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Meditation Experience and the Reinvestment of Awareness into Automatic Behaviour

by

Rae A. Holden

A Thesis

Submitted to the Faculty of Graduate Studies

in Partial Fulfillment of the Requirements for the

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Department of Psychology

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Abstract

The purpose of this research was to test Deikman's proposal that meditation facilitates a deautomatization of learned responses to stimuli, opening the way for novel responses to those same stimuli. Subjects were 36 nonmeditating university students and 80 volunteers from the International Meditation and Student International Meditation Societies. They were given two tasks. In the first, a mathematical judgment task, they were required to estimate the mean of a series of numbers. In the second, a verbal learning activity, they were asked to learn lists of paired-associates. Both tasks were presented such that subjects formed a set regarding what was expected of them. Following training, they were given similar tasks with new stimuli. It was predicted that meditators, especially the long-term meditators, would deautomatize to a greater extent than nonmeditators, allowing them to perform more effectively on the new stimuli. This prediction was not supported. It was concluded that meditation seems to be a receptive mode process, while the tasks required active mode functioning. If this is the case, then it is possible that meditation only influences performances on receptive mode activities.

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CHAPTER I

Introduction

Although the practice of meditation is firmly rooted in eastern tradition and western religion, it is only recently that most westerners have become aware of it. In the West, the word meditation has been used to refer to such a variety of different techniques that there is considerable confusion as to what the word signifies.

Three Forms of Meditation

Naranjo (Naranjo & Ornstein, 1971) has attempted to alleviate this confusion by categorizing the numerous techniques of meditation into three forms: concentration techniques, rejection techniques, and spontaneous self-expression techniques. Concentration techniques are those that emphasize mentally focussing on a specific object, idea or sensation. An example of this form is Transcendental Meditation, the technique most frequently studied by western scientists. Transcendental Meditators are required to give their full attention to the mental repetition of a sound (mantra) during two 20 minute periods each day. Other concentration techniques less familiar to western man make use of a variety of meditation objects such as the cross, the Star of David, the rose, and the lotus.

Naranjo's second form, rejection techniques, is characterized by the emphasis placed on the necessity of rejecting everything from awareness. All thoughts, imaginings, feelings, etc., which enter consciousness are considered distractions from the desired tranquility of a blank field of consciousness. Naranjo considers the Japanese Zen technique called Zazen (just sitting) close to a pure expression of this form (Naranjo & Ornstein, 1971, pp. 82-85). Zazen students are instructed to eliminate all fantasies, thoughts, expectations, etc., in order to attain the emptiness and inner silence of "just sitting."

Spontaneous self-expression techniques, Naranjo's third form, are opposed to the first two forms in that one attends to whatever spontaneously enters consciousness rather than focussing on a single object, or attempting to eliminate all ideas from consciousness. Fantansies, which need to be suppressed in rejection techniques, may here be taken as the object of meditation, yet there is no fixed meditation object as there is in concentration techniques. Since one attends to whatever images or fantasies arise within the field of consciousness, all meditation of this type is individualistic. Each person develops his own unique way according to his inner promptings. Shamans' trances, interpreted by them as communication with the spirit world, and the inspired visions of prophets are examples of this form of meditation (Naranjo & Ornstein, 1971, pp. 96-112).

Transcendental Meditation, Zazen, and Shamans' trance states are useful illustrations of the three forms of meditation because they clearly emphasize the defining characteristics of their respective forms. Many techniques, however, emphasize a mixture of these attributes. An instance of this is a Theravadan practice (Naranjo & Ornstein, 1971, p.10) which consists of watching the rising and falling of the abdomen during respiration. As such, it is an example of the concentrative form of meditation techniques. However, the meditator is also instructed to acknowledge anything else which enters his field of consciousness by mentally naming it three times before returning his awareness to the original object of meditation. The entire meditation is thus a mixture of the concentrative and the spontaneous forms.

Common Attribute

Despite the apparent disparity among techniques which emphasize different behaviours, they all share an important common attribute: the deliberate cultivation of attention. The attitude or inner posture required of, sought after, and practised by the meditator is the same regardless of the meditation object or "non-object." Naranjo (Naranjo & Ornstein, 1971) thus defines meditation as "a practice in awareness . . . in the capacity of giving up ourselves and being available to our perceptions, in receptivity and in freedom from preconceptions necessary to reception . . ." (p.32). The fundamental importance of attention in meditation practice is expressed by Kapleau (1965) in an anecdote about Zen Master Ikkyu. The master was asked to write some maxims of the highest wisdom and replied by writing "Attention." Asked for more, he wrote "Attention. Attention." (In Ornstein, 1973, pp. 237-238). Rahula (1959) notes "It should be clearly borne in mind that whatever the form of 'meditation' may be, the essential thing is mindfulness or awareness (sati), attention or observation (anupassna)" (In Ornstein, 1973, p. 244).

Not only is attention of central importance to the meaning and practice of meditation but a certain kind of attention is required. The particular attitude sought after and practised by the meditator can be more readily understood when it is viewed within the framework of the modes of human functioning.

Modes of Functioning

The idea that there are two general modes: a receptive, non-verbal, a-rational, visuospatial mode; and an active, verbal, rational, symbolic one, has been an integral part of human understanding for a very long time. Bogen (1973) points out that this duality is reflected in the pre-Confucian Oriental concept of Yang and Yin and in Hindu philosophy as buddhi (intellect or rational thought) and manas (mind or integral thought). He also notes its existence in the work of such psychologists as William James (differential vs. existential discrimination), Hobbes (directed, purposeful vs. free, unordered thinking), Pavlov (second vs. first signalling systems), Freud (secondary process and primary process thinking), and Goldstein (abstract reasoning vs. concrete, unreflective attitudes).

The present author has noticed this idea reflected in numerous sources as well. Gellhorn and Kiely (1972) discuss the trophotropic and ergotropic systems of autonomic-somatic integration. The first is associated with parasympathetic activity, relaxation of the skeletal muscles, increased synchrony of EEG (decreased cortical excitation) and such behavioural concomitants as inactivity, sleep, and meditation. The ergotropic system is associated with augmented sympathetic discharges, desynchrony of EEG, and occurs during active thinking and other forms of heightened arousal.

Solley and Murphey (1960) describe two processes of awareness. Non-reflective consciousness is characterized by vivid awareness of experience without the presence of thinking and interpreting. Attention is passive and experience is immediate. Reflective consciousness, on the other hand, is associated with active planning and logical thinking.

Austin (1971) refers to the terms convergers and divergers. Divergers are people who do well on tests that require imaginativeness and mental fluency. They tend to specialize in the arts. Convergers are people who do well on conventional IQ tests, are strong in analytic reasoning and tend to specialize in the physical sciences. Austin's dream recall study supported the contention that the intellectual differences that discriminate convergers from divergers reflect a more general difference in temperament.

> There appears to be a general inhibition or repression among convergers about the emotional and non-rational, which reinforces their capacity for 'logical construction' at the expense of 'combinatory play.' These terms were coined by Einstein, who considered combinatory play a central feature of his productive thought. (Austin, 1971, p. 59).

Carl Jung in his forward to the I Ching, the Chinese book of wisdom based on the Yin Yang principle, discusses two general ways of thinking. One way, particularly emphasized by Western man, centres around the principle of causality and has fathered western science and technology. The other way, best known to the Orientals, involves a principle Jung calls synchronicity, a point of view diametrically opposed to that of causality. While Western man looks for a sequential chain of cause-effect links, the Orientals are preoccupied with the "picture of the moment," a configuration formed by chance events in the moment of observation. Western man perceives himself as the outsider-subject who actively sifts, weighs, collects and classifies the objects around him in his search for causes. The Oriental mind perceives itself as an integral part of the momentary situation, neither subject nor object, but part of the whole (Jung, 1972).

Recently, the idea of two modes of consciousness has gained some popularity, or at least conscious consideration, as a result of the writing of such men as Ornstein (1972, 1973) and Deikman (1971), and the abundant neurophysiological evidence for lateral brain specialization (Bogen, 1973; Levy & Trevarthen, 1976; Milner, 1971). Bogen (1973), a neurologist involved in Roger Sperry's research on the split brain, summarizes evidence from 1864 to the present time that suggests there is a biological basis for two modes of organization. The left and right hemispheres of the brain, although they receive the same input, process the material differently, and often arrive at different results. According to Bogen, various researchers have attempted to describe the difference in such terms as: expressive vs. perceptive, linguistic as opposed to visual and kinesthetic, symbolic vs. visual and imaginative, verbal vs. perceptual or non-verbal, discreet and selective vs. diffuse and vague, linguistic vs. pre-verbal, symbolic and verbal vs. visuospatial, and logical and analytical vs. synthetic and perceptual. Bogen argues very elegantly that the difference is not as simple as verbal vs. non-verbal because both hemispheres have some language capabilities. Rather, the difference lies in what each hemisphere does, not only with words, but with all input. The left hemisphere (in most right-handed people) seems to use its language capacity to make propositions. It operates on its input in a more logical, analytic, computerlike fashion. The right hemisphere, on the other hand, seems to specialize in Gestalt perception. It uses its language in a metaphorical manner to appose and juxtapose ideas, to synthesize and relate, to write poetry rather than prose, to sing rather than speak. Bogen thus calls the left and right modes of organization propositional and appositional, respectively.

Since there is really no one word which aptly describes either of the modes, or the difference between them, Deikman's (1971) designation of ACTIVE for the more logical, manipulative, propositional left hemispheric mode and RECEPTIVE for the perceptual, gestalt, a-rational right hemispheric mode will be used during the rest of this paper.

Meditation as a Receptive Mode Activity

Although there is no absolute proof that meditation belongs to the receptive mode of functioning, this category seems to be the most appropriate whether one considers meditation as a state, a process, or in terms of its effects. Spokesmen of numerous meditation disciplines emphatically state that meditation is a suspension of the cognitive, interpretive processes in a passive attempt to remain in quiet receptiveness. The following passages are, in the author's opinion, typical of these writings.

Akishige (1968) discussing the Zen practice of meditation on a question or koan, states:

> . . .one at first employs intellectual reasoning to deal with koan, and then, growing conscious that logic may never help to solve it, comes to keep it in mind as an objection of attention, and with utmost efforts renders oneself to it, thus killing all the ideas that may come up to consciousness. As a result of such extraordinary and desperate efforts, one suddenly enters into a state of

> mind free from partiality. . . . In the (late) deep state, the normal thinking process entirely ceases, and though sensorial impressions from the outer world are even as clear as in a blurless mirror, there is no cognitive reaction to them inside (pp. 4-5).

In the same fashion Kapleau (1965) says of Zazen, A Buddhist form of meditation:

> For the ordinary man, whose mind is a checkerboard of crisscrossing reflections, opinions, and prejudices, bare attention is virtually impossible: his life is thus centred not in reality itself but in his ideas of it. By focussing the mind wholly on each object and every action, Zazen strips it of extraneous thoughts and allows us to enter into a full rapport with life. (In Ornstein, 1973, p. 238).

Owens (1975) says of Zazen: ". . . the discriminating mind (the conscious mind) is quieted and the intuitive mind (the unconscious) is liberated and identifies with the universal Mind" (p. 156).

Alan Watts, a Zen spokesman claims: "Meditation is therefore the art of suspending verbal and symbolic thinking for a time, somewhat as a courteous audience will stop talking when a concert is about to begin" (1974, p. 32) and again: "Zen should tease us out of thought and leave the mind like an open window instead of stained glass" (1957, p. 14).

Wise (1974), a Christian meditator, states: "This is the suspension of judgment (the temporary suppression of the critical faculty) . . . the setting aside of all preconceptions and biases, to let the subject speak its truth to you unimpeded by you and your hangups" (pp. 71, 72).

