

Effects of Techniques of Receptive Meditation and Relaxation on Attentional Processing

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Previous research has indicated that receptive techniques of meditation improve one's ability to sustain, distribute, and divide attention. However, relaxation has also been found to improve attention. Here the effects of receptive techniques of meditation and relaxation are compared on two groups of participants performing a divided-attention task. It was hypothesized that meditation would lead to a broader, more flexible, and more sustained attentional style. Meditation was not found to enhance overall attentional capacity more than relaxation, however it did lead to increased attentional flexibility and sustainment.

Although a powerful tool for reducing anxiety and inducing relaxation, meditation's most important function is to train one's attention (Goleman, 1988; Naranjo & Ornstein, 1971). Some investigators have had success in using meditative techniques as therapeutic methods of attention control training for individuals with mental health problems or attention deficit disorder (Eugene, 1999; Ferguson, 1976; Morris, 1976). Nonetheless, the majority of research on meditation has not been concerned with its attentional effects, and the vast majority of research has focused on transcendental meditation (TM) without distinguishing it from other forms of meditation. Clearly, the investigation and application of various techniques of self-regulation that can alter or enhance attention, has powerful implications for education and mental health.

Although there are a multitude of meditative practices, researchers have generally been able to classify them into two categories: concentrative meditation or mindfulness meditation. As noted by Shapiro (1984), the practice of these different techniques utilizes different attention styles. In concentrative meditation practices, such as Raj Yoga, the practitioner utilizes what Shapiro refers to as 'zoom-lens attention,' focusing on a specific object (an event, image, or sound), thus trying to refine all of his or her attention to a single focal point. In mindfulness meditation practices such as Zen meditation or Vipassana, the practitioner utilizes 'wide-angle-lens attention.' Here one extends their attention to the entire perceptive field. Mindfulness practitioners try to attain a state of receptivity, becoming aware of any and all emergent thoughts and sensations without becoming actively involved in them.

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Transcendental meditation integrates features of concentrative meditation (i.e. it utilizes a vocal 'mantra'), however in terms of its essential cognitive qualities it can be described as receptive (Roth, 2002). Shapiro's different strategies of attention have been attributed to different processing centers in the brain (Pribram & McGuinness, 1975), as well as different physiological patterns reflecting habituation (Dunn, Hartigan, & Mikulas, 1999; Kasamatsu & Hirai, 1969).

An enhanced attentional capacity has been found as a result of mindfulness meditation, concentrative meditation, TM, and relaxation, however the implications of all of these findings vary (Travis, Tecce & Guttman, 2000; Valentine & Sweet, 1999; Yesavage & Rolf, 1984). Valentine and Sweet (1999) found that both concentrative and mindfulness practitioners had improved sustained attention on a continuous performance task (Wilkin's counting test) in contrast to control participants, however mindfulness practitioners displayed less distraction to unexpected stimuli. According to Shapiro's (1984) model of attentional strategies, whereas practice of a 'zoom-lens' strategy of attention should intensify one's orientation to a single object or continual task, practice of a 'wide-angle-lens' strategy of attention should lead to an enhanced readiness to differentiate between, and attend to varying objects or tasks.

Psychological differentiation can be examined through the lens of field dependence. Witkin (1977), in Bloom-Feshbach (1980), refers to field dependence as an undifferentiated, global style of perceiving things, whereas field independence is the ability to experience items as a distinct from their background. An enhancement in the ability to differentiate between different sets of stimuli and to appropriate attention among different tasks demanding different attentional styles can be seen as one corollary of field independence. Testing regular practitioners of TM and non-meditating controls on several measures used to test field independence (the Autokinetic Test, the Rod-and-

Frame Test, and the Embedded-Figures Test), Pelletier (1974) found that, TM practitioners had a more increased perceptual acuity and better field independence. Pelletier's findings have been supported by other researchers (Rani & Rao, 2000).

Performance on divided-attention tasks has been found to improve both as a result of TM and relaxation (Travis, Tecce, & Guttman, 2000; Yesavage & Rolf, 1984). Travis, Tecce, and Guttman (2000) related performance on an auditory-response/letter-recall task of TM practitioners to self-reported levels of transcendence experienced during meditation. They found that participants who had reported more transcendent experiences showed quicker reaction times, reduced effects of distraction, and according to EEG and EOG measurements, a heightened physiological preparedness for response. Yesavage and Rolf (1984) implemented a similar divided-attention task, on a group of elderly people and found that a reduction in anxiety through relaxation techniques enhanced their reaction times on both tasks.

