular in America today. As such, the findings of this study imply that there is a need to conduct further research on the effects of hatha yoga- on the physiological changes in the brain that accompany the practice and the effect on various populations- clinical populations, business-people and students in school settings. It is an area wide open for further study. These studies are just beginning to surface and are clearly worthwhile.

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## Annotations for Appendix A

### Tables listing the results from the measures

*T1-2*: Period of time between the first day of the study and eight weeks later, the last day of the first practice

*T2-3*: Period of time between the last day of the first practice, eight weeks into the study, and two weeks later after a two week break from the first practice

*T3-4*: Period of time between the end of the two week break, the first day of the second practice, and the last day of the second practice, eight weeks later

n= number of subjects who completed the measures at both starting and finishing times (ie. T1 & T2)

*t-value*: Higher t-values indicate that we can reject the null hypothesis, the idea that there is no change from a given practice. Higher t-values coincide with lower p-values.

p-value: Lower p-values indicate a low probability that we would see this difference in a population of people not engaged in the practice in question.

*d-value*: Higher d-values result from higher t-values and lower p-values. They reflect the difference in terms of standard deviations.

#### Quantitative Measures:

*Life Orientation Test-Revised (LOT-R)* measures levels of optimism

*Positive Affect Negative Affect Schedule (PANAS)* measures levels of positive affect (PA) and negative affect (NA).

*Modified Positive Affect Negative Affect Schedule (PANAS-M)* includes four extra positive adjectives: serene, refreshed, content, relaxed.

*Multidimensional Health Locus of Control (form A) test (HLC)* measures subjects' notion that they have control over their own health

*Medical Outcomes Study Short Form-12 (SF-12)* measures subject's perception of their physical and emotional health and ability to function

*Self Efficacy (SE)* measure determines to what extent subjects feel confident in their ability to improve their well-being with their practice

#### Qualitative Measures:

*Mood*- feelings sustained over a period of time

*Cognition*- ability to think, remember, concentrate and plan

*Motivation*- desire and/ or ability to get things done

*Quality of Life*- How subjects were feeling in genera, including any new or unusual physical, mental or emotional symptoms-good or bad



**Within-Subjects:** This table reflects the extent to which people improved on each of the measures after eight weeks of hatha yoga practice.

**Table 1. Hatha Yoga (T2-T1)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	1.40	4.61	1.18 <sup>a</sup>	.26	.63	.30
PA	2.69	7.17	1.50 <sup>b</sup>	.16	.77	.36
PAM	4.53	9.68	1.81 <sup>a</sup>	.09	.97	.44
NA	-.41	7.30	-.23 <sup>c</sup>	.82	.12	.06
HLC	1.87	4.17	1.73 <sup>a</sup>	.10	.92	.42
SF-12	-1.00	4.85	-.80 <sup>a</sup>	.43	.43	.21
Self-Efficacy	-.06	.75	.32 <sup>c</sup>	.75	.16	.08

Note: <sup>a</sup> *df* = 14, <sup>b</sup> *df* = 15, <sup>c</sup> *df* = 16

**Within-Subjects:** This table reflects the extent to which people improved on each of the measures after the second hatha yoga practice period.

**Table 2. Hatha Yoga (T4-T3)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	1.00	2.31	1.15 <sup>b</sup>	.30	.94	.42
PA	1.11	3.55	.94 <sup>d</sup>	.38	.66	.32
PAM	2.63	5.58	1.33 <sup>c</sup>	.23	1.00	.45
NA	-1.11	5.49	-.61 <sup>d</sup>	.56	.42	.21
HLC	-2.00	5.66	-.50 <sup>a</sup>	.71	1.00	.45
SF-12	-1.89	3.95	1.43 <sup>d</sup>	.19	1.01	.45
Self-Efficacy	-.78	1.30	-1.79 <sup>d</sup>	.11	1.27	.53

Note: <sup>a</sup> *df* = 1, <sup>b</sup> *df* = 6, <sup>c</sup> *df* = 7, <sup>d</sup> *df* = 8

Note: The results for the HLC measure could not be considered due to the small number of subjects who completed the measure (n=2).

**Within-Subjects:** This table reflects the extent to which people improved on each of the measures after the first eight week meditation practice period.