Maharishi (1969), the founder of the Transcendental Meditation movement, defines meditation as: ". . . turning the attention inward towards the subtler levels of a thought until the mind transcends the experience of the subtlest state of the thought and arrives at the source of thought" (p. 470).

These are the words of Gopi Krishna (1974), an Indian yogi-scientist-philosopher: "The object of developing the practice of meditation to the point where only one object remains as the focus of attention, and all other flow is arrested, is to create a condition of stillness in the mind so that the reality behind our thoughts, fancies, passions, and desires becomes manifest" (p. 8).

De Ropp (1968), a biochemist and follower of Gurdjieff's (Sufi) tradition, writes: ". . . enter the silence as often as possible; remain there for as long as possible. Stop thoughts!" and again: "The legitimate road to the fourth room and the fifth lies through the silent world, the world of simple awareness, beyond words, beyond thoughts (p. 71).

Goldsmith (1974), founder of the Infinite Way Centre in Hawaii, speaks of the need for intermittent periods of meditation in order to experience ". . . the joy of communion with God. It is in this complete stillness and respite from thinking that the Father takes over in our experience" (p. 176).

Durand Kiefer (1974), writing about meditation on the physical act of breathing, says: "It is a special form of interoceptive exercise that acts to divert self-conscious attention (self-consciousness) from mental constructions and images to simple physical or neural proprioception."

Meditation, then, would seem to be a form of practice in the kind of concentration described by Naranjo (Naranjo & Ornstein, 1971):

> Complete concentration, complete giving of our attention to something, reaches a point where we are, so to say, pure receptivity

> filled by the object: not a screen or a mind where the object is reflected, not an 'I' that perceives, but a nothingness filled by the contemplation; only the object exists, empathetically perceived, as it were, from within (p. 29).

Meditation, as a non-verbal, a-logical, perceptual, receptive activity seems to belong to the appositional, receptive mode of consciousness. In fact, it has been indicated by Meyer (1971) as a suitable tonic for those in whom the critical analytical type of thinking is overdeveloped and interfering with other functions such as feeling and intuition.

The "active doing" mode of functioning is physiologically associated with various signs of arousal, including increased cardiac rate, blood pressure, and sweat secretion; desynchrony of the EEG, increased skeletal muscle tone; and the elevation of certain hormones (Gellhorn & Kiely, 1972). On the other hand, a relaxed, attentional, non-thinking, receptive state is characterized by a reduction in cardiac rate, blood pressure, and sweat secretion; synchrony of EEG; and loss of skeletal muscle tone. The results of numerous physiological correlate studies indicate that meditation brings about the quiet receptive state as opposed to the active doing state. Firstly, it results in synchrony of EEG (Akishige, 1968; Anand, Chhina, & Singh, 1961a; Banquet, 1973; Kasamatsu, Okuma, Takenaka, Koga, Ideda, & Sugiyama, 1957; Kasamatsu & Hirai, 1966; Pagano, Rose, Stivers, & Warrenburg, 1976; Schwartz, 1973; Wallace, 1970). Secondly, it reduces heart rate (Anand et al., 1961a; Goyeche, Chihara, & Shimizu, 1972; Wallace, 1970). Thirdly, it reduces blood pressure and has been used successfully in the treatment of hypertension (Benson & Wallace, 1972; Blackwell, Hanenson, Bloomfield, & Magenheim, 1975; Patel, 1975; Smith, 1975; Wallace, Benson & Wilson, 1971). Fourthly, it reduces sweating (Schwartz, 1971; Wallace, 1970; Wallace et al., 1971). And finally, it reduces stress reactions (Goleman & Schwartz, 1976; Orme-Johnson, 1973). Physiologically, meditation clearly falls into the receptive mode.

There is one exception to this statement: Das and Gastaut (1955) and Anand, Chhina, and Singh (1961b) recorded high frequency electrocortical activity during the meditation of highly experienced Indian Yogis who reported achieving Samadhi during these sessions. Perhaps this tremendously intense and rarely achieved state belongs to a different pattern than that descriptive of the more commonly experienced meditative states.

There is some experimental evidence to support the contention that the desired meditative attitude is one of open receptivity freed of cognition. Maupin (1965) found that subjects' responses to an introductory Zen meditation exercise were positively correlated with two measures of "adaptive regression in the service of the ego." Adaptive regression was operationally defined as the amount and degree of primary-process thinking on the Rorschach, and the existence of visual imagery during free association. It thus referred to the ability to perceive inner and outer experiences without the use of logic, realistic thinking, or secondary, cognitive processes.

Lesh (1970) was interested in the relationship between the practice of meditation and two skills embodied in the capacity for empathy: accuracy in decoding affective communication and openness to inner and outer experience. The first skill was measured by an Affective Sensitivity Scale, a situational test which consisted of identifying the feelings expressed in video-taped client-counsellor interactions. Openness was measured by Fitzgerald's Experience Inquiry which was designed to tap Schachtel's (1959) description of the person who is open to inner and outer experience. The experimental group, which was treated to four weeks of daily practice of an introductory Zen exercise, showed significantly greater improvement on the Affective Sensitivity Scale than two non-meditating control groups. Also, the meditating subjects' responses to the Zen exercise were positively correlated with their scores on the Experience Inquiry, i.e., the more proficient of the meditators received higher scores on a measure of their openness to experience.

Osis, Bokert, and Carlson (1973) obtained self-reports on the subjective meditation experiences of subjects practicing a variety of meditation techniques and submitted these reports to a factor analysis. One of the five factors they found, "self-transcendence and openness," included such items as: a feeling of oneness wherein boundaries were dissolved, closeness with other meditators in the group, and the experience of a melting or merging with others.

Two independent research studies stumbled onto an interesting demonstration of meditation's receptive mode alignment. Schwartz (1974) compared teachers of T.M. with non-meditating controls on two standardized measures of creativity, the Barron-Welsh Art Scale and a battery devised by Wallace and Kogan. Contrary to expectation, the meditators performed consistently worse on the active problem-solving sort of creativity and consistently better on the more free-associational measures. Schwartz concluded that T.M. seemed to enhance "the germinal stages of creativity . . . (that) allows for novel integrations, or gestalts, and creative ideas . . ." but that it may reduce ". . . the expression of these ideas (which) often requires activity, excitement and a good deal of rational and sequential thought" (p. 43). Similarly, Cowger (1973), comparing the creativity of Zazen meditators before and after four weeks of initial daily practice, found that Zazen did not affect individual creativity because the participants produced fewer ideas with words after the meditation experience. In terms of creative output, meditation seems to be aligned with the receptive mode.

It would seem then that eastern meditation Masters and western experimenters are in agreement that the special attitude required during meditation is a suspension of the ordinary flow of thoughts, a non-cognitive open receptivity to the object or "non-object" of the meditation practice.

This non-cognitive open posture is very different from the attitude normally practised by western man. During most of our waking life we are highly selective, cognitive beings. In short, we favour the active mode rather than the receptive one. The content of our awareness at any given time is not a perfect mirror of some external reality; rather, we selectively attend to the myriad of stimuli impinging upon us (Bruner, 1957; Ittelson & Kilpatrick, 1951; Kelly, 1955). Our sensory systems are not sensitive to the entire range of stimuli which we know to exist, and even within the small range to which we are capable of responding, we selectively limit our awareness through such processes as sensory gating (Hernadez-Peon, 1956), attitude (Hastorf & Cantril, 1954), set or expectancy (Bruner, 1957), habituation to constancies (Grossman, 1967) and many others (Morgan & King, 1956, pp.340-378). For example, the stimulus "run" is invariably perceived by a literate English speaking adult as a word with a specific meaning. He is highly unlikely to appreciate the curvature of the lines, to notice that the stimulus is almost symmetrical, to perceive it with figure-ground reversed, or to process it in any manner other than on the basis of an English language cognitive set. The learned association between the visual stimulus "run" and the English word is so strong that he perceives it as such, automatically. He is not receptive to the stimulus as in meditation; he is involved in an active cognitive process of efficiently extracting from the stimulus the bit of information he has learned to consider relevant.

Deautomatization

Normal awareness, then, is an active, selective process; meditation is a passive, receptive one. This distinction led to the formulation of a theory by Deikman (1963, 1966, 1971) who hypothesized that meditation practice consists of a degree of deautomatization of the psychic structure that normally limit and select the objects of our awareness. He referred to Hartmann's (1958, pp.88-91) concept of automatization which states that actions and perceptions frequently repeated are eventually carried out without the perceiver's awareness of the various steps he is taking. Deautomatization, then, is a reinvestment of awareness into actions and perceptions. To return to the earlier example of "run", the literate English speaking person did not always automatically perceive "run" as a word with a specific meaning. He learned to make this association over time, perhaps in the following manner. First he learned to recognize the alphabet through frequent pairings of visual presentations of letters with their respective names and phonetic sounds. Combinations of letters (words) were then presented to him together with guidance in sounding out the sequence. Eventually, after numerous visual presentations of letter combinations like "run" had been paired with the appropriate spoken words, he learned to automatically recognize these stimuli as words. Should this learned recognition be deautomatized in Deikman's sense, that person would again be aware of sorting out the symbols and integrating them in a particular way. He would also be freed to visually organize the stimulus in other ways since he would not automatically perceive a word. He would thus be less bound to the most stereotyped manner of perceiving the stimulus, and consequently freed to view it otherwise.

Deikman (1966) reasoned that meditation should result in a deautomatization of psychic structures because:

> it seems to constitute just such a manipulation of attention as is required to produce deautomatization. The percept receives intense attention while the use of attention for abstract categorization and thought is explicitly prohibited. Since automatization normally accomplishes the transfer of attention <u>from</u> a percept or action to abstract thought actively, the meditation procedure exerts a force in the reverse direction. Cognition is inhibited in favour of perception; the active intellectual style is replaced by a receptive perceptual mode. (p.221)

His theory was supported by the reported experiences of subjects during and after experimental meditation sessions (Deikman, 1963). One subject, for example, reported an inability to visually organize his perception of a familiar landscape. He could no longer see the patterning in it, nor could he impose a pattern on it. It appeared that the normally automatic process of visual organization was disrupted, resulting in a less stereotyped perception of an otherwise familiar landscape. Deikman's theory was also supported by the East Indian Professor of physics and Yoga practitioner, Asrani (1969), who claimed that the Buddhist method of Mindfulness or Attentiveness deautomatizes patterns that have become automatic. Similarly, Onda (1962), in a paper discussing the influences of Zen practice on creativity, stated that Zen results in the ability to be puzzled, to question, to be surprised by that which many people take for granted. The capacity to be surprised by the ordinary is another way of expressing the deautomatization theory; that which is normally dealt with automatically is re-invested with awareness so that it is perceived as though for the first time.

While research investigating the effect of meditation on deautomatization is sparse, there are a number of physiological correlate studies which indirectly supported the theory by comparing the degree to which meditators and non-meditators habituated to numerous repetitions of a stimulus. Normally, one is alert to a novel or unexpected stimulus. However, after numerous repetitions of that stimulus, one tends to view it with decreased interest, or if the stimulus has been insignificant in the past, not to notice it at all (Grossman, 1967, pp.641-654). This phenomenon, termed habituation, is a learned inhibition of sensory mechanisms. Anand, Chhina, and Singh (1961a) studied the EEG patterns of Yogis who practiced a concentrative meditation technique. The experimenters found that the Yogis did not attend at all (there was no alpha blocking) to extraneous stimulation during meditation. However, when not meditating, they showed no habituation to constant repetitions of these stimuli, i.e., they responded to each repetition of a stimulus as though they were perceiving it for the first time. Kasamatsu and Hirai (1966) found that Zen meditators did not habituate (alpha blocking did not decrease) to a repetitive click stimulus during their meditation; each click was responded to as though it had never occurred before. Yet the control subjects, resting with eyes closed, presented the usual habituation pattern. The meditators thus appeared to be reinvesting awareness into that which would normally be automatically disregarded.

To recapitulate: eastern writings and western experimental observations both point to the conclusion that meditation requires an abnormally open, passive, non-cognitive attitude. Drawing on this idea, Deikman hypothesized that meditation should result in a reinvestment of awareness into actions, perceptions, etc., which had become automatic. His hypothesis has received some support from his own research and the formulations of various eastern thinkers.

Purpose of Present Study

The purpose of the present investigation was to further examine Deikman's deautomatization theory. In order to test Deikman's hypothesis about meditation, subjects were assessed on tasks which required them to reinvest awareness into learned behaviour which had become "set' or automatic.

The term "set" has been defined by Johnson (1972) as "a readiness to make a specified response to a specific stimulus" (p.152). The term was previously used (cf. pp.14 and 15) to refer to the readiness of an English speaking person to make a specified response to the stimulus "run." The concept of set suggests that one's previous learning history influences one's response toward a stimulus; hence, it refers to the process of automatization (Hartmann, 1958). According to deautomatization theory, the meditative process should effect a degree of undoing of such cognitive structures as set thereby allowing the meditator to respond to a familiar stimulus as though he were perceiving it for the first time.

Furthermore, there is some suggestion that this deautomatization process affects the meditator's behaviour beyond the actual meditation session. Deikman's previously mentioned (1963) study reports deautomatized behaviour both during and after experimental meditation sessions. Similarly, Anand et al.,(1961a) report an abnormal lack of habituation to repetitive stimuli before meditation sessions. Research into the effect of meditation on other aspects of human behaviour demonstrate changes that persist beyond the actual meditation session. Examples include personality (Hjelle, 1974; Seeman, Nidich, & Banta, 1972), drug use (Benson & Wallace, 1972; Shaffi, Lavely, & Jaffe, 1974), and perception (Pelletier, 1974). Consequently, it is possible that the deautomatization effects of meditation on set also extend beyond the meditation session. This possibility was examined in the present study.

Hypotheses

The major hypothesis of this investigation was that meditation would result in a deautomatization of the normal tendency to respond (automatically) to familiar stimuli on the basis of sets or expectations created by past experience. In other words, it was expected that meditators, having developed their capacity to reinvest awareness into automatized activities, would demonstrate less set-bound behaviour. Furthermore, this phenomenon was expected to increase as a function of the length of meditation history.

These hypotheses were tested in two situations: (1) a numerical estimation task and (2) a verbal learning, negative transfer task using paired associate lists. In both tasks, subjects were initially presented with certain stimuli until a response set was established to specified criteria. A change was then introduced into the task stimuli, and the subjects' responses to the change were measured.

Numerical Estimation Task

The numerical task was created specifically for this study, and originated from research (Beach, 1968; Laestadius, 1970; Peterson & Beach, 1967) that has made use of probability theory and statistics as a framework within which to study human statistical inference. Subjects are generally required to estimate such statistics as the means, variances, correlations or proportions of samples and populations, and their estimations are then analyzed to determine whether or not they can be accounted for by probability and statistical theory. A similar approach was used in the present study. Subjects were presented with a population of 100 numbers, one number at a time, and were required to estimate the mean of the total population each time they were presented with another number. As a result, they made 100 estimations of the population mean, and each successive estimation was based on an increasing amount of information about the numbers comprising that population.

The actual mean of the first 50 numbers presented was 9.0. After trial 50, the number values increased such that the overall population mean became 10.5. The purpose of the first 50 stimulus numbers was to create a response set in subjects as to the value of the population mean. A response set was considered to be adequately established if the 41st through 50th estimates of a subject had a standard deviation less than 1.00. The required change in stimuli was introduced through an increase in the value of the numbers. Subjects' response to this change was their last 50 estimations of the population mean. In accordance with the stated hypotheses, it was expected that: (1) meditators would respond more accurately than non-meditators after the change in task materials, and (2) accuracy of the 51st through 100th estimates would increase as a function of length of meditation history.

Verbal Learning Task

The verbal learning task was a paired-associate, negative transfer, A-B, A-C paradigm, including the required D-E control list (Kausler, 1974, p.222). The initial stimuli presented to subjects were the paired-associates comprising the A-B list. (An example would be DAWN-QUEEN). A response set was considered established by those subjects who demonstrated acquisition of these pairs to a minimum criterion of 80 per cent correct recall. The change in stimuli was introduced through the A-C list, in which new response nouns were paired with previous stimulus nouns (for example, DAWN-CABIN). Acquisition of this new A-C list was then compared to acquisition of the control D-E list. The derived difference, termed negative transfer, was considered a measure of the degree to which the learned set (A-B) was interfering with present learning. Negative transfer is defined by verbal learning theorists as the decrement in learning of a second task due to the learning of some prior task (Jung, 1968, p.79). Since it was hypothesized, in this study, that meditators would be less bound to respond to familiar stimuli on the basis of their past learning history, it was expected that: (1) meditators would experience less negative transfer than non-meditators, and (2) negative transfer would vary inversely with length of meditation history.

The necessity of specifying performance criteria in each task for the establishment of a set resulted in an uneven rejection of subject data over the two tasks. All subjects participated in both tasks, but due to failure to meet the set criterion, some subjects were not included in the data analysis of one task or the other.

CHAPTER II

Method

Subjects

The subjects were 36 non-meditators, whose participation was a requirement of the Introductory Psychology course at the University of Manitoba, and 80 volunteers from the International Meditation and Student International Meditation Societies. Twenty-nine of the volunteers had meditated regularly for an average of 35.5 months immediately prior to their participation in the study. They formed a group labelled "seasoned meditators." Another 28 volunteers had meditated regularly during the previous one to seven months, for an average of 3.4 months and were designated "new meditators." The remaining 23 volunteers had expressed an interest in meditation by attending an introductory lecture at the Transcendental Meditation Centre. They had not actually practiced meditation prior to participation in the study, and formed the "interest" control group. It is possible that people who are interested in meditation differ from the general population quite independently of any changes effected by meditation practice. The "interest" group was included to control for this possible source of variation. The 36 introductory students were non-meditators who claimed no particular interest in meditation. They formed a second control group. The sex, age, and educational background of the subjects were noted, but difficulties in obtaining sufficient numbers of subjects prevented adequate control of these variables. The sex distribution and average age in each of the groups is tabled in Appendix A.

The meditators obtained through the meditation societies had all completed the basic Transcendental Meditation course which introduces its students to the theory of Maharishi Mahesh Yogi and instructs them in a specific meditation procedure. Meditators are required to spend two, 20 minute periods each day, seated with eyes closed, attending to the mental repetition of a mantra. Each student receives a specific mantra according to criteria unrevealed to initiates.

All subjects participated in both experimental tasks; however, some of them failed to meet the above mentioned "established set" criteria for one or both tasks. As a result of this, some subjects were included in the data analysis of only one of the tasks while others were included in both. Thus the research consisted of two overlapping subject samples selected from a common subject pool. Also, because the subjects differed across tasks, the research was appropriately treated as two studies. In the first study, involving the numerical estimation task, 36, 20, 22, and 21 subjects from the student control, interest, new and seasoned groups, respectively, met the consistency criterion. In Study 2, which consists of the verbal learning task, 30, 21, 24, and 22 subjects met the first list acquisition criterion.

Design

Subjects were assigned to the cells of a 2 x 4 factorial design. The variables investigated were length of meditation history (control, interest-control, new, and seasoned) and time of testing in relation to a meditation session (immediately after or immediately before a regular

20 minute meditation session). This latter variable was included to control for, and investigate, a possible pre-post meditation effect. Subjects in the "post" condition meditated (if meditators) or relaxed with eyes closed (if controls) in a group setting just prior to task administration. Meditators in the "pre" condition did not meditate until after task participation, and their control counterparts did not have a 20 minute relaxation session.

Study 1

The dependent variables of the numerical estimation task were transformations carried out on subjects' 51st through 100th estimates. These 50 estimates were collapsed into five groups of ten: 51-60, 61-70, 71-80, 81-90, and 90-100, and each group became a level of a repeated measures variable designated "information." Information was then the within factor of a 2 x 4 x 5 split-plot design (Kirk, 1969, p.284).

Study 2

The dependent variable of the verbal learning task was the amount of negative transfer in each of the four second list trials. This repeated measures variable was designated "trials" and became the within factor in a 2 x 4 x 4 split-plot design (Kirk, 1969, p.284).

Materials

Study 1

The materials for the numerical estimation task consisted of a population of 100 numbers with an overall mean of 10.5, standard deviation of 2.513, and range of five to 16. Each of the 100 numbers was stenciled on a 12.7 x 7.62 cm. card in 10.16 cm. gothic print. The first 50 of these numbers had an overall mean, standard deviation, and range of 9.0, 2.02, and five to 13, respectively. They were stratified such that each consecutive group of ten numbers had a mean of 9.0. The last 50 numbers had an overall mean, standard deviation, and range of 12.0, 2.02, and eight to 16, respectively. They were similarly stratified so that the mean of each set of ten numbers was 12.0. The 100 number cards were placed on a set of metal binder rings and the rings mounted on a wooden stand. This made it possible to flip over each card during their presentation. The numbers used in the estimation task were chosen on the basis of prior pilot work.

The materials also included taped instructions on the procedure for making estimates, a response sheet for each subject, and a separate group of ten numbers, also stenciled on cards, which composed a sample group to accompany the instructions.

Study 2

The materials for the verbal learning task consisted of two lists of ten paired-associates. Both stimuli and responses were nouns selected from Paivio's norms of concreteness, imagery and meaningfulness (Paivio, Yuille, & Madigan, 1968) such that each noun consisted of a maximum of six letters and scored high on imagery (six or above) and meaningfulness (seven or above). High imagery and high meaningfulness nouns have been found to increase learning performance (Paivio et al., 1968) and hence negative transfer (Kausler, 1974, p.233; Jung, 1963). It was important for the purpose of this study to maximize both of these variables. Thirty-five nouns were randomly selected from those that met these qualifications. From these nouns, the acquisition and transfer lists, each of ten paired-associates, were formed and placed in the traditional A-B, A-C paradigm (Kausler, 1974, p.222).

The transfer list consisted of five (control) pairs in the D-E condition and five (experimental) pairs in the A-C condition; consequently, each subject served as his own control. In an attempt to maximize the negative transfer effect and minimize variation in first list learning, the lists were scanned to ensure low intra-list similarity of both stimuli and responses, low inter-list similarity of responses, and low association value of stimulus-response pairs. The effects of these variables on negative transfer have been demonstrated by Dallett (1962), Jung (1962), Kausler (1974, p.233) and Wimer (1964). Noun pairs which met the above criteria were stenciled in 5.08 cm. Roman print on 16.51 x 44.45 cm. cardboard. The stimuli were similarly stenciled on 8.89 x 36.83 cm. cardboard. Four random orders of each of the paired-associate lists and stimulus lists were constructed in order to prevent serial learning of the responses.

Other materials included taped instructions on the task procedure, a sample stimulus and a sample paired-associate to facilitate instruction, a stop-watch, and a response pad for each subject.

Procedure

All subjects were informed that the purpose of the investigation was to study the effect of meditation on mental flexibility. Meditators and controls in the "post" condition came to the experimental room prior to testing in order to meditate (if a meditating subject) or relax with eyes closed (if a control subject) for the usual 20 minute period. They were joined by people in the "pre" condition one half hour later for group testing. During all sessions the numerical estimation task preceded the verbal learning one.

Study 1

The instructions for the numerical estimation task were tape-recorded and can be found in Appendix B. The concept of the mean was explained as the centre of gravity of a teeter-totter according to Beach and Swenson's (1966) recommendations and by the $(\Sigma X)/N$ computational formula. Subjects were presented with each number of the 100 number population for approximately four seconds. They were instructed to estimate the overall mean of the population after each presentation of a number and to record their estimates on response sheets. This resulted in each subject estimating the population mean 100 times.

Upon completion of the numerical task, subjects were given a five minute rest period.

Study 2

The verbal learning task was presented by the study-test method. Noun pairs and stimuli were presented manually for two and three seconds, respectively. The acquisition and transfer lists were presented for four trials each. The number of study-test trials and the exposure time of paired-associates and stimuli were determined by prior pilot work. Subjects responded during test trials in written form. Instructions were tape-recorded and have been transcribed verbatim in Appendix B.

Statistical Methodology

Study 1

It was hypothesized that the meditation groups' estimations of the population mean, after the change in task stimuli, would be more accurate than that of the control groups, and that accuracy would increase as a function of length of meditation history. "Accuracy" was defined by two measures: absolute deviations and adjusted deviations.

Absolute deviations. This measure of accuracy was the sum of the absolute deviations of subjects' 51st through 100th estimates from the actual accumulative means. These 50 absolute deviations were then collapsed into five groups of ten (51-60, 61-70, 71-80, 81-90, 91-100), the mean of each group computed, and these five means designated "information." Since subjects had more information about the number population when they made their 91st to 100th estimates than when they made their 51st to 60th estimates, the five means reflected subjects' accuracy as it changed due to increased information.

It was expected that absolute deviations would decrease as a function of length of meditation history.

Adjusted deviations. Each subject's set as to the value of the population mean was defined as the average of his 41st through 50th estimates and was called his "base-mean." Different subjects developed different sets. It might be expected that subjects' responses to the increase in number values after the 50th number would be, in part, a function of their base-mean. Subjects with a relatively low base-mean would be expected to continue making lower estimations than subjects with a relatively high base-mean. The absolute deviation measure of accuracy did not take this base-mean variation into consideration, thus necessitating the construction of another measure which could do so. This measure, called adjusted deviations, was constructed in the following manner. First, the true base-mean of 9.0 was subtracted from each of the actual accumulative means for numbers 51 through 100. This transformation resulted in 50 successively greater values ranging from 0.12 to 1.51. (For example, the actual accumulative mean for number 51 was 9.12. The true base-mean, nine, subtracted from 9.12 provided the first value, 0.12). Secondly, the same kind of transformation was carried out on each subject's 51st through 100th estimates of the accumulative means. Specifically, each subject's base-mean was subtracted from each of his 51st through 100th estimates, thus resulting in a second set of 50 values. (For example, if a subject's 51st estimation was "ten" and his base-mean was 8.5, the new value would be 1.5). Finally, each of the first group of 50 values was subtracted from each of the second group to form a third set. (To follow through with our example: 0.12 would be subtracted from 1.5 to form the "adjusted deviation" of 1.38). This third set of 50 numbers, labelled "adjusted deviations," was thus a measure of the extent to which each subject's estimates varied from his base-mean as compared to the extent to which the actual accumulative means varied from the true base-mean. The mathematical formula representing this measure can be found in Appendix C. The 50 adjusted deviations were then collapsed into five groups of ten to form the five levels of the "information" factor.

It was expected that adjusted deviations would decrease as a function of length of meditation history.

Study 2

As explained above (cf. pp.20-21) the dependent variable of the verbal learning task was called negative transfer and was derived from a comparison of A-C acquisition with D-E acquisition. For example, if a subject responded correctly to three of the five A-C (experimental) pairs, and to four of the five D-E (control) pairs, his negative transfer value for that trial would be one (i.e., 4-3=1).

Negative transfer was expected to decrease as a function of length of meditation history.

CHAPTER III

Results

In accordance with the deautomatization theory it was hypothesized that the meditation groups' estimations of the population mean, after the change in task stimuli, would be more accurate than that of the control groups. Also, it was expected that accuracy (of the 51st through 100th estimates) would increase as a function of length of meditation history. The accuracy of subjects' estimates after the change in number values was defined by the two previously described measures: absolute deviations and adjusted deviations.

Before the accuracy measures could be meaningfully interpreted, it was necessary to ensure that each of the eight experimental groups had established an equally strong response set prior to the change in task stimuli. The standard deviation of each subject's 41st through 50th estimates was considered an indicator of the strength of his response set. As previously mentioned, if these estimates had a standard deviation of 1.0 or more, response set was considered inadequately established and the subject's data were eliminated from further analysis. This consistency criterion helped to limit response set strength variation among subjects; however, it was still possible that the groups differed systematically from one another within the range allowed by the response set criterion. In order to determine whether or not there was a set strength bias among the subject groups, these standard deviations were entered into an analysis of variance with meditation history (control, interest, new, and seasoned) and time (pre-meditation and post-meditation) as the between groups factors. As indicated in Table 1, no significant differences were found. Thus it is clear that the strength of set, as measured by response consistency, was not significantly different among the various experimental groups.

Absolute Deviations

As described above, each subject's 50 absolute deviations were collapsed into five mean values and designated "Information." These mean values were entered into an analysis of variance with meditation history (control through seasoned) and time (pre and post) as the between group factors, and information (I1 through I5) as the within groups factor. Table 2 presents a summary of this analysis. As can be seen, there were no significant differences among the four history groups. Also, there was no significant difference between subjects who participated immediately prior to a regular meditation session as opposed to those who participated immediately after one. In terms of this measure, neither meditation nor the length of meditation history significantly affected subjects' accuracy after the change in task materials. The two main hypotheses of this study were not supported.

Adjusted Deviations

The 50 adjusted deviation values were also collapsed into five groups to form the five levels of the "information" factor. These data were treated to an analysis of variance with meditation history and time as the between group factors and information as the within groups factor. Table 3 summarizes these results. As with absolute

Table 1

Analysis of Variance of the Strength of Response Set

Study 1

Source	df	MS	F
Meditation History (H)	3	.021	.263
Time (T)	1	.141	1.725
H x T	3	.029	.354
Error	91	.0815	

Table 2

Analysis of Variance of Absolute Deviations 51 - 100

Study 1

Source	df	MS	F
Meditation History (H)	3	1.320	.241
Time (T)	1	1.431	.261
H x T	3	.642	.117
Error	91	5.476	
Information (I)	4	.189	1.053
I x H	12	.171	.955
I x T	4	.210	1.171
I x H x T	12	.099	.549
Error	364	.180	

Table 3

Analysis of Variance of Adjusted Deviations 51 - 100

Study 1

Source	df	MS	F
Meditation History (H)	3	4.267	1.051
Time (T)	1	.398	.098
H x T	3	2.066	.509
Error	91	4.058	
Information (I)	4	1.636	6.504*
I x H	12	.159	.631
I x T	4	.101	.399
I x H x T	12	.053	.212
Error	364	.252	

* $p < .001$

deviations, neither length of meditation history nor time of participation in relation to a meditation session significantly affected accuracy.

Subjects' estimations did significantly improve (adjusted deviation values decreased) as they gained more information about the number population ($\underline{F}(4,364)=6.504$, $\underline{p} < .001$). This effect is shown in Figure 1. Scheffé's test (Kirk, 1968) was used to compare the various levels of information and a summary table of the results can be found in Appendix D. Performance at I1 was significantly different at the .05 level from each of I3, I4, and I5. Also, I1 plus I2 was significantly different from I3 plus I4 plus I5.

Additional Analyses

The main hypotheses were not supported by the foregoing analysis. However, graphs of the data and observation of the means suggested that additional post hoc testing might be useful. Four such analyses were carried out. The purpose and design of each is summarized in list form in Appendix E.

Adjusted deviations. Figure 2 shows the adjusted deviation scores at I1 as a function of time (pre-post-meditation) for each of the four history groups. The figure indicates that both groups of non-meditators (control and interest) performed better just after a relaxation session, while the two groups of meditators (new and seasoned) experienced a slight change in the opposite direction. In order to focus on these descriptive differences, the four history groups were collapsed into two: meditators vs. non-meditators. The adjusted deviation data were then entered into an analysis of variance

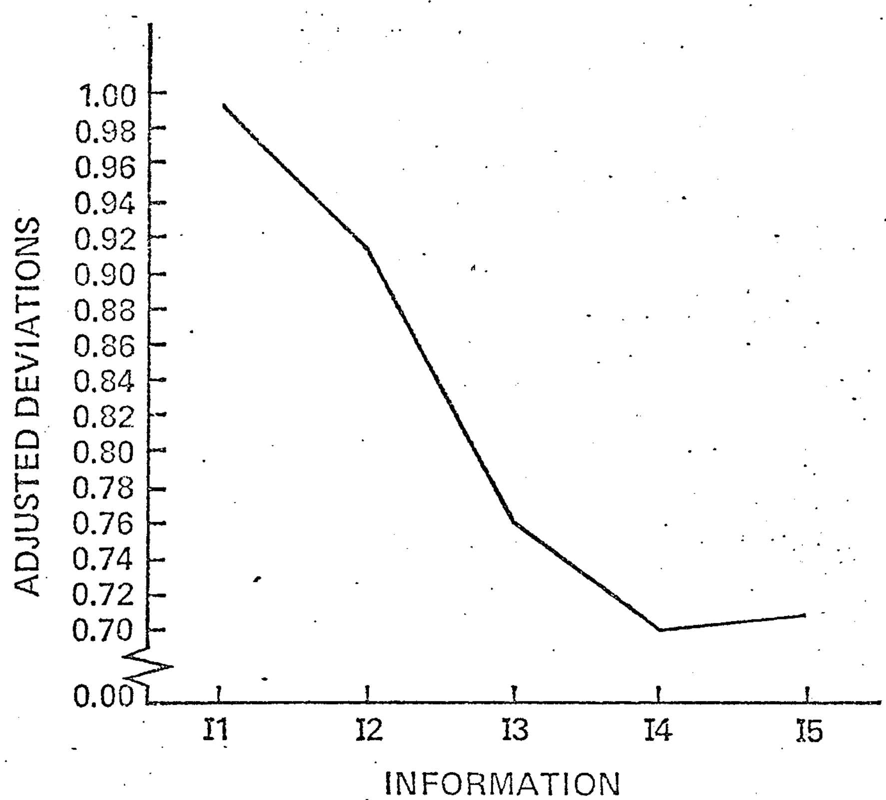

Figure 1: Adjusted deviations of all subjects as a function of information.

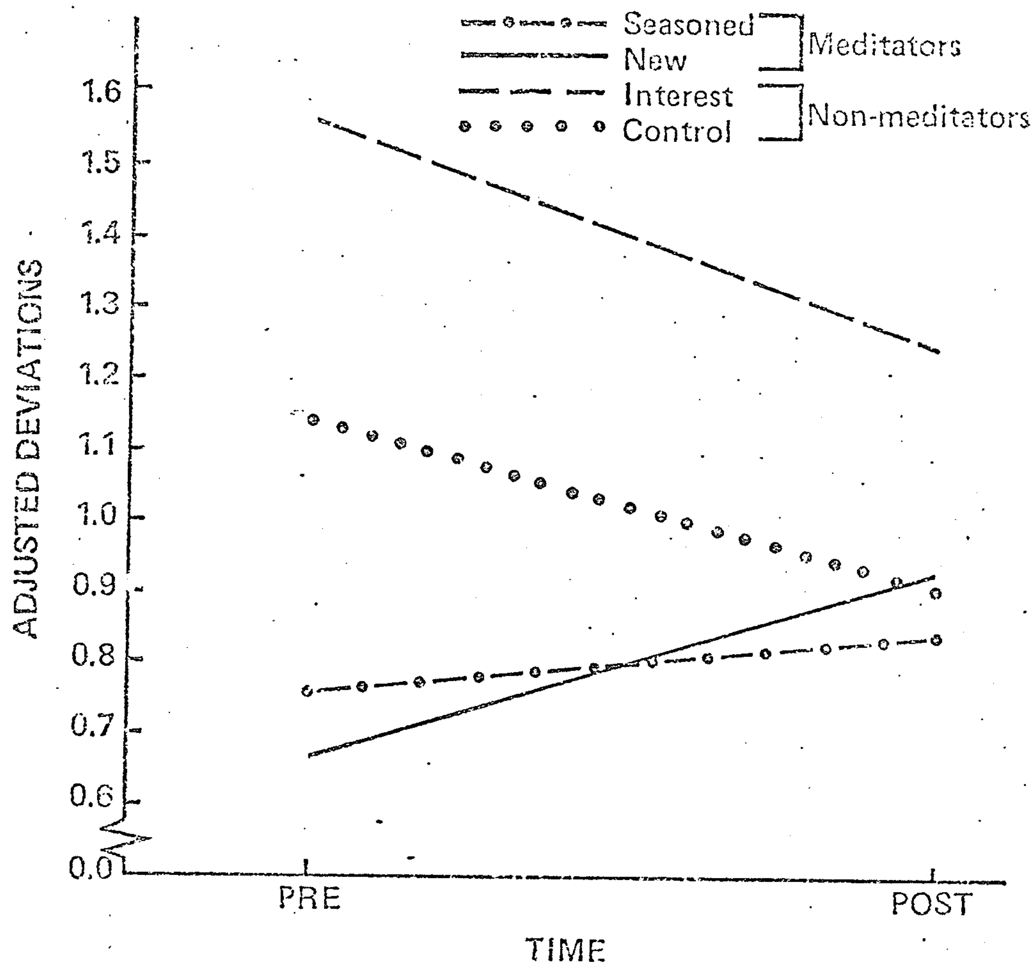

Figure 2: Adjusted deviations of groups at (ii) as a function of time in relation to a meditation or relaxation session.

with meditation (meditators vs. non-meditators and time (pre- vs. post-_ as the between groups factors, and information (I1 to I5) as the within groups factor. As presented in Table 4, the relevant interaction was not statistically significant. It seems that time in relation to a meditation or relaxation session did not differentially affect the meditators as opposed to the controls.

Estimates 51 to 100. The absolute deviation and adjusted deviation analyses indicated that the raw data (subjects' estimates), compared with the actual accumulative means, did not differ across the experimental groups. These analyses both investigated the same type of comparison; namely, a comparison against the theoretical mean values to determine which groups were most accurate in their judgments. A second type of comparison was also available. This one makes no reference to the theoretical means, but simply asks if there were significant differences among the various groups in terms of their empirical means. In order to investigate this type of comparison, estimates 51 to 100, collapsed into five groups of ten, were treated to an analysis of variance with history and time as the between groups factors and information (one to five) as the within groups factor. As can be seen in Table 5, neither history nor time significantly affected performance. The experimental groups did not differ from each other in their estimates. The estimates, as would be expected, did significantly change as a function of information.

Estimates and absolute deviations 1 to 50. Deautomatization theory suggests that meditators should be more aware of their environment since they experience less interference from preconceived bias,

Table 4

Analysis of Variance of Adjusted Deviations

Study 1

Source	df	MS	F
Meditation (M)	1	4.988	1.511
Time (T)	1	.227	.060
M x T	1	6.319	1.595
Error	95	3.962	
Information (I)	4	1.623	6.658*
I x M	4	.259	1.061
I x T	4	.124	.508
I x M x T	4	.072	.294
Error	380	.245	

* $p < .001$

Table 5

Analysis of Variance of Estimates 51 - 100

Study 1

Source	df	MS	F
Meditation History (H)	3	29.93	1.965
Time (T)	1	3.166	.208
H x T	3	3.562	.234
Error	91	15.229	
Information (I)	4	8.403	33.405*
I x H	12	.159	.631
I x T	4	.101	.399
I x H x T	12	.053	.212
Error	364	.252	

* $p < .001$

thoughts, imaginings, etc. If this is so, it might be expected that the meditation groups, especially the seasoned meditators, would perceive the true characteristics of the number population more quickly than the non-meditators. Such a difference would be reflected in both (1) the subjects' first 50 estimates and (2) the absolute deviations of these estimates from the actual mean of nine. The first analysis simply asks if the group estimates differed from each other whereas the second analysis asks if the groups showed differential accuracy with regard to the theoretical mean.

(1) Estimates 1-50. Subjects' first through 50th estimates were therefore divided into five groups and placed in an analysis of variance with history and time as the between groups factors and information as the within groups factor. As presented in Table 6, the only significant effect was the within groups factor. Meditation did not produce a difference in the subjects' first 50 judgments.

(2) Absolute deviations 1-50. Subjects' first through 50th estimates were taken in five groups of ten and the mean of each ten estimates calculated. The absolute deviation of each of these means from the true mean of 9.0 was placed into an analysis of variance with history and time as the between groups factors and information (one to five) as the within groups factor. The results of this analysis are summarized in Table 7. There were no significant history or time effects. Apparently, meditation did not result in a more accurate perception of the population mean. Accuracy did increase (the absolute deivations decreased) for all subject groups as a function of increased information.

Table 6

Analysis of Variance of Estimates 1 -50

Study 1

Source	df	MS	F
Meditation History (H)	3	7.989	.690
Time (T)	1	.613	.053
H x T	3	2.323	.201
Error	91	11.578	
Information (I)	4	8.944	14.342*
I x H	12	.278	.445
I x T	4	.147	.236
I x H x T	12	.328	.526
Error	364	.624	

* $p < .001$

Table 7

Analysis of Variance of Absolute Deviations (1 - 50)

Study 1

Source	df	MS	F
Meditation History (H)	3	5.482	.703
Time	1	.885	.114
H x T	3	3.782	.485
Error	91	7.797	
Information (I)	4	2.075	4.052*
I x H	12	.406	.792
I x T	4	.424	.829
I x H x T	12	.602	1.176
Error	364	.512	

* $p < .01$

In view of the lack of significant findings with regard to the variables of interest, further post hoc analyses were not carried out.

Study 2: Verbal Learning Task

First list learning. The degree to which subjects learned the first list of paired-associates was considered an indicator of the strength of their response set. As previously mentioned, if first list correct recall did not equal or exceed 80 per cent, response set was considered inadequately established, and the subject's data were eliminated from further analysis. This first list acquisition criterion somewhat limited response set variation among subjects; however, since this variable was not experimentally controlled, it was necessary to statistically check for a set strength bias among the groups. This was done in two ways. First, Trial 4 recall was placed into an analysis of variance, with history and time, as the between groups factors. As shown in Table 8, set strength was the same for all groups. Secondly, total correct recall on Trials 1 to 4 was calculated, and this sum treated to an analysis of variance with the same between groups factors. Table 9 indicates that the subject groups did not differ on this measure either. It would seem, then, that the experimental groups developed equally strong response sets during the four first list trials so that this variable was not a confounding factor in the experiment.

Negative transfer. In accordance with deautomatization theory, it was hypothesized that meditators, being less set bound than non-meditators, would experience less interference from first list learning in their second list recall. Also, it was expected that this interference would decrease as a function of length of meditation history.

Table 8

Analysis of Variance of Response-Set Strength (1)

Study 2

Source	df	MS	F
Meditation History (H)	3	.134	.134
Time (T)	1	.011	.025
H x T	3	.478	1.058
Error	89	.452	

Table 8

Analysis of Variance of Response-Set Strength (2)

Study 2

Source	df	MS	F
Meditation History (H)	3	19.978	.607
Time (T)	1	1.700	.052
H x T	3	28.519	.867
Error	89	32.909	

Interference of first list learning on second list recall was equated with negative transfer, a measure taken on second list performance. The latter was operationally defined for each second list trial as the number of correctly recalled associates from the five D-E or control pairs (C) minus the number of associates correctly recalled from the A-C or experimental pairs (E). These (C-E) data were treated to an analysis of variance with meditation history (control, interest, new, and seasoned) and time in relation to a meditation session (pre and post) as the between groups factors. Since there were four second list or transfer trials, trials (one to four) became the within groups factor. Table 10 presents a summary of this analysis. There were no significant differences among the four history groups. Also, there was no significant difference between subjects who participated immediately prior to a regular meditation session as opposed to those who participated immediately after one. In terms of negative transfer, neither meditation nor the length of meditation history significantly affected subjects' performance. The two main hypotheses of this study were also not supported.

Subjects' second list recall did significantly improve (negative transfer decreased) over the four transfer trials ($\underline{F}(3,267)=24.042$, $\underline{p} < .001$). This effect is graphed in Figure 3. Post-hoc comparisons of these means were carried out using Scheffé's S method (Kirk, 1968), and a summary table of the results can be found in Appendix D. Negative transfer on Trial 1 was significantly different at the .05 level from that on Trials 2, 3, and 4. Also, Trials 1 plus 2 significantly differed from Trials 3 plus 4.

Additional analysis: Negative transfer. Figure 4 presents Trial

Table 10

Analysis of Variance of Negative Transfer

Study 2

Source	df	MS	F
Meditation History (H)	3	.178	.134
Time (T)	1	.680	.512
H x T	3	1.268	.954
Error	89	1.330	
Trials (Tr)	3	15.542	24.042*
Tr x H	9	.505	.782
Tr x T	3	.962	1.488
Tr x H x T	9	.673	1.041
Error	267	.646	

* *p* < .001

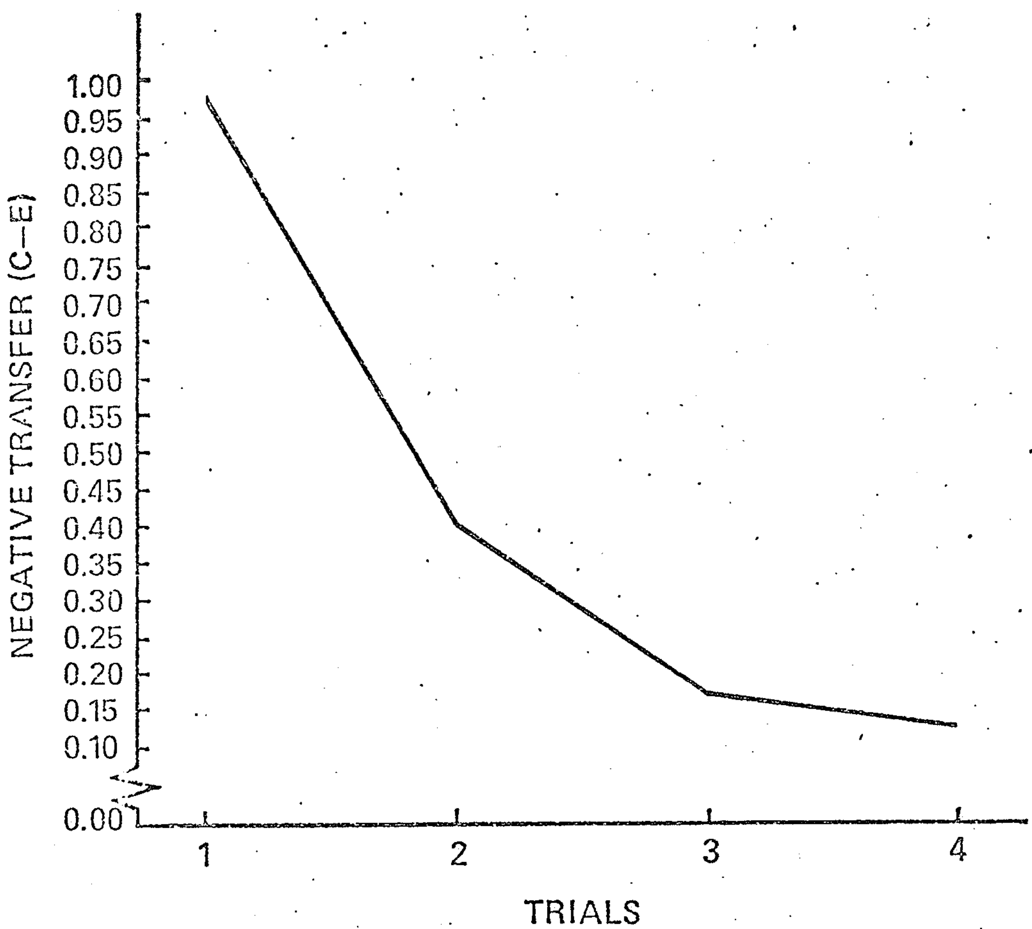

Figure 3: Negative transfer of all subjects over List 2 trials.

1 negative transfer as a function of time (pre-, post-meditation or relaxation) for each of the four history groups. As can be seen from this figure, both groups of non-meditators (control and interest) experienced less negative transfer in the post condition, while the two groups of meditators (new and seasoned) experienced a slight change in the opposite direction. In order to focus on these descriptive differences, the four history groups were collapsed into two: meditators vs. non-meditators. The negative transfer data was then entered into an analysis of variance with meditation (meditators vs. non-meditators and time (pre- vs. post-) as the between groups factors, and trials (one to four) as the within groups factor. The results are summarized in Table 11; the meditation by time interaction was not statistically significant ($\underline{F}(1,93)=2.469$, $\underline{p} < 0.119$). Apparently, time in relation to a meditation or relaxation session did not differentially affect the meditators as opposed to the controls.

Inter-task Correlations

Both the numerical estimation and the verbal learning task failed to support the main hypotheses. Whether or not these tasks provided independent or redundant measures of the hypotheses was, however, still unknown. In order to resolve this issue, it was necessary to examine the correlations of subjects' performance on the two tasks. The five mean adjusted deviation scores from estimates 51 to 100 (I1-I5), and the negative transfer (C-E) data from Trials 1 and 2, were correlated for those subjects to the interest, new, and seasoned groups whose performance met the criteria of both tasks. Separate Pearson product-moment correlation coefficients were computed for each of the three

Table 11

Analysis of Variance of Negative Transfer

Study 2

Source	df	MS	F
Meditation (M)	1	.119	.093
Time (T)	1	.544	.424
M x T	1	3.169	2.469
Error	93	1.283	
Trials (Tr)	3	14.709	22.785*
Tr x M	3	.334	.517
Tr x T	3	.726	1.124
Tr x M x T	3	.688	1.066
Error	279	.646	

* $p < .001$

Table 11

Analysis of Variance of Negative Transfer

Study 2

Source	df	MS	F
Meditation (M)	1	.119	.093
Time (T)	1	.544	.424
M x T	1	3.169	2.469
Error	93	1.283	
Trials (Tr)	3	14.709	22.785*
Tr x M	3	.334	.517
Tr x T	3	.726	1.124
Tr x M x T	3	.688	1.066
Error	279	.646	

* $p < .001$

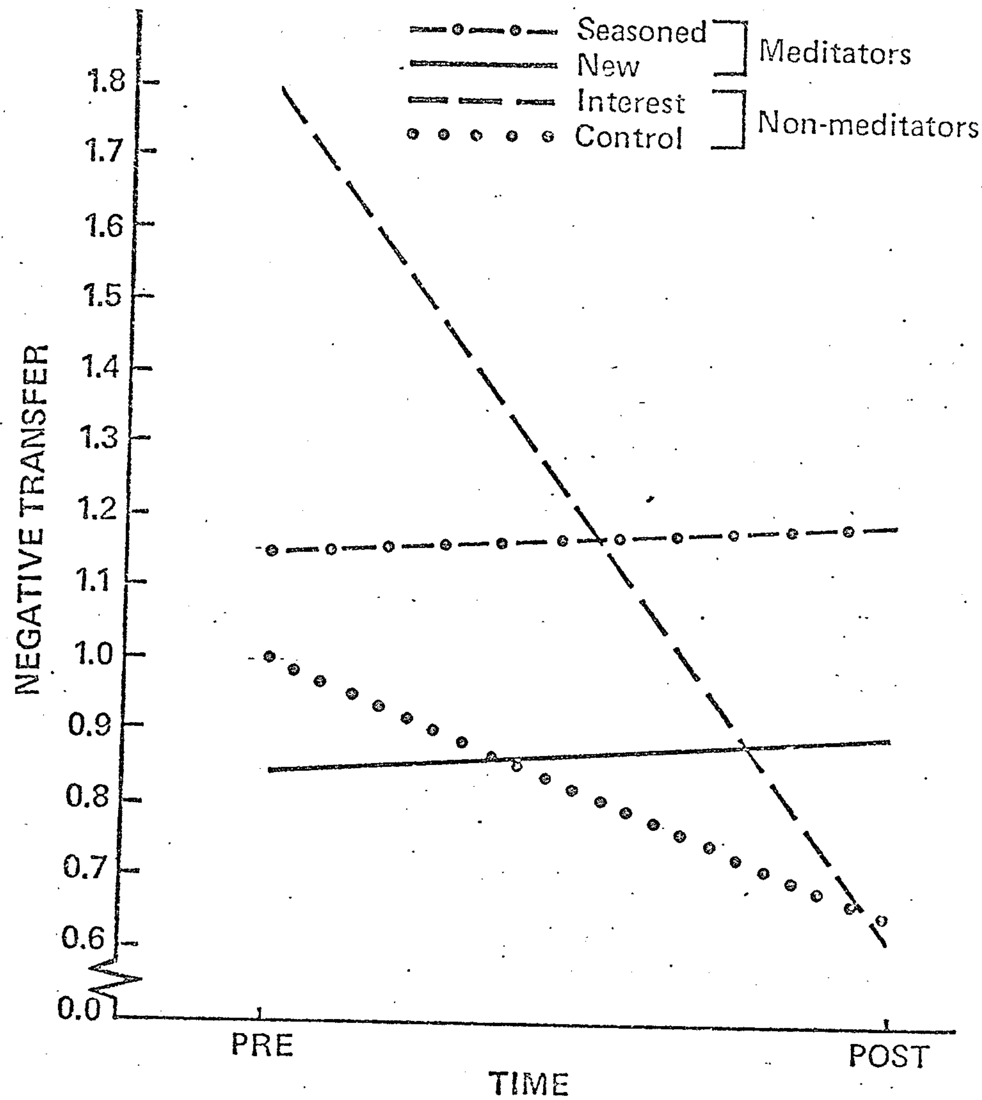

Figure 4: Trial 1 negative transfer of each experimental group as a function of time in relation to a meditation or relaxation session.

history groups, summed over the time condition. Consequently, five levels of adjusted deviations were correlated with each of two levels of negative transfer, for three independent groups. The resulting 30 correlations, tabled in Appendix F, yielded only one significant result at the .01 level: adjusted deviations (91-100) with Trial 1 for the interest group (r=.64). Due to the elevated probability of significance among such a large number of correlation tests, significance below the .01 level was not considered. It was concluded that the two tasks were not redundant, i.e., they were each measuring a different kind of behaviour.

CHAPTER IV

Discussion

To recapitulate, the purpose of the present investigation was to study deautomatization, as defined by Deikman (1966), in relation to meditation. Two tasks were constructed in order to test the following hypotheses. First, it was expected that meditators would be less "set-bound" than non-meditators, and would therefore perform better on tasks that required the participants to abandon their response sets. Secondly, it was predicted that this capacity would be more developed in seasoned meditators than in relatively new meditators. These hypotheses were examined within the context of two different areas: verbal learning and mathematical judgments.

Study 1: Numerical Estimation Task

Main predictions: meditation and length of meditation experience. The mathematical task required subjects to repeatedly estimate the mean of a population of numbers. In the process of being presented with the first 50 numbers while repeatedly estimating their mean, subjects became quite consistent in their estimations, indicating that they had developed a response set about the value of this parameter. This consistency was, of course, essential to the use of the task, since a set had to be developed in order to measure the extent to which it interfered with accurate estimation after the change in task stimuli. It was hypothesized that meditators, under the deautomatizating influence of their regular meditation practice, would experience less interference from their sets, and would thus attain greater accuracy in their estimations. The results did not support this hypothesis. Nor did they confirm the prediction that seasoned meditators would demonstrate the influence of deautomatization more strongly than new meditators. In fact, the two meditation groups performed equally well. The most important implication of these unexpected results is that meditation (particularly Transcendental Meditation) does not bring about a deautomatization of the tendency to respond to familiar stimuli on the basis of established sets. This opposes previously cited studies which supported deautomatization theory, and suggests a need to reexamine the evidence in the light of the present study. Such a reconsideration also involves the verbal learning task results, and is therefore carried out as part of the integrated discussion found below.

Secondary prediction: pre- post-meditation. The present study also set out to examine the short-term, "acute" effects of meditation on task performance by randomly assigning all subjects to either a "pre" or a "post" condition. The "post" subjects came to the experimental room earlier, and either meditated or relaxed with eyes closed for 20 minutes immediately prior to task participation. The "pre" subjects, on the other hand, participated in the tasks without prior relaxation or meditation. As can be observed in Figure 2, page 38, both control groups performed more accurately in the post or relaxed condition than in the pre condition while the meditation groups both performed more accurately in the pre condition. However, this observable meditation-control by pre-post interaction was not statistically significant. It has been conclusively demonstrated that meditation is physiologically relaxing (Akishige, 1968; Anand et al., 1961a; Banquet, 1973; Blackwell et al., 1975; Pagano et al., 1976; Wallace, 1970; Woolfolk, 1975), thus one would expect that an immediately preceding meditation experience would affect performance in a similar manner to an immediately preceding relaxation experience. That this did not happen may result from an important difference between the relaxers and meditators: meditators deliberately "relax" every day, twice a day: the relaxers do not. Consequently, the effects of relaxation are more likely to have stabilized in the meditation subjects, such that there would not be appreciable acute effects.

However, if this were the total explanation, one would expect no change or perhaps a small increase in the accuracy of the post meditation subjects over their pre-meditation counterparts. The reversed findings indicate that meditation practice, though relaxing, is something more, or other than simple relaxation. It has been suggested that transcendental meditation evokes a unique state of consciousness quite different from the various waking and sleeping states that have been previously identified (Goleman, 1971; Wallace, 1971). Different states of consciousness tend to facilitate and impair performance on different tasks (Tart, 1975b), and although this is more obvious in dramatically different states such as our ordinary waking state compared with stage four sleep, it is also true of transcendental meditation as opposed to normal waking (Apelle & Oswald, 1974; Deikman, 1966; Goleman & Schwartz, 1976; Orme-Johnson, 1973; Pelletier, 1974; Van Nuys, 1973). In retrospect, it is quite possible that meditation, as a unique state of consciousness, is not optimal for the kind of cognitive processes involved in the numerical estimation task, and thus resulted in a decrement in the performance of the post meditation subjects. This possibility will be discussed more thoroughly in the integrated discussion below.

Limitations of the task. The fact that all subjects responded more accurately as they received more information (cf., p.37) indicates that they understood the instructions and were responding appropriately, i.e., responding as they would in any normal learning situation. This was also the case during the pilot sessions when various number populations were tried out and the instructions refined. However, closer observations of the subjects' performances yielded some interesting information. The actual accumulative mean, after the 50th number, rose very slowly from the base-mean of 9.0, until it eventually reached 10.5 by the 100th number. Subjects in all groups, noticing the rise in number values, tended to over-estimate the effects of this immediate rise on the overall population mean, and so make overly large jumps in their estimations. The more accurate subjects, then, were those who maintained enough perspective on the first 50 numbers to very slowly raise the value of their estimates. As a result of this quirk of numbers, the task may have focused less on subjects' ability to abandon their response set, and more on their ability not to over-react to the change in number values. Furthermore, any subjects who were unable to abandon their previously established sets would stay close to the mean of the first 50 numbers and hence appear accurate when in fact they were rigid. This problem is extremely difficult to eliminate because any attempt to widen the gap between the two sets of 50 numbers, while accelerating the rise in the actual accumulative mean, also makes the change in task materials too obvious.

Another problem experienced with this task was the necessity of rejecting the data of the many subjects who were unable to master its complexity. This high rejection rate was not only discouraging to the experimenter, it increased the likelihood that some confounding variable such as intelligence, educational background, or mathematical ability was influencing the results.

Further investigation to determine the significance of these perceived limitations would need to be carried out before this procedure could be used again.

Study 2: Verbal Learning Task

Main predictions: meditation and length of meditation experience. In keeping with the overall hypothesis that meditation results in a deautomatization of the tendency to respond to familiar stimuli on the basis of learned sets, it was predicted that meditators, especially seasoned meditators, would experience less negative transfer than non-meditators in the paired-associate task. This did not happen. In fact, the negative transfer results of the most relevant trial (list 2, trial 1; cf., p.51) were not even in the predicted direction, and there was no significant difference among the various experimental groups.

There was no indication that the task itself, including the word lists chosen, was at fault. The final choice of word lists, exposure times, instructions and number of transfer trials were based on their effectiveness during previous pilot sessions. Also, subjects' performance implied that they understood the instructions and their significant improvement over the four transfer trials indicated that the task was working properly. The unexpected findings support the conclusions reached in the numerical estimation task; namely, that neither meditation practice nor the length of meditation history had any measurable deautomatizating effect on the previously established sets. Furthermore, the fact that subjects' performance in the two tasks were not correlated indicates that deautomatization theory was not supported on two independent measures. An integration of these findings with the meditation literature in general is presented in the integrated discussion below.

Secondary prediction: pre- post-meditation. As in Study 1, all subjects were randomly assigned to participate in the experimental task either immediately before (pre) or after (post) a meditation or relaxation session. The graphed results of this pre-post condition (cf., p.51) were remarkably similar to those in Study 1. There was a non-significant but observable meditation-control by pre-post interaction such that both control groups performed "better" (experienced less negative transfer) in the relaxed than in the pre condition, while the meditation groups were not affected by the time factor. This finding lends an independent though inconclusive source of support for the idea that the acute or immediate effects of meditation and relaxation are not the same.

Limitations of the task. A major difficulty with this task was its probable lack of statistical power. Negative transfer, the difference between each subject's recall of the control (C) pairs from his recall of the experimental (E) pairs, is itself a "difference" transformation on the second list data. There were five control and five experimental pairs per list, and subjects tended to present a negative transfer (C-E) effect of one or two on their first transfer trial. While such a transfer effect is highly significant, it does not allow much opportunity for significant differences among the C-E results of the various experimental groups. In other words, the problem lies in the fact that the final analysis was a difference among differences. This difficulty could be lessened by doubling list length so that subjects would be presented with ten control and ten experimental pairs. In this manner the C-E values would likely be amplified, and the possibility of significant between group differences increased. This option was not used in the present study because the minimization of inter-subject variation was essential and this is increasingly difficult to achieve as list length is increased. Another way to alleviate this problem is to employ a separate group of subjects as the D-E control group rather than having each subject serve as his own control. This design was not used because it would have entailed doubling the number of subjects and this was not possible given the limited number of volunteers available.

A second limitation of this task was the failure to experimentally control the degree of first list learning and thereby ensure that it was not a confounding factor. Research examining the relationship between degree of first list learning and negative transfer has produced some conflicting results (Spence & Schulz, 1965). However, those studies employing a D-E group to control for non-specific transfer, have found slight decrements in negative transfer as a function of increased first list learning (Jung, 1962; Postman, 1962; Spence & Schulz, 1965). Traditionally, paired-associate tasks are administered individually in order to experimentally control the degree of first list learning. This was not feasible in the present study due to time limitations. However, the highly non-significant differences among the experimental groups indicates that there was no systematic bias in degree of first list learning and decreases the likelihood that this variable played a confounding role.

Integrated Discussion

Limitations of the study. Aside from the previously discussed limitations of the specific tasks, there were a few problems with the study as a whole.

The scarcity of large numbers of subjects resulted in inadequate control of sex, age, educational background, and intelligence (verbal and numerical ability). It is quite probable that numerical ability and experience with numbers affected performance on the numerical estimation task. Similarly, there is some evidence (Sommerkamp, 1973) that highly intelligent people (as measured by the WAIS) overcome negative transfer more quickly than average and low intelligence people. This may have been a confounding factor in the second study.

Perhaps of more importance, however, was the fact that the quality of subjects' meditation was an unknown factor. Brown (Brown, Stewart, & Blodgett, 1971) included an EEG criterion of meditation and the results of his experiment were quite different depending on whether or not this criterion was met.

Demand characteristics. Finally, there always exists a potential danger of experimenter bias in studies where the individual administering the tasks is aware of the research hypotheses. In both of the present studies, the author served as her own experimental administrator, thus conceivably influencing subject performance in some way. While no special precautions were taken to guard against this possibility, a re-examination of the experimental procedure suggests that this effect was unlikely to have been important. First, instructions were tape-recorded for presentation to subjects, thus largely eliminating possible variation among orally presented information. Secondly, subjects belonging to the various groups were tested simultaneously and the experimenter would have had to differentially affect the groups present. Thirdly, the experimenter did not know who belonged to the various history groups, thus further reducing the likelihood of contamination. She was aware of which subjects were in the pre and post groups because they entered the testing situation at different times; however, there were no hypotheses regarding this factor. In summary, it would seem improbable that the experimenter was able to bias the subjects.

Re-assessment. Previous evidence discussed in the introduction suggested that meditation results in a reinvestment of awareness into perceptions and activities which had become automatic. The failure of the present research to support this contention indicated a need to reconsider the evidence in the light of this work. The nature of the two experimental tasks, viewed within the framework of the modes of human functioning, presents a possible solution.

The idea that there are two general modes of functioning (a receptive, non-verbal, a-rational, visuospatial mode; and an active, verbal, rational, symbolic one) was discussed at length in the introduction (cf. pp.4-7). Also, it was argued that meditation, as a non-verbal, a-logical, perceptual activity, clearly belongs to the receptive mode (cf. pp.7-14). If we accept the presented evidence and consider meditation a receptive mode function, we can employ this framework to predict the differential effect of meditation on various human behaviours.

According to the laws of transfer, that which is practiced and learned during a particular activity is more readily transferred to those activities which most closely resemble it (Hilgard & Bower, 1956).

Similarly, one would predict that that which is practiced during meditation (including deautomatization) would be most readily transferred to other receptive mode activities since they most closely resemble the meditation experience.

Furthermore, Tart's (1975) theory of state induction and maintenance would postulate that skills learned during meditation would not only be less transferable, but would be actively rejected during activities which require an active mode of organization. On the basis of many years of productive research and writing on states of consciousness, Tart has developed a paradigm or systems approach to make sense of the mass of data in this field. He suggests that any given state of consciousness is stabilized by such processes as: heavily loading the person's system with appropriate tasks; correcting one's functioning when it deviates too far from normality as defined by that state; rewarding activities within this normal range; and restricting the range of functioning of structures whose intense operation would destabilize the system. During active mode activities, then, a person's system would reject meditation-like structures in order to maintain the integrity and stability of the active mode. In many situations this sort of maintenance at the cost of rejecting "foreign" processes is important to human survival. For example, when driving a car through a complex traffic system, it is not preferable to suddenly experience a deautomatization of the structures which allow us to interpret and organize the stimuli around us!

It is not surprising, in the light of the foregoing discussion, that all of the evidence for deautomatization has come from research on receptive mode activities. Deikman's (1963, 1966) reports of deautomatization during and after experimental meditation involved a change in his subjects' ability to visually perceive their environment. The previously mentioned reports on dehabituation (Anand et al., 1961a; Kasamatsu & Hirai, 1966) and a similar report in regard to T.M. (Bloomfield, Cain, Jaffe, & Kory, 1975, p.89) involved deautomatization at a perceptual level. Tart (1971), reporting on his own personal experience with T.M., noted a newfound ability to "be aware of my environment, my bodily sensations, and so forth, without automatically and involuntarily thinking about them, which is my normal state" (p.139). The effect was felt at the level of receptive awareness. Curtin (1973), interested in adaptive regression, found that subjects trained in T.M. became significantly more open to inner and outer experience than a randomly assigned control group. This finding was in accord with Maupin's (1965) and Lesh's (1970) results on Zen meditation. The general conclusion was that meditation enhanced the ability to perceive other secondary, cognitive processes. Again the effect was demonstrated in a receptive perceptual area. Grim (1975) reported a personal experience of deautomatization while trying to maintain a visual image. The activity was a perceptual one. Davidson, Goleman and Schwartz (1976), using the Tellegen Absorption Scale, observed a significant enhancement in the ability to "just attend" as a function of length of meditation history. All of the above reports involved receptive mode activities. None of them involved activities which required critical analytical thinking.

The line of reasoning that has been put forward in this discussion is that if meditation is practice in deautomatizating the structures which normally organize and interpret experience, it would be expected to have such a deautomatizating effect on receptive mode activities.

However, given the laws of transfer and Tart's maintenance model, it is unlikely that the deautomatization effect would occur in situations which demand "higher-order" or "secondary process" thinking, i.e., situations which induce the active mode of functioning. The tasks utilized in the present study were both of this nature. The verbal learning task was a fast-moving, verbal,expressive, memorization task while the numerical estimation task required subjects to rapidly perform an abstract mathematical operation on a series of numbers. The choice of these active mode activities as a testing ground for deautomatization theory may well explain the unexpected results.

A reconsideration of the meditation literature in light of the present study has thus resulted in a new, more specific hypothesis. It is suggested that meditation, as an exercise in investing attention in percepts while deliberately removing it from "higher-order" thought, should result in deautomatization provided that the ongoing activity involves receptive, appositional rather than active, propositional functions. This new statement gives rise to numerous research possibilities, some of which will be suggested in the following section.

Research suggestions. It would be interesting to investigate the same independent variables (meditation experience and pre-post meditation), using the 2 x 4 factorial design, but measuring performance on both active and receptive mode tasks. One would expect that deautomatization would increase as a function of meditation experience on the receptive mode tasks but that the null hypothesis would be supported on the active mode tasks.

Another possibility would be to vary meditation technique (T.M., Zen, Yoga, etc.), and again, test everyone on both active and receptive mode tasks. The hypothesis would be that meditators, regardless of technique, would demonstrate deautomatization on receptive but not on active mode tasks.

In order to carry out either of these projects, activities which primarily tap receptive mode functions would have to be devised. Some promising and interesting areas include:

1) Perception of self. Deautomatization of the structures which normally select and limit available input regarding oneself, would inhibit both positive and negative distortions of one's self-image. It is feasible to predict, then, that meditation would result in a more realistic self-concept.

2) Perception of others. In the same manner, a deautomatization of the structures which normally cause us to perceive others on the basis of established sets would result in a less biased perception of other people. One could therefore predict that a) meditation would decrease prejudices for and against other cultures and b) it would enhance the ability to perceive familiar individuals in a fresh manner rather than on the basis of formulated assumptions.

3) Perception of objects. Bruner and Postman (1949) found that subjects perceived incongruous playing cards as though they were actual playing cards. For example, people would mistake a black ace of hearts for an ace of spades or an ace of hearts. The set or expectation was so strong, that they were convinced they were seeing red while observing a black card. If meditation has a deautomatizing effect, then meditators should be more accurate in the perception of such "trick" objects.

Similarly, in the context of Asch's (1955) norm-fixation study, meditators should be less easily swayed from their perceptions by experimenter-confederates.

4) Ambiguous stimuli. Leeper (1935) found that subjects who were trained to perceive one of the two figures in a reversible figure, tended to see only that possibility when later presented with the ambiguous picture. They seemed "locked-in" on that view of the stimulus. Deautomatization theory would predict that meditation would increase the likelihood of perceiving both figures despite past training.

Studies investigating the differential effect of meditation on active and passive mode activities could significantly refine our understanding of the area and thereby eliminate some of the false hopes and fears of prospective meditators. At present, various meditation groups make use of the published research to justify their claims that meditation benefits every aspect of human functioning. Similarly, people who are anti-meditation use the literature to prove that meditation dangerously inhibits one's ability to function in a normal manner. The results of the present study suggest that meditation is neither a cure for all ills nor a potentially dangerous source of insanity; rather, it is a natural phenomenon with differential effects, depending on the information provided by the environment.

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Appendix A

Summary of Demographic Data

Table 12

Demographic Data

	Group	Mean Age	S.D. Age	f Males	f Females
STUDY I	Controls (Pre-Med.)	19.	1.1	10	8
	Controls (Post-Med.)	19.1	1.6	8	10
	Total	19.	1.4	18	18
	Interest (Pre)	26.	7.9	2	8
	Interest (Post)	24.2	3.8	6	4
	Total	25.1	5.9	8	12
	New Meds. (Pre)	24.3	4.9	7	5
	New Meds. (Post)	32.4	13.6	9	1
	Total	28.	9.6	16	6
	Seasoned (Pre)	31.1	18.7	7	2
	Seasoned (Post)	28.9	13.	9	3
	Total	28.9	15.3	16	5
STUDY 2	Controls (Pre)	18.9	1.0	7	9
	Controls (Post)	19.1	1.3	6	8
	Total	19.0	1.2	13	17
	Interest (Pre)	26.5	8.8	4	6
	Interest (Post	23.4	4.1	7	4
	Total	25.0	6.6	11	10
	New Meds. (Pre)	23.8	4.4	6	7
	New Meds. (Post)	32.1	12.7	8	3
	Total	27.6	9.	14	10
	Seasoned (Pre)	34.6	16.7	7	5
	Seasoned (Post)	30.9	16.5	7	3
	Total	32.9	16.2	14	8

Appendix B

Transcript of Recorded Instructions

INSTRUCTIONS

With your help, I am conducting an exploratory study of meditation. Tonight, I will be asking you to participate in two different tasks - one involving work with numbers and another involving work with words. After we have finished working on the tasks, I would be happy to explain the purpose of the research being carried out.

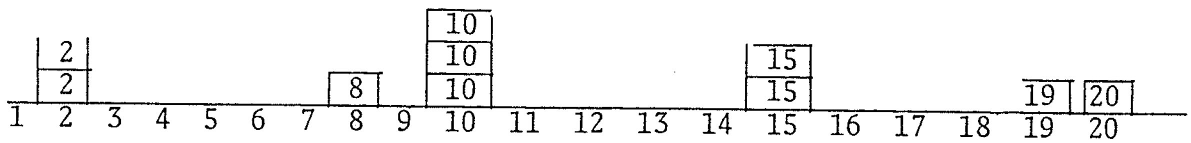
Please listen carefully to the instructions and ask about anything that is not completely clear to you before we begin the task. Your questions will help clarify the instructions for everyone, and it is very important that you all understand what I am asking you to do.

We will begin with the number task.

Imagine a group of numbers such as those on the board: 2, 2, 8, 10, 10, 10, 15, 15, 19, and 20. This group of ten numbers has what we call a mean-average, which is some number that is the average of all these numbers. The mean-average is found by adding together all the numbers and dividing this sum by the number of members in the group. In this example, 2 + 2 + 8 + 10 + 10 + 10 + 15 + 15 + 19 + 20 = 111. Now we divide this sum, 111, by ten (because there are ten members in the group) and come up with a mean-average of 11.1.

We all use mean-average frequently in everyday living. When we want to know how much money we are spending per week on food on the average - we add up each week's food spendings and divide this sum by the appropriate number of weeks - when we want to know how many cigarettes we are smoking a day, we add up the number of cigarettes smoked each day for perhaps seven days, and divide this sum by seven. So the mean-average of a group of numbers is not a new concept to you.

Another way to understand the mean average is to think of it as the balance point or centre of gravity of a teeter-totter. To illustrate, let us take our group of numbers and place them along a board as in this diagram:



Each number is now a block on the teeter-totter. All the blocks weigh the same and are exactly alike except for their positions on the teeter-totter. The point at which a support placed under the board would result in a state of balance is the mean-average value of these numbers. If the support were placed to the right of position 11.1, the teeter-totter would weigh down on the left side - if it were placed to the left of 11.1, it would weigh down on the right side. But when it is placed at the mean-average position, the board is perfectly balanced.

Keep in mind that the mean average is not necessarily the most frequent number in the group. In our sample group, the most frequent number is ten, but that is not the mean-average. In fact, in this case, the mean-average of 11.1 is not a number of the group at all. Do you understand what I mean by average? . . . . . . I have here a sample group of ten numbers. The lowest number is one and the highest number is nine. Therefore, the mean-average of this group of numbers must be between one and nine. I will present the numbers to you - one at a time - and would like you to guess or estimate the mean-average of the total group each time I present another number. In other words, each time I present <u>one</u> of the numbers of this group of ten, I would like you to write down your guess or estimate of the mean-average of this total group. The group has only one mean-average and this is what you are estimating each time. Keep in mind that the mean-average is not necessarily a whole number, so feel free to estimate in decimals. . . . . . . Now that you all understand the instructions and have tried them out on a sample group of numbers, we will begin the experimental task. I would like you to do the same thing, i.e., estimate the mean-average of a group of numbers, but this time I have a group of 100 numbers that range from five to 15, so you will be estimating the mean-average of this group 100 times. Please feel free to use decimals (for example 7.6) as well as whole numbers, because the mean-average is not necessarily a whole number.

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These are the instructions for the word task. Again, please listen carefully and ask about anything that is not completely clear to you. The learning material consists of ten pairs of nouns like this one: (demonstration). Your task is to learn the ten pairs of nouns, such that when I show you only the first noun in the pair, (demonstration), you can write down the noun that should go with it.

The procedure is a simple one: First we will go through a <u>study trial</u> in which I will show you the ten pairs, one pair at a time, for a short period of time - something like this: (demonstration). Study the pairs silently as they are presented. Study each pair rather than trying to concentrate on a few. That is the study trial. After the study trial, we will have a <u>writing trial</u> in which I will present only the first noun of each pair - again for a short period of time - and you will try to write down the noun that goes with the word you can see. Try to remember and write down the correct noun before I present another. Each time I present the next noun-card, I will say "next" so that if you are writing, you will know to look up. When we have finished the writing trial, we will do a second study trial, then a second writing trial, etc. We will keep alternating study and writing trials.

A few things to keep in mind are:

First of all, on writing trials you have only a very short time to think of and write down the correct noun - so start writing as soon as I show you the card.

Secondly, on writing trials, if you think you know the noun but are not certain, it is okay to guess. Errors will not count against you.

Thirdly, if you find you cannot get many pairs during the first few writing trials, do not be discouraged. Most students find that learning to associate the correct word with the given word is more difficult than it appears to be. If for any reason you find that you are unable to follow the instructions after we have begun, let me know this at the end of the session. Once we begin, we cannot stop for any reason.

Okay, to review briefly! On study trials, I will present the ten noun pairs one at a time. Study them silently. On writing trials, I will present only the first noun of each noun pair and you will try to write the noun that goes with it. The study and response trials will alternate. . . . . . . (After completion of first list) . . . . . .

Okay, we are now going to go through a second list of paired nouns in the same way we went through this last list. Again, I will present the ten new noun pairs one at a time for you to silently study. Then I will present the first noun and you will try to write down the noun that goes with it in this new list.

Appendix C

Adjusted Deviations

Adjusted Deviations

9.0 = true base mean = mean of numbers 41 through 50.

A = actual accumulative mean. e.g., A51 = actual accumulative mean for the 51st number.

$\overline{X}$ base = the average of a subject's 41st through 50th estimates.

E = estimate. e.g., E100 = a subject's 100th estimate.

AD = adjusted deviations.

Each subject's data was transformed into 50 adjusted deviations according to the following formula:

$$AD = (E51 - \overline{X}\text{ base}) - (A51 - 9.0) \ldots (E100 - \overline{X}\text{ base}) - (A100 - 9.0)$$

Appendix D

Scheffe Test Summary Tables

Table 13

Summary Table of Results of Scheffe's Test

Comparing Levels of the Information Factor

Study I

	I1	I2	I3	I4	I5
I1	--	NS	*	*	*
I2	--	--	NS	NS	NS
I3	--	--	--	NS	NS
I4	--	--	--	--	NS
I5	--	--	--	--	--

*$p < .05$.

a) I = Information

NS = Not Significant

Table 14

Summary Table of Results of Scheffe's Test

Comparing Levels of the Trial Factor

Study II

	T1	T2	T3	T4
T1	--	*	*	*
T2	--	--	NS	NS
T3	--	--	--	NS
T4	--	--	--	--

*$p < .05$.

a) T = Trial

NS = Not Significant

Appendix E

Additional Analyses of Study I

Table 15

Additional Analyses of Study I

Analyses	Purpose
A) Adjusted deviation values (51-100) collapsed into five means, were entered into an ANOVA. Meditation (meds. vs. non-meds.) and time (pre vs. post) were the between group factors.	A) To test graphed interaction between time and meditation history.
B) Estimates 51-100, collapsed into five means, were treated to an ANOVA with meditation history and time (pre vs. post) as the between group factors.	B) To test whether the various groups differed in regard to their actual estimates.
C) Estimates 1-50, collapsed into five means, were placed in ANOVA. History and time were between group factors.	C) Same as B)
D) Absolute deviation values (1-50), collapsed into five means, were placed in ANOVA. History and time were the between group factors.	D) To test whether meditators perceived the true characteristics of the number population more quickly than non-meditators.

Appendix F

Inter-Task Correlations

Table 16

Correlations of Negative Transfer on Trials 1 and 2 with Adjusted Deviations of Information Levels 1 Through 5 for Interest-Controls

		I1	I2	I3	I4	I5
Trial 1:	(r)	.030	.223	.350	.455	.640
	(N)	18	18	18	18	18
	(p)	.907	.373	.154	.058	.004*
Trial 2:	(r)	.054	-.028	-.031	-.067	.027
	(N)	18	18	18	18	18
	(p)	.831	.911	.902	.793	.914

*p < .005.

Table 17

Correlations of Negative Transfer on Trials 1 and 2 with Adjusted Deviations of Information Levels 1 Through 5 for New Meditators

		I1	I2	I3	I4	I4
Trial 1:	(r)	-.375	-.434	-.518	-.475	-.394
	(N)	19	19	19	19	19
	(p)	.114	.064	.023*	.040*	.095
Trial 2:	(r)	-.234	-.508	-.526	-.502	-.355
	(N)	19	19	19	19	19
	(p)	.336	.026*	.021*	.029*	.136

*p <.05.

Table 18

Correlations of Negative Transfer on Trials 1 and 2 with Adjusted Deviations of Information Levels 1 Through 5 for Seasoned Meditators

		I1	I2	I3	I4	I5
Trial 1:	(r)	-.262	-.185	-.370	-.516	-.449
	(N)	17	17	17	17	17
	(p)	.309	.478	.145	.034*	.071
Trial 2:	(r)	.121	.354	-.097	-.231	-.189
	(N)	17	17	17	17	17
	(p)	.642	.164	.712	.373	.469

*$p < .05$.