Thus, enhanced attentional capacity has generally been found to be a result of meditation as well as relaxation. However, since certain forms of meditation have also been recognized as effective relaxation techniques (Eppley, Abrams, & Shear, 1989; Zipkin, 1985), the question of whether enhanced attentional capacity can be attributable to special features of meditation or simply to relaxation has not been empirically answered. Physiological differences found between concentrative meditation, mindfulness meditation, and relaxation may indicate possible corresponding attentional differences (Dunn, Hartigan, & Mikulas, 1999). A comparative study on the attentional effects of meditation and relaxation is needed.

The purpose of the author's study was to investigate the effects of receptive forms of meditation, such as mindfulness and TM, and simple relaxation on the process of attentional distribution in divided-attention tasks. As in the

studies conducted by Yesavage and Rolf (1984) and Travis, Tecce, and Guttman (2000), the divided-attention task used for this study employed a continual visual task (in this case a visual rotary pursuit) as a primary task, and an auditory stop task as a secondary task. It was presumed that performance on a primary task would reflect centralized attention by requiring the majority of one's attention continuously, whereas performance on a secondary task would reflect residual attention by demanding additional attention sporadically. In the current study, it was presumed that the visual rotary pursuit would engage centralized attention, since it involved continuous focus and coordination and would elicit a habituation response, whereas the stop task would engage residual attention, since it only demanded sporadic attention, and does not rely on a habituated response. Participants performing these tasks were a sample of self-reported mindfulness meditation practitioners and relaxing controls.

Overall, in contrast to the relaxation control group, the author hypothesized that after treatment, meditators would display greater attentional capacity, greater attentional flexibility, and a more sustained attention. The hypotheses can be clearly stated as follows:

1. Practitioners of meditation would exhibit a greater overall attentional capacity after meditation than would relaxed controls on both primary and secondary tasks, which would be reflected by a higher composite score for performances on both tasks.
2. Practitioners of meditation would exhibit greater attentional flexibility after meditation than would relaxed controls, which would be reflected by a comparatively greater improvement in secondary task scores than in primary task scores. Attentional flexibility was gauged in this study by one's reflected ability to respond with readiness to stimuli that have not been habituated, such as a randomly activated buzzer.
3. Practitioners of meditation would display a

more sustained attention across trials after treatment than would relaxing controls. This would be characterized by a greater degree of consistency in scores between trials after meditation, suggesting a less rapid decline in attentional capacity, and less modal shifting in attention distribution.

4. Overall, both relaxing controls and meditators would display attentional enhancements after treatment, however findings would be more limited for relaxation.

Method

Questionnaire

After consenting to the experiment, all participants in the study completed a brief questionnaire before they were tested. The questionnaire asked participants if they regularly practiced a technique of meditation, had them ordinarily rate both the frequency of their practice and their level of experience, as well as assessing possible factors that may interfere with the participants' ability to relax or attend to tasks (i.e. ADHD, hypertension). A dual forced choice item was on the questionnaire instructing meditating participants to determine whether or not they practiced a form of mindfulness meditation or concentrative meditation according to a self-assessment by choosing between the following descriptions: Concentrative— the meditator focuses his or her attention on an internal or external object (e.g., sound, word, bodily sensations, etc.) while minimizing distractions and bringing the wandering mind back to attention on the chosen object; Mindfulness— the meditator focuses on the present moment. The meditator focuses his or her attention alertly but non-judgmentally on all processes passing through the mind.

The descriptions used for both forms of meditation were based on descriptions of the techniques given in many published texts on meditation (Davidson & Goleman, 1977; Naranjo & Ornstein, 1972). The questionnaire can be

found in Appendix A.

Participants

Participants were 35 undergraduate students, 16 males and 19 females (age range 18-24 years), however only data from 31 participants (males=14, females=17) were kept for analysis. Participants volunteered through personal contact, public advertisements and announcements made in psychology courses (where they received course credit for participation), a Hinduism and Buddhism course, and a meeting for meditation of a campus Buddhist group.

Seventeen participants (7 males, 10 females) did not report regularly practicing a technique of meditation as described on the questionnaire. All of these participants were assigned to the relaxation control group. Fourteen participants (7 males, 7 females) reported that they regularly practiced a form of mindfulness meditation, which included Zen and Vipassana, as well as other unspecified techniques. Two of these participants (1 male, 1 female) reported that they practiced TM, and were included in this study since they had chosen mindfulness meditation as the best description of their technique on the questionnaire. Three of these participants had reported prior to testing that they had regularly practiced both a mindfulness technique as well as a concentrative technique (1 male, 2 females). These participants were assigned to the meditation group and instructed to practice a mindfulness technique during the experimental session. Reported experience levels of meditators ranged from one month of practice to over 9 years, with the majority of participants having practiced for more than 3 years. The frequency at which participants reported meditating, ranged from three times daily to only twice a month.

Three participants reported that they exclusively practiced a form of concentrative meditation (1 male, 2 females). Data collected from these individuals was excluded from the main data analysis. Additionally, data from one male participant was excluded for failure to fully

follow instructions. All participants included in this study reported being right-handed.

Apparatus

A Lafayette Instruments model 30013 photoelectric rotary pursuit with stylus, a model 63035 visual choice reaction time apparatus, and two model 54030 stop-clocks, were used for the divided-attention task. A handheld Texas Instruments stopwatch was also used to time activation of the reaction time apparatus. The rotary pursuit was set to rotate clockwise at a speed of 40 RPM. Only the auditory stimulus buzzer on the reaction time apparatus was used for the experiment.

Procedure

Participants were instructed to operate the rotary pursuit table, and simultaneously respond to the reaction time apparatus immediately whenever activated. The rotary pursuit table used in this study comprised of a light stimulus, which rotated clockwise around a rotary wheel and was displayed on a plate-glass screen. Using a magnetic stylus, participants were directed to track the light's rotations as precisely as possible around the screen, and their performance was recorded automatically as the cumulative number of seconds the stylus accurately traced the light. The cumulative score was referred to as 'time-on-target.' The reaction time apparatus used in this study was set so that the researcher could spontaneously activate an auditory buzzer by pressing a panel. In order to deactivate the buzzer participants were required to press an opposing panel and cumulative reaction time was automatically recorded in milliseconds.

Once ready to begin a trial, the researcher signaled to the participant and started a handheld stopwatch as he or she began the task. The researcher activated the buzzer on the reaction time apparatus based on a randomized series of time intervals as displayed on Table 1 on the following page. The buzzer was thus activated at

completion of this time were gradually awakened from their state by the researcher slowly raising the lights.

After treatment all participants were given 1 minute in which they were told they could stretch out and readjust to a more waking state. After this minute had passed participants returned to the testing room for the collection of posttest scores.

Results

The dependent variables were participants' time-on-target (s) for the rotary pursuit task, and their mean reaction time (ms) for the auditory stop task on each trial. A third variable assessed in this study was participants' composite score for divided-attention, which was produced by an index of both rotary pursuit scores and mean reaction times. Composite scores were calculated for each trial, and can be expressed as: time-on-target (s)/mean reaction time (s); in which case reaction time was converted from milliseconds to seconds. These scores were divided to provide an index depicting how participants' performance on the two tasks contrasted. This was calculated in attempt to assess participants' overall attentional capacity for performance on these divided tasks.

To test the researchers' hypotheses, repeated measures analysis of variance tests (ANOVA) were conducted on the dependent variables, comparing data from meditators and non-meditators, both before and after treatment. To test the hypothesis that meditation would lead to a higher overall attentional capacity than would relaxation, composite scores were compared for meditators and non-meditators before and after treatment. To test the hypothesis that meditators would exhibit a more increased attentional flexibility after treatment than non-meditators, stop task mean reaction times were compared for meditators and non-meditators before and after treatment. To test the hypothesis that meditators would display a more sustained attention across trials, the researcher tested for interactions between trial scores and treatment conditions for

rotary pursuit scores and reaction time.

For composite scores there was a main effect for treatment as indicated by comparing means of pretest and posttest blocks, $F(1,27) = 63.48, p < .0001$. The direction of this effect showed an overall improvement after both meditation and relaxation, however no interactions were shown to suggest that the effects of meditation and relaxation significantly differed. Figure 1 consists of figures showing line graphs comparing mean composite scores for individual trials for meditators' and non-meditators' both before and after treatment.

An overall main effect was also shown for treatment when comparing means of pretest and posttest blocks for mean reaction time, $F(1,29) = 13.43, p < .001$. A between-subjects analysis for reaction time showed an interaction for treatment condition and treatment effect, indicating a difference in the effectiveness of meditation and relaxation in enhancing stop-task performance across pretest and posttest conditions, $F(1,29) = 4.37, p < .05$. Separate repeated measures ANOVA tests for pretest and posttest blocks showed no significant differences between groups prior to treatment, although there was a main effect for treatment condition after treatment, $F(1,29) = 5.89, p < .02$. This data indicated that the overall difference between meditators and non-meditators was due to a greater improvement resulting from meditation reflected in posttest scores. Line graphs plotting mean reaction times for both meditators and non-meditators for individual trials both before and after treatment are shown in Figure 2.

For mean reaction times, a marginally significant interaction was also found between treatment condition and trial, $F(7,29) = 2.00, p < .056$. Looking at the data presented in Figure 2, it appears that non-meditators generally exhibited a gradual increase in reaction time across trials, whereas meditators' reaction times did not significantly vary across trials, for both pretest and posttest blocks. Separate analyses of pretest and posttest reaction times, did not reveal any

interactions between treatment condition and trial attributable to either pretest or posttest performance alone.

Several important findings revealed in this study that were not originally hypothesized, were main effects for sex. Results pertaining to differences in performance across sexes were produced by several repeated measures ANOVA tests. The effect of sex for composite scores was $F(1,29) = 5.503, p < .026$. For reaction times alone there was no main effect. For rotary pursuit scores the value was $F(1,29) = 4.198, p < .05$. Separate analyses of sex as a factor for meditators and non-meditators showed no effect of sex for meditators, however for non-meditators there were main effects reflected for all indexes: $F(1,15) = 7.019, p < .018$ for rotary pursuit scores, $F(1,15) = 8.228, p < .012$ for mean reaction times, and $F(1,15) = 9.82, p < .007$ for composite scores. Overall, male non-meditators performed better for all variables than did female non-meditators. The overall mean scores for pretest and posttest trials for males and females within the meditation and relaxation treatment groups are shown in Figures 4, 5, and 6 for composite ratio scores, rotary pursuit scores, and mean reaction times, respectively.

Discussion

The results of the current study supported many of the hypotheses, while failing to support others. It appears that overall both meditation and relaxation lead to enhancements in attention, however it appears that meditation specifically leads to improvements that relaxation does not. Both techniques do not appear to differ significantly in their potential for enhancing overall attentional capacity, however the findings of this study do suggest that practitioners of receptive techniques of meditation are able to cultivate a more sustained and flexible attentional style than are individuals who merely relax.

Quicker reaction times in stop task performance were reflected by both meditators

and non-meditators after treatment, suggesting that both techniques could have potentially improved attentional flexibility. However, meditators' reaction times improved significantly more than non-meditators' after treatment whereas overall attentional capacity did not. This may be attributable to attentional flexibility since it suggests that meditators displayed more readiness than non-meditators to shift their attention to the reaction time apparatus while centrally engaged with the rotary pursuit. Thus, the current study suggests that meditation leads to a qualitatively more flexible mode of attention than relaxation alone does.

Based on trends suggesting that meditators overall had less decline in their performance on the stop-task across trials, it is also evident that meditation leads to a more sustained mode of attention than does relaxation. Though based on the limited number of trials in this study, it is not certain how much more evident this disparity would differ gradually across more trials. An experiment with a greater number of trials would have had more significant findings pertaining to the effects of meditation on sustained attention.

The significant attentional effects credited to meditation in this study, can only be validly postulated as immediate effects and have yet to be proven. The lack of significant findings regarding any between subjects differences in pretest data for any of the measured variables, suggests that meditation had reflected no notable long-term effects, although there do appear to be some preliminary differences (See the pretest data in Figures 1, 2, and 3). Since the sample used in this study was small and not all meditators had long-term experience, nor meditated with extreme frequency, long-term effects of meditation were not identified. The intention of this study was to investigate the short-term effects of receptive forms of meditation, although a longitudinal study investigating long-term effects would have much greater implications regarding the practical merits of meditation.

The techniques of meditation investigated in

this study were chosen mainly because participants practicing them were available. Even though practitioners of transcendental meditation identified their technique as a mindfulness technique, it is not unforeseeable that there may be some significant qualitative differences between TM and other mindfulness techniques, or even between other mindfulness techniques. Such differences were not accounted for in this study.

Another factor that was not accounted for in this study, was possible differences in performance between participants arising from the order in which the researcher activated the reaction time apparatus in implementing trial series blocks A and B in Table 1. Since all intervals were generated randomly, it is not highly likely that there would be significant qualitative differences between series A and B effecting differences in results between meditators and non-meditators, although their implementation was not carefully counterbalanced and such a possibility must not be ruled out. Also, sex differences were found in performance, which may have interfered with differences between meditating and control participants since there were a few more females in the control group. It is foreseeable that in addition to preliminary sex differences in performance ability, there may be some differences in how meditation and relaxation effect attentional processing in males and females, though such interaction effects were not found with such a small sample.

An important theoretical question which must be raised regarding differences in performance of meditators and non-meditators is if meditators are generally more predisposed to become meditators based on inherent cognitive features, which may have had more to do with the differences in attentional effects noted in this study than the treatment itself did. Following models of previous research (Pelletier, 1974; Rani & Rao, 2000), implementing a meditation instructional program on a controlled sample of participants unfamiliar with the technique prior to a similar study would resolve such uncertainties. At any rate, it is highly

evident from the current study that there are some immediate effects on attention that can be attributed to meditation and not relaxation, shedding light on some of the potential of using receptive techniques of meditation as self-regulation strategies.

It is evident from the findings of this study that further research with a larger, more controlled sample may increase the significance of findings made in this study, reveal attentional effects that were too small to be significant in this study, as well as providing findings relating to the long-term effects of meditation. A better understanding of how the practice of meditation can help facilitate attention particularly may have some important implications for education and the treatment of cognitive impairments. In particular, this study gives strong support for implementing both receptive techniques of meditation and relaxation as potential tools for enhancing one's attentional capacity, and further support for meditation as a potential tool for improving selective attention and increasing one's attention span. The effectiveness of meditation as an alternative or supplementary treatment for attention deficit disorders has already been addressed, and it has been implemented in many clinical and education settings (Eugene, 1999; Zipkin, 1985).

Findings of this study are consistent with previous research, however unlike previous research this study provides a framework for future research comparing meditation and relaxation in divided-attention processes. In order to investigate the attentional benefits of meditation not relevant to relaxation techniques, it is important for researchers to conduct comparative studies. For further research, the effects of both arousing activity and concentrative techniques of meditation on attention would be worth comparing with receptive techniques of meditation and relaxation. Additionally, further research examining these and other variables relating to the larger framework would test the validity of the claims. ■

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Appendix A

Questionnaire

- 1) Do you have any cognitive conditions or learning disabilities, which may effect your processing of attention or ability to concentrate (i.e. Adult ADD, ADHD)?
- 2) Do you have any conditions, which may effect your ability to relax?
- 3) Do you practice Transcendental Meditation, or some other technique of meditation?

If yes:

- 4) How often do you practice meditation (circle one. specify technique)?
 - a. Rarely (once or twice a month, semiweekly)
 - b. At least every week
 - c. Several times a week
 - d. Daily
 - e. Other (explain):
- 5) How long have you been practicing meditation?
- 6) Which best describes your method of meditative practice (choose one):
 - a. Concentration
 - The meditator focuses his or her attention on an internal or external object (e.g., sound, word, bodily sensations, etc.) while minimizing distractions and bringing the wandering mind back to attention on the chosen object.
 - b. Mindfulness
 - The meditator focuses on the present moment. The meditator focuses his or her attention alertly but non judgmentally on all processes passing through the mind.

Appendix B

Relaxation Instructions

I want you to find a comfortable place in the room where you can just sit and relax for a while. There are pillows in the corner of the room, feel free to use them. You will have about 4 minutes to position yourself anywhere, and after these four minutes let me know if you are not comfortable.

For the next 20 min. I want you to just relax. Take a moment to find a comfortable place in the room to sit upright. I want you to start your relaxation by paying close attention to your breathing. Take deep easy breaths in and out, pay attention to the rhythm of your inhalations and exhalations, how it feels in your stomach and how it feels through your nostrils. Then you will relax for twenty minutes and I will tell you when to stop. I want you to use this time as an opportunity to really relax letting in whatever thought may come to your mind. Do not make any extra effort in trying to avoid thoughts, or in concentrating specifically on any one thought. You are free to reposition yourself to make yourself more comfortable at any given time, just as long as you do not stand or move to another part of the room. You may keep your eyes open or closed as you wish, however you may not sleep. If you start to feel sleepy you may want to open your eyes or reposition yourself.

Figures

Fig. 1: Pretest and posttest composite divided-attention scores for meditating and relaxing participants. Vertical lines depict standard errors of the means.

Fig. 2: Pretest and posttest stop task mean reaction times (ms) for meditating and relaxing participants. Vertical lines depict standard errors of the means.

Fig. 3: Pretest and posttest time-on-target rotary pursuit scores (s) for meditating and relaxing participants. Vertical lines depict standard errors of the means.

Fig. 4: Pretest and posttest composite divided-attention scores for males and females within the meditation group and the relaxation group. Vertical lines depict standard errors of the means.

Fig. 5: Pretest and posttest time-on-target rotary pursuit scores (s) for males and females within the meditation group and the relaxation group. Vertical lines depict standard errors of the means.

Fig. 6: Pretest and posttest stop task mean reaction times (s) for males and females within the meditation group and the relaxation group. Vertical lines depict standard errors of the means.