**Table 3. Seated Meditation (T2-T1)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	.33	2.90	.40 <sup>b</sup>	.70	.24	.12
PA	-1.67	5.64	-1.02 <sup>b</sup>	.33	.62	.29
PAM	-1.08	7.94	.47 <sup>b</sup>	.65	.28	.14
NA	.42	8.02	.18 <sup>b</sup>	.86	.11	.05
HLC	-3.50	5.17	-2.14 <sup>c</sup>	.06	1.43	.58
SF-12	.54	3.02	.64 <sup>a</sup>	.53	.37	.18
Self-Efficacy	.62	.87	-2.55 <sup>a</sup>	.02	1.47	.59

Note: <sup>a</sup>*df* = 12, <sup>b</sup>*df* = 11, <sup>c</sup>*df* = 9

**Within-Subjects:** This table reflects the extent to which people improved on each of the measures after the second eight week meditation practice period.

**Table 4. Seated Meditation (T4-T3)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	1.56	4.02	1.56 <sup>d</sup>	.14	.80	.37
PA	2.67	6.71	1.54 <sup>c</sup>	.15	.82	.38
PAM	4.67	7.40	2.44 <sup>c</sup>	.03	1.30	.55
NA	-.23	6.96	-.13 <sup>c</sup>	.90	.07	.03
HLC	1.04	8.31	.45 <sup>a</sup>	.66	.26	.13
SF-12	-1.39	5.17	-1.00 <sup>b</sup>	.33	.55	.27
Self-Efficacy	-.13	.62	-.81 <sup>d</sup>	.43	.42	.20

Note: <sup>a</sup>*df* = 12, <sup>b</sup>*df* = 13, <sup>c</sup>*df* = 14, <sup>d</sup>*df* = 15

**Between-Subjects (Was Hatha Yoga better than Seated Meditation?)**

**Table 5.**

This table reflects the difference scores from Time 2 – Time 1, the first eight week practice period. Note t-tests are all looking at the superiority of hatha yoga over seated meditation. Positive values represent yoga > meditation. Negative values represent meditation > yoga.

	Hatha Yoga		Seated Meditation		<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
LOT-R	1.40	4.61	.33	2.90	.70 <sup>a</sup>	.60	.28	.14
PA	2.69	7.17	-1.67	5.65	1.74 <sup>b</sup>	.17	.68	.32
PAM	4.53	9.68	-1.08	7.94	1.62 <sup>a</sup>	.22	.64	.30
NA	-.41	7.30	-.42	8.02	-.29 <sup>c</sup>	.77	.11	.06
<b>HLC</b>	<b>1.87</b>	<b>4.17</b>	<b>-3.50</b>	<b>1.63</b>	<b>2.87<sup>d</sup></b>	<b>.009**</b>	<b>1.20</b>	<b>.51</b>
SF-12	-1.00	4.85	.54	3.02	.99 <sup>b</sup>	.33	.39	.19
<b>Self-Efficacy</b>	<b>-.06</b>	<b>.75</b>	<b>.62</b>	<b>.87</b>	<b>2.28<sup>e</sup></b>	<b>.03*</b>	<b>.86</b>	<b>.40</b>

\* significant at the  $p < .05$  level

\*\* significant at the  $p < .01$  level

Note: <sup>a</sup>  $df = 25$ , <sup>b</sup>  $df = 26$ , <sup>c</sup>  $df = 27$ , <sup>d</sup>  $df = 23$ , <sup>e</sup>  $df = 28$

**Between-Subjects (Was Hatha Yoga better than Seated Meditation?)**

**Table 6.**

This table reflects the difference scores from Time 4 – Time 3, the second practice period. Note t-tests are all looking at the superiority of hatha yoga over seated meditation. Positive values represent yoga > meditation. Negative values represent meditation > yoga.

	Hatha Yoga		Seated Meditation		<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
LOT-R	1.00	2.31	1.56	4.02	-.34 <sup>a</sup>	.74	.15	.07
PA	1.11	3.55	2.67	6.71	-.64 <sup>b</sup>	.53	.27	.14
PAM	2.63	5.58	4.67	7.40	-.68 <sup>a</sup>	.50	.30	.15
NA	-1.11	5.49	-.23	6.96	.32 <sup>b</sup>	.75	.14	.07
HLC	-2.00	5.66	1.04	8.31	-.49 <sup>d</sup>	.63	.27	.13
SF-12	-1.89	3.95	-1.39	5.17	.25 <sup>a</sup>	.81	.11	.05
<b>Self-Efficacy</b>	<b>-.78</b>	<b>1.30</b>	<b>-.13</b>	<b>.62</b>	<b>1.71<sup>c</sup></b>	<b>.10</b>	<b>.71</b>	<b>.34</b>

Note: <sup>a</sup>  $df = 21$ , <sup>b</sup>  $df = 22$ , <sup>c</sup>  $df = 23$ , <sup>d</sup>  $df = 13$

**Within-Subjects:** This data reflects the extent to which people improved on these measures after eight weeks of practice.

**Table 7. Hatha Yoga (T2-T1)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
Mood	.25	1.12	.89	.39	.46	.22
Cog.	-.06	1.06	-.24	.82	.12	.06
Motivation	.12	1.09	.46	.65	.24	.12
QOL	.18	1.22	.61	.55	.32	.16

Note: *df* = 15

**Table 8. Seated Meditation (T2-T1)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
Mood	.00	.866	.00	1.00	.00	.00
Cog.	.67	1.00	2.00	.08	1.41	.58
Motivation	.55	1.13	1.47	.18	1.04	.46
QOL	-.33	1.50	-.67	.52	.47	.23

Note: *df* = 8

**Within-Subjects:** This data reflects the extent to which people improved on these measures as measured after the second eight week practice period.

**Table 9. Hatha Yoga (T4-T3)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
Mood	.78	.83	2.80	.023	1.98	.70
Cog.	.44	.88	1.51	.169	1.07	.47
Motivation	.22	1.20	.56	.594	.40	.19
QOL	1.11	.78	4.26	.003	3.01	.83

Note: *df* = 8

**Table 10. Seated Meditation (T4-T3)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
Mood	.18	1.25	.48	.640	.30	.15
Cog.	.36	.81	1.49	.167	.94	.43
Motivation	.64	.81	2.61	.026	1.65	.64
QOL	.91	.83	3.63	.005	2.30	.75

Note: *df* = 10

**Between-Subjects (Was Hatha Yoga better than Seated Meditation?)**

**Table 11.**

This data reflects the difference scores from Time 2 – Time 1, the first eight weeks of practice. Note that t-tests are all looking at the superiority of hatha yoga over seated meditation. Positive values represent Yoga > Meditation. Negative values represent Meditation > Yoga. The data reflects the extent to which either yoga or meditation is better at leading to changes.

	Hatha Yoga		Seated Meditation		<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Mood	.25	1.12	.00	.866	.58	.57	.24	.12
Cog.	-.06	1.06	.67	1.00	-1.68	.11	.70	.33
Motivation	.12	1.09	.55	1.13	-.94	.36	.39	.19
QOL	.18	1.22	-.33	1.50	.94	.36	.39	.19

Note: *df* = 23

**Table 12.**

This data reflects the difference scores from Time 4– Time 3, the second eight week practice period. Note that t-tests are all looking at the superiority of hatha yoga over seated meditation. Positive values represent Yoga > Meditation. Negative values represent Meditation > Yoga. The data reflects the extent to which either yoga or meditation is better at leading to changes.

	Hatha Yoga		Seated Meditation		<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Mood	.78	.83	.18	1.25	1.22	.24	.58	.28
Cog.	.44	.88	.36	.81	.21	.83	.10	.05
Motivation	.22	1.20	.64	.81	-.92	.37	.43	.21
QOL	1.11	.78	.91	.83	.56	.59	.26	.13

Note: *df* = 18

## CARRY-OVER EFFECTS

Looking at differences from Time 2 to Time 3, the effects of the two week break.

**Within-Subjects:** This data reflects the extent to which people improved on these measures after the two week break between practices.

**Table 13. Hatha Yoga (T3-T2)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	-.18	2.63	-.28 <sup>d</sup>	.78	.14	.07
PA	-4.00	6.52	-2.45 <sup>c</sup>	.03	1.26	.53
PAM	-5.60	8.93	-2.43 <sup>b</sup>	.03	1.30	.54
NA	-.65	6.89	-.39 <sup>d</sup>	.70	.20	.10
HLC	-2.03	4.20	-1.94 <sup>c</sup>	.07	1.00	.45
SF-12	1.00	4.44	-.87 <sup>b</sup>	.40	.47	.23
Self-Efficacy	.06	.43	-.57 <sup>d</sup>	.58	.29	.14
Mood	-.25	1.14	-.76 <sup>a</sup>	.46	.46	.22
Cog.	-.67	.89	-2.60 <sup>a</sup>	.02	1.57	.62
Motivation	-.58	1.17	-1.74 <sup>a</sup>	.11	1.05	.46
QOL	-.75	1.14	-2.28 <sup>a</sup>	.04	1.37	.57

Note: <sup>a</sup>*df* = 11, <sup>b</sup>*df* = 14, <sup>c</sup>*df* = 15, <sup>d</sup>*df* = 16

**Table 14. Seated Meditation (T3-T2)**

	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
LOT-R	1.13	1.55	2.05 <sup>b</sup>	.08	1.55	.61
PA	2.25	4.06	1.57 <sup>b</sup>	.16	1.19	.51
PAM	2.00	4.47	1.27 <sup>b</sup>	.25	.96	.43
NA	.22	4.52	.15 <sup>b</sup>	.89	.11	.06
HLC	4.67	4.37	2.62 <sup>a</sup>	.047	2.34	.76
SF-12	-.11	3.44	.10 <sup>c</sup>	.93	.07	.04
Self-Efficacy	.11	1.54	-.22 <sup>c</sup>	.83	.16	.08
Mood	.00	.76	.00 <sup>b</sup>	1.00	.00	.00
Cog.	.00	.54	.00 <sup>b</sup>	1.00	.00	.00
Motivation	-.12	.99	-.36 <sup>b</sup>	.73	.27	.13
QOL	-.50	.76	-1.87 <sup>b</sup>	.10	1.41	.58

Note: <sup>a</sup>*df* = 5, <sup>b</sup>*df* = 7, <sup>c</sup>*df* = 8

**Between-Subjects (Was Hatha Yoga better than Seated Meditation?)**

**Table 15.**

This data reflects the difference scores from Time 3 – Time 2, the two week break between practices. Note that t-tests are all looking at the superiority of hatha yoga over seated meditation. Positive values represent Yoga > Meditation. Negative values represent Meditation > Yoga. The data reflects the extent to which either yoga or meditation is better at leading to changes.

	Hatha Yoga		Seated Meditation		<i>t</i>	<i>p</i>	<i>d</i>	<i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
LOT-R	-.18	2.63	1.13	1.55	-1.29 <sup>e</sup>	.21	.54	.26
PA	-4.00	6.52	2.25	4.06	-2.47 <sup>d</sup>	.02	1.05	.47
PAM	-5.60	8.93	2.00	4.47	-2.24 <sup>c</sup>	.04	.98	.44
NA	-.65	6.89	.22	4.52	-.34 <sup>f</sup>	.74	.14	.07
HLC	-2.03	4.20	4.67	4.37	-3.30 <sup>b</sup>	.004	1.48	.59
SF-12	1.00	4.44	-.11	3.44	-.64 <sup>d</sup>	.53	.27	.14
Self-Efficacy	.06	.43	.11	1.54	.13 <sup>f</sup>	.90	.05	.03
Mood	-.25	1.14	.00	.76	-.54 <sup>a</sup>	.59	.25	.13
Cog.	-.67	.89	.00	.54	-1.90 <sup>a</sup>	.07	.90	.41
Motivation	-.58	1.17	-.12	.99	-.91 <sup>a</sup>	.37	.43	.21
QOL	-.75	1.14	-.50	.76	-.54 <sup>a</sup>	.59	.25	.13

Note: <sup>a</sup>*df* = 18, <sup>b</sup>*df* = 20, <sup>c</sup>*df* = 21, <sup>d</sup>*df* = 22, <sup>e</sup>*df* = 23, <sup>f</sup>*df* = 24

## QUANTITATIVE DATA

**Table 18. Seated Meditation (T1, T2, T3), Means and Standard Deviations**

	Time 1		Time 2		Time 3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
LOT-R	22.82	4.81	22.50	4.36	24.00	4.56
Positive Affect	32.87	5.00	31.67	6.30	34.75	4.69
Positive Affect – Modified	43.11	7.14	42.67	9.02	45.67	6.15
Negative Affect	20.09	7.92	19.08	10.43	17.00	6.24
Locus of Control	79.14	8.37	75.83	7.66	76.4	7.34
SF-12	17.32	6.88	16.38	4.66	15.33	3.42
Self-Efficacy	1.78	.80	2.23	1.17	2.33	1.16

**Table 19. Seated Meditation (T3, T4), Means and Standard Deviations**

	Time 3		Time 4	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
LOT-R	23.88	6.41	25.31	5.83
Positive Affect	32.38	7.49	34.56	7.79
Positive Affect – Modified	42.31	10.58	46.80	10.78
Negative Affect	17.88	6.72	16.30	5.09
Locus of Control	83.66	9.68	84.92	10.90
SF-12	16.56	5.25	14.43	5.19
Self-Efficacy	1.41	.62	1.31	.48



## QUANTITATIVE DATA

**Table 16. Yoga (T1, T2, T3), Means and Standard Deviations**

	Time 1		Time 2		Time 3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
LOT-R	21.68	6.94	24.06	6.82	23.88	6.41
Positive Affect	33.95	5.98	36.23	7.06	32.38	7.49
Positive Affect – Modified	44.05	8.80	48.31	10.70	42.31	10.58
Negative Affect	20.47	7.68	18.53	7.25	17.88	6.72
Locus of Control	82.37	8.96	85.29	8.77	83.66	9.68
SF-12	17.75	5.33	15.69	6.07	16.56	5.25
Self-Efficacy	1.43	.51	1.35	.702	1.41	.62

**Table 17. Yoga (T3, T4), Means and Standard Deviations**

	Time 3		Time 4	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
LOT-R	24.00	4.56	24.56	5.10
Positive Affect	34.75	4.69	34.90	3.00
Positive Affect – Modified	45.67	6.15	48.28	3.42
Negative Affect	17.00	6.24	16.30	4.08
Locus of Control	76.4	7.34	75.20	10.47
SF-12	15.33	3.42	14.40	3.86
Self-Efficacy	2.33	1.16	1.50	.850

## QUALITATIVE DATA

**Table 18. Seated Meditation, Means and Standard Deviations**

	Time 1 (2/25)		Time 2 (4/22)		Time 3 (5/6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mood	2.76	1.09	2.92	1.08	3.18	.87
Cog.	3.00	1.06	3.42	1.24	3.55	.93
Motivation	2.71	.85	3.67	1.07	3.64	.81
QOL	3.71	1.36	3.58	1.00	3.45	.82

Time 3, Time 4

	Time 3 (5/6)		Time 4 (7/1)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mood	3.25	1.06	3.69	1.14
Cog.	3.00	.95	3.50	.82
Motivation	3.33	1.23	4.00	.82
QOL	3.08	1.17	4.00	1.12

**Table 19. Hatha Yoga, Means and Standard Deviations**

	Time 1 (2/25)		Time 2 (4/22)		Time 3 (5/6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mood	3.15	1.04	3.41	.71	3.25	1.06
Cog.	3.35	.99	3.35	.86	3.00	.95
Motivation	3.80	.95	3.82	.95	3.33	1.23
QOL	3.70	1.30	3.88	.99	3.08	1.17

Time 3, Time 4

	Time 3 (5/6)		Time 4 (7/1)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mood	3.18	.87	3.91	.54
Cog.	3.55	.93	4.00	.78
Motivation	3.64	.81	4.09	.83
QOL	3.45	.82	4.36	.81

Appendix B. History of Prior Yoga and Meditation Practice Spreadsheet

prior practice	subject	practice	yrs. Yoga	yrs. Med	fq yoga cl	fq. Yog hm	fq med gr	fq med hm
	1	M, Y	1.5	0	1	0	0	0
	2	M, Y	9	0	2	0	0	0
		Y,M						
		Y,M						
		M,Y						
	6	Y,M	0	0	1.5	2.5	0	0
	7	M,Y	9	9	3	1	1	3
		Y,M						
		M,Y						
	10	Y,M	3.5	0	2	3	0	0
	11	M,Y	2	0	1	1		
	12	Y,M	9	0	1	0	0	0
		M,Y						
	14	M,Y	9	0	2	2	0	0
	15	Y,M	1.5	0	1	1	0	0
	16	Y,M	1	0	1	0	0	0
		M,Y						
	18	Y,M	7.5	1.5	2	1	1	0
	19	M,Y	9	1.5	3	0	2	0
	20	Y,M	1.5	0	1	0	0	0
	21	Y,M	3.5	0	2	0	0	0
		M,Y						
	23	Y,M	3.5	0	2	0	0	0
	24	M,Y	3.5	0	1	1	0	0
	25	Y,M	1.5	9	2	0	0	3
	26	Y,M	5.5	5.5	2.5	2.5	1	1
		M,Y						
	28	Y,M	1	0	1	0	0	0
	29	Y,M	0.5	0	0	0	0	0
		M,Y						
	31	M,Y	3.5	0	1	0	0	0
		Y,M						
	33	M,Y	1.5	1.5	2	0	1	1
	34	Y,M	3.5	0	2	2		
	35	M,Y	3.5	0	2	0	0	0
	36	Y,M	1.5	0	2	0	0	0
	37	M,Y	1.5	0	1	0	0	0
	38	M,Y	0.25	0	1	0	0	0
		M,Y						
	40	Y,M	5.5	1.5	2	1	1	0
	41	M,Y	0	0	0	0	0	0
	42	M,Y	5.5	0	2	1	0	0
		Y,M						
	44	M,Y	5.5	0	1	0	1	0
			3.68548	0.95161	1.54838	0.61290	0.27586	0.27586
	average		4	3	7	3	2	2
	median		3.5	0	2	0	0	0

Appendix C1: **PANAS with slight modification\***

This scale consists of a number of words that describe different feelings and emotions.

Read each item and then mark the appropriate answer in the space next to the word.

Indicate to what extent [you generally feel this way, that is, how you feel on average]\*.

Use the following scale to record your answers.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>very slightly or not at all</b>	<b>a little</b>	<b>moderately</b>	<b>quite a bit</b>	<b>extremely</b>
___ interested				___ irritable
___ distressed				___ alert
___ excited				___ ashamed
___ upset				___ inspired
___ strong				___ nervous
___ guilty				___ determined
___ scared				___ attentive
___ hostile				___ jittery
___ enthusiastic				___ active
___ proud				___ afraid
				___ serene
				___ refreshed
				___ content
				___ relaxed

\*The part of the instructions in brackets may be changed to reflect different time frames. The authors of the PANAS have used the following instruction in place of the bracketed segment:

1. Moment: “you feel this way right now, that is, at the present moment”
2. Today: “you have felt this way today”
3. Past few days: “you have felt this way during the past few days”
4. Week: “you have felt this way during the past week”
5. Past few weeks: “you have felt this way during the past few weeks”
6. Year: “you have felt this way during the past year”
7. General (used above): “you generally feel this way, that is, how you feel on average”

\*\*The following adjectives were added to the PANAS test: serene, refreshed, content, relaxed

### **Positive and Negative Affect Schedule (PANAS).**

**Reference:** Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology, *54*, 1063-1070.

**Scoring:** Sum positive affect (PA) and negative affect (NA) items separately, for two scores ranging from 10 to 70 for PA and 10 to 50 for NA.

Appendix C2: [Self-efficacy](#)

How confident are you that you can improve your well-being with your personal practice? (please circle the correct number)					Self1 ____
<b>Very Confident</b>				<b>Not at all Confident</b>	
1	2	3	4	5	

Appendix C3: [SF-12](#)

<b>The following questions ask for your views about your health. This information will help us keep track of how you feel and how well you are able to do your usual activities.</b>										
1) In general, would you say <b>your health</b> is ( <i>check one</i> ):										
1	Excellent	2	Very Good	3	Good	4	Fair	5	Poor	Sf1 ____

<b>The following questions are about activities you might do during a typical day. Does your health <i>now</i> limit you in these activities? If so, how much?</b>					
2) <b>Moderate activities</b> , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf					Sf2 ____
2	Yes, limited a lot	1	Yes, limited a little	0	
3) Climbing <b>several</b> flights of stairs					Sf3 ____
2	Yes, limited a lot	1	Yes, limited a little	0	

During the <i>past 4 weeks</i> , have you had any of the following problems with your work or other regular daily activities <i>as a result of your physical health</i> ?					
4) Accomplished less than you would like 1 Yes 0 No					For Office Use Only: <b>CODING COLUMN</b>  Sf4 _____
5) Were limited in the kind of work or other activities 1 Yes 0 No					Sf5 _____
During the <i>past 4 weeks</i> , have you had any of the following problems with your work or other regular daily activities <i>as a result of any emotional problems</i> (such as feeling depressed or anxious)?					
6) Accomplished less than you would like 1 Yes 0 No					Sf6 _____
7) Didn't do work or other activities as carefully as usual 1 Yes 0 No					Sf7 _____
8) During the <i>past 4 weeks</i> , how much did pain interfere with your normal work (including both work outside the home and housework)?					
<b>Not at all</b>	<b>A little bit</b>	<b>Moderately</b>	<b>Quite a bit</b>	<b>Extremely</b>	Sf8 _____
1	2	3	4	5	

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the *past 4 weeks*...

	<b>All of the time</b>	<b>Most of the time</b>	<b>A Good bit of the time</b>	<b>Some of the time</b>	<b>A little of the time</b>	<b>None of the time</b>	
	1	2	3	4	5	6	
9) Have you felt calm and peaceful?							Sf9 _____
10) Did you have a lot of energy?							Sf10 _____

	<b>All of the time</b>	<b>Most of the time</b>	<b>A Good bit of the time</b>	<b>Some of the time</b>	<b>A little of the time</b>	<b>None of the time</b>	For Office Use Only: CODING COLUMN
	1	2	3	4	5	6	
11) Have you felt downhearted and blue?							Sf11 _____
12) During the <i>past 4 weeks</i> , how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?							
<b>All of the time</b>	<b>Most of the time</b>	<b>Some of the time</b>	<b>A little of the time</b>	<b>None of the time</b>			Sf12 _____



#### Appendix C4: LOT-R (Life Orientation Test-Revised)

The Life Orientation Test (LOT) was developed to assess individual differences in generalized optimism versus pessimism. This measure has been used in a good deal of research on the behavioral, affective, and health consequences of this personality variable. A somewhat dated review of that literature can be found in the following article:

Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research*, 16, 201-228.

Although the LOT has been widely used, it has some problems. Most important, its original items did not all focus as explicitly on expectations for the future as theory dictated. In part to remedy this deficiency, we have since developed a modest revision of the LOT, called LOT-R. It was published in the following article:

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, 67, 1063-1078. [[abstract](#)]

We (and other people) have used the LOT-R in a good deal of research. More information on this work is contained in some of the articles on [this list](#). A Spanish version of the LOT-R can be found [here](#). A French version can be found [here](#).

The LOT-R is a very brief measure that is easy to use. Its brevity makes it ideal for use in projects in which many measures are being used. Here is the LOT-R as it is used in our own work:

-----

LOT-R

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

- A = I agree a lot
- B = I agree a little
- C = I neither agree nor disagree
- D = I DISagree a little
- E = I DISagree a lot

1. In uncertain times, I usually expect the best.
- [2. It's easy for me to relax.]
3. If something can go wrong for me, it will.
4. I'm always optimistic about my future.
- [5. I enjoy my friends a lot.]
- [6. It's important for me to keep busy.]
7. I hardly ever expect things to go my way.
- [8. I don't get upset too easily.]
9. I rarely count on good things happening to me.
10. Overall, I expect more good things to happen to me than bad.

-----

Note:

Items 2, 5, 6, and 8 are fillers. Responses to "scored" items are to be coded so that high values imply optimism. Researchers interested in testing the potential difference between affirmation of optimism and disaffirmation of pessimism should compute separate subtotals of the relevant items.

Appendix C5: **Multidimensional Health Locus of Control (Form A)**

Instructions: Each item below is a belief statement about your medical condition with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you agree or disagree with that statement. The more you agree with a statement, the higher will be the number you circle. The more you disagree with a statement, the lower will be the number you circle. Please make sure that you answer **EVERY ITEM** and that you circle **ONLY ONE** number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

1=STRONGLY DISAGREE (SD)	4=SLIGHTLY AGREE (A)
--------------------------	----------------------

2=MODERATELY DISAGREE (MD)	5=MODERATELY AGREE (MA)
3=SLIGHTLY DISAGREE (D)	6=STRONGLY AGREE (SA)

		SD	MD	D	A	MA	SA
1	If I get sick, it is my own behavior which determines how soon I get well again.	1	2	3	4	5	6
2	No matter what I do, if I am going to get sick, I will get sick.	1	2	3	4	5	6
3	Having regular contact with my physician is the best way for me to avoid illness.	1	2	3	4	5	6
4	Most things that affect my health happen to me by accident.	1	2	3	4	5	6
5	Whenever I don't feel well, I should consult a medically trained professional.	1	2	3	4	5	6
6	I am in control of my health.	1	2	3	4	5	6
7	My family has a lot to do with my becoming sick or staying healthy.	1	2	3	4	5	6
8	When I get sick, I am to blame.	1	2	3	4	5	6
9	Luck plays a big part in determining how soon I will recover from an illness.	1	2	3	4	5	6
10	Health professionals control my health.	1	2	3	4	5	6
11	My good health is largely a matter of good fortune.	1	2	3	4	5	6
12	The main thing which affects my health is what I myself do.	1	2	3	4	5	6
13	If I take care of myself, I can avoid illness.	1	2	3	4	5	6
14	Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.	1	2	3	4	5	6
15	No matter what I do, I'm likely to get sick.	1	2	3	4	5	6
16	If it's meant to be, I will stay healthy.	1	2	3	4	5	6
17	If I take the right actions, I can stay healthy.	1	2	3	4	5	6
18	Regarding my health, I can only do what my doctor tells me to do.	1	2	3	4	5	6

Appendix C6. Qualitative Measure: Subjects filled this out on a weekly basis for their own reference. Based on these weekly journals, they wrote one page summaries describing their experiences at the outset of the study, over each of the eight week practice periods, and after the two week break between practices.

### Weekly Directed Journal Entry

Please comment on anything you've noticed over the past [eight] weeks with regard to:

Mood- feelings sustained over a period of time. Have you noticed any changes over the past week?

Cognition- mental activity- remembering, planning, learning, making meaning. Have you noticed that your ability to think, remember, concentrate and plan have changed?

Motivation- activating force towards a desired goal. Have you noticed any changes in your desire or ability to get things done?

Quality of Life- Comment on your quality of life. How have you been feeling in general? Do you have any new or unusual physical, mental or emotional symptoms-good or bad?

How does this relate to your personal practice?

Appendix D1. Other Study Instruments  
 May 6, 2007

Subject Participant Number \_\_\_\_\_

Prior Yoga and Meditation Practice History

Please describe your yoga and meditation experience prior to beginning the study.  
 Describe duration- ie. 5 months or 25 years- and frequency of practice- ie. daily or once a week.

Years of Active Engagement with Yoga Prior to Study

0	1-2	3-4	5-6	7-8	9+

Years of Active Engagement with Seated Meditation Prior to Study

0	1-2	3-4	5-6	7-8	9+

Frequency of Yoga Practice in Class Setting Prior to Study

NEVER	ONCE A WEEK	TWICE A WEEK	THREE + TIMES WEEK	DAILY

Frequency of At Home Yoga Practice Prior to Study

NEVER	ONCE A WEEK	TWICE A WEEK	THREE + TIMES WEEK	DAILY

Frequency of Seated Meditation in Group Setting Prior to Study

NEVER	ONCE A WEEK	TWICE A WEEK	THREE + TIMES WEEK	DAILY

Frequency of At Home Seated Meditation Practice Prior to Study

NEVER	ONCE A WEEK	TWICE A WEEK	THREE + TIMES WEEK	DAILY

Appendix D2.

Weekly Personal Practice Log

Please log in the number of minutes you practice each session that you do.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1							
Week 2							
Week 3							
Week 4							
Week 5							
Week 6							
Week 7							
Week 8							
Week 9							
Week 10							
Week 11							
Week 12							
Week 13							
Week 14							
Week 15							
Week 16							

## Appendix D3.

### A Skillful Attitude towards a Personal Practice

#### Practicing safely:

The spirit of the personal practice is such that you are taking time out of a busy day to care for your well-being. To that end, you want to elicit effort rather than strain. With attention to what you are doing, you are less likely to cause any harm to yourself. Pay attention to what you are doing and how you are feeling. If you find yourself straining, lessen the intensity. Do what you need to in order to make a pose easier.

If at any point you want to modify a hatha yoga pose, it is perfectly appropriate to do so. The idea is that you are spending time listening to and feeling the body. The particular shape that the body assumes is less important.

If you are sitting for meditation and thoughts or feelings arise which become emotionally uncomfortable, you can either sit with them, observing their coming into your field of consciousness and then moving away. Alternatively, you always have the choice of getting up and walking around. You are in control of the process. What is most important is curiosity about the process. You are taking the time to get to know yourself, your particular patterns of thinking and feeling as you cultivate the quality of your attention.

#### Consistency:

Additionally, most likely you will find it easier to commit to the practice if you choose a particular time of day and place where you will practice consistently- i.e. first thing in the morning in a particular room or place within a room. Momentum builds of itself over time. Having a personal practice can become as habitual as brushing one's teeth.



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\*References marked with an asterisk indicate studies included in Sharon Begley's *Train Your Mind, Change Your Brain*

\*\*References marked with an asterisk indicate studies included in Dan Siegel's *The Mindful Brain*

## Footnotes

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