THE EFFECTS OF TRANSCENDENTAL MEDITATION ON PERCEPTION OF AN INCONGRUITY

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ABSTRACT

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ON PERCEPTION OF AN INCONGRUITY

By

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The purpose of this study was to test the hypothesis that Transcendental Meditation practice facilitates perception which is more sensitive to color and features of a stimulus which are contrary to expectation and common conception. Two measures were used to test these hypotheses. One measure consisted of an auditory stimulus word which became louder relative to three masking words over nineteen trials. A second measure consisted of a normal playing card and an incongruent playing card in which the normal black or red color was reversed. Each card was tachistoscopically presented with exposure time increased over trials.

Sixty-one subjects were divided into three groups matched for age, sex and education. Each subject in these groups was tested on the auditory measure immediately prior to a twenty minute treatment condition and then tested on both the auditory and visual measures immediately following their treatment. One group (control group) consisted of subjects who attended an "introductory lecture" on transcendental meditation and said they planned to take the transcendental

meditation course and begin meditation practice in the near future. This group engaged in twenty minutes of light, presumably relaxing activity (i.e., reading of a light and popular health magazine or rest as they chose), between the pre and post testings. A second group consisted of beginning meditators (BTM_1) who had been practicing transcendental meditation for 4 1/2 to 7 weeks but had not meditated for at least five hours. Between pre and post testing, this group engaged in the same light activity as the control group. A third group consisted of beginning meditators (BTM_2) who also had been practicing transcendental meditation for 4 1/2 to 7 weeks but had not meditated for at least five hours. Unlike the other two groups, the BTM_2 group meditated for twenty minutes between the pre and post testing.

The results of the statistical analyses indicated the following: 1) no differences between groups on the auditory measure; 2) subjects who had been practicing meditation but had not meditated for at least five hours (BTM_1) performed significantly better on the visual measure than did subjects who had just meditated (BTM_2) and subjects who had never meditated (control group); 3) no differences between groups in sensitivity to color. Various explanations of the above results were discussed. Results on the visual measure supports the hypothesis that meditation experience over time (and not right after a meditation session) facilitates the ability to identify and perceive features of a stimulus which are contrary to expectation,

while a meditation session has the immediate effect of decreasing this ability. Nevertheless, in light of the results on the auditory measure this conclusion is tentative. The possibility that meditation practice affects auditory and visual systems differently and that the hypothesis may be valid for the visual but not for the auditory measure was discussed. Contrary to previous self-report and research literature meditation does not seem to increase sensitivity to color. Implications of these results in terms of past theories and research were discussed, as well as suggestions for future research. Lastly, this study suggests that contrary to much meditation theory and research the changes which occur during, immediately after, and hours after a meditation session may not lie on a simple continuum or progression from lesser to greater effect.

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By

Richard William Ince

A THESIS

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DEDICATION

To my parents

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Having concluded this thesis, one of the finer rewards has been the opportunity to take stock and reflect on the satisfaction of a job well done and contemplate eagerly the tasks ahead. During this reflection, I have become most aware of the important contributions that numerous individuals have made to this thesis. Because I have often found it difficult to ask for and receive help from others, this realization brings me special joy. Thus, it is with a genuine relish and gratefulness that I acknowledge those who have been important in helping me through this project.

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INTRODUCTION

Transcendental Meditation is only one of many forms of meditation. Despite this diversity of meditation techniques, the techniques seem to be similar when viewed in terms of operation, phenomenology, and outcome (Naranjo and Ornstein, 1971; Smith, 1973).

Overview of Meditation

In most schools of meditation the practitioner sits quietly in an area where external stimulation is minimal and focuses on a single object. This focus may be upon a thought, a constant sound (such as a waterfall), a word repeated internally, a visual object (such as a vase), an image, a phrase, a paradoxical riddle, a repetitive body process (such as breathing or heartbeat), or a voluntary physical movement constantly repeated, as evidenced by the whirling dervishes. The important point is that the object serves as a constant, single source of stimulation.

The practitioner is instructed to attend to the focal object without deliberately engaging in cognitive or affective activity. Nevertheless, thoughts, feelings, fantasies, internal and external stimulation inevitably distract the meditator's attention from the

focal object. Once attention drifts off the focal object, the meditator is instructed, in different ways depending upon the particular school of meditation, to re-establish focal attention upon the central stimulus.

Phenomenologically, meditators' experiences seem remarkably similar across schools. Meditation is usually described as an experience of relative stillness which occurs as the usual cognitive, affective, and daily activity diminish as a result of attention focusing on a single point of stimulation. However, the beginning meditator usually finds emotions, thought, fantasies, images, external stimulation and bodily sensation repeatedly distracting his attention from the focal object. At times, the distracting stimulus can be powerful and uncomfortable. Strong anxiety, anger, sexual desires, despair, joy and bodily sensations are some of the more powerful distractions documented (Maupin, 1965; Goleman, 1972). Often the beginning meditator's experience seems anything but still as his attention shifts repeatedly from the focal object to a series of changing stimuli, back to the focal object and so on. Nevertheless, he may be in a state of relative "stillness." Many theorists maintain that these discomforts or distractions were always present, but the meditator has been so busily engaged in incessant physical, cognitive and affective activity that he has never noticed them before.

Over time the meditator's experience becomes increasingly still and uninterruptedly focused upon the focal object. Advanced

and even some beginning meditators describe the experience of remaining alert while sinking into ever deeper levels of stillness until awareness of the focal object and even awareness of being conscious at all ceases. This state is often described as the experiencing of "the void," "nothingness," or in terms of Transcendental Meditation, "pure consciousness."

Physiological research supports advanced yoga meditators' claims that during meditation no stimulus other than the unchanging focal object enters consciousness. While meditating, advanced yoga meditators, unlike non-meditators, showed no reactivity to different experimentally induced stimuli as measured in terms of respiration rate, palmar skin conductance, heart rate and blocking of EEG/alpha activity (Anand, Chhina, and Singh, 1961).

In the preceding, the purpose has not been to deal with the varieties of meditation in depth but to give the reader a brief description of the essential aspects of meditation among many schools. In this approach, there is the danger that the differences between schools may be underemphasized. Thus, some qualifying remarks are necessary. First, as Smith (1973) and others have noted, some schools of meditation have the meditator focus upon the focal stimulus in a more consciously deliberate manner than do other schools. Secondly, some schools attach more importance to such meditation experiences as uninterrupted stillness, freedom from intruding stimuli, and particular visual or affective occurrences. Thirdly, some schools of meditation emphasize the importance of

adherence to a particular, often complex, belief system. Lastly, most schools of meditation instruct the meditator to focus his attention on a single source of stimulation while some, such as that of some Zen schools, involve just the opposite. Instead of having just one focal object, the advanced Zen meditator is instructed to attend to each external stimulus as each individually enters consciousness. Similar to other forms of meditation, the advanced Zen meditator focuses on a stimulus or set of stimuli in a constant, consistent, attentional manner. As in other forms of meditation, he experiences the immediate stimulus at hand with whole-hearted, single-pointed, uninterrupted attention.

Research has shown that advanced Zen meditators' alpha blocking response continues to respond to an experimentally induced stimulus, such as a clicking sound, over a high number of trials and does not habituate as it does with non-meditators (Kasamatsu, Hirai, and Izawa, 1962, 1965). In contrast to the earlier cited yoga meditators, the advanced Zen meditator will report having experienced a repetitive, monotonous external stimulus clearly while meditating as if he were hearing the stimulus for the first time each time it was presented.

Transcendental Meditation

Because it is simple and can be practiced in almost any setting, Transcendental Meditation (TM), its proponents maintain, is one of the easiest forms of meditation to learn and practice. The meditator is to sit comfortably with eyes closed for twenty minutes in the morning and again eight hours later. During the meditation period the meditator continually and silently repeats his "mantra" (a sanskrit word). The repetition of the mantra may take some conscious effort in the beginning but quickly becomes effortless and automatic. The meditator is to continue repeating it simply and effortlessly even if it changes in sound or volume. If such stimuli as thoughts, feelings, desires, bodily sensations or external stimuli enter consciousness and distract attention from the mantra the novice is instructed to regard these intrusions passively and effortlessly without concern, criticism, suppression or thought. The meditator merely lets them drift out of consciousness at which point he exerts absolutely no effort but "favors" the mantra and waits for the cycle of repetition to begin again. Experiences, thoughts, feelings, desires and sensations which may arise in addition to the mantra are to be regarded as meaningless and unimportant; they are only to be watched without attendant cognitive activity. As one TM teacher said, "Consider all thoughts and distractions as if they were meaningless words from some foreign language" (cited in Smith, 1973).

As the reader has probably guessed, effort exerted in any way is inimical to the meditation process. TM instructors reiterate that the worst thing one can do in meditation is to try to meditate. Meditation should always be effortless and easy even if it is not always comfortable.

The theory of TM says that in meditation there will be both periods of relative calmness free from distractions and periods of "roughness of awareness" in which one's attention is continuously distracted from the mantra. The meditator is to treat these distractions as described above. According to the theory of TM, no one kind of experience is more valuable than another, and that during these "rough" periods the meditator should behave in the same observant, effortless fashion. Although these periods do not feel tranquil, they are just as beneficial and important as the calm periods. In fact, this roughness is said to be symptomatic of "stress release" which is an integral phase of the meditation process.

The formal TM instructional period takes about eight hours spread over a five-day period. Before receiving instructions the initiate hears two ninety-minute introductory lectures which describe the technique and theory of meditation, the detrimental effects of drug usage on the meditative process, the ease of meditation, and the claimed healthful benefits of TM as evidenced by meditators' reports and scientific research.

A personal instructor teaches the beginning meditator how to meditate. This takes less than one hour. Over the next three days, the initiate meets with the TM instructors and his fellow initiates for two hours each day. During these periods, the instructor answers questions, elaborates the correct method of meditation, and encourages the initiates to share their meditation experiences with the group. During this sharing, the instructor continuously reassures the group that all meditation experiences are normal and uses these experiences to explain further the proper method of meditation. This often means re-emphasizing the importance of not trying to meditate and just attending to the stimuli without effort. Learning this attitude of effortless, simple attention seems to be most difficult for the beginner.#

Review of Meditation Research

What about the reported effects of meditation? Physiological research suggests that meditation induces a relaxed hypometabolic state. During meditation brain wave activity slows and prolonged alpha and sometimes theta and delta wave activity occurs (Banquet, 1972; Brown, Stewart, and Blodgett, 1971; Wallace, 1970; Wallace,

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#See Appendix A for more information concerning the initiation, instruction and implicit belief system communicated to initiates during the instructional lectures.

Benson and Wilson, 1971; Anand, Chhina and Singh, 1961;* Askishige, et al., 1962, 1963;* Kasamatsu, Hirai and Izawa, 1962, 1963;* Kambe and Sato, 1962*). This type of prolonged alpha activity has been associated with mental relaxation which is relatively undisturbed by thoughts and cognitive activity and is alert rather than drowsy (Kamiya, 1966; Wallace, Benson and Wilson, 1971). On the average, there is less oxygen consumption (Wallace, 1970; Wallace, Benson, and Wilson, 1971; Wallace and Benson, 1972) and carbon dioxide elimination (Anand, Chhina, and Singh, 1961*) during meditation than sleep (Wallace and Benson, 1972). Respiration during meditation is both shallower and half the rate found in wakeful resting. In fact, respiration rate falls as low as four breaths per minute with no compensatory overbreathing (Allison, 1970). On the average, heart rate decreases three to five beats per minute depending on the research study (Wallace, 1970; Wallace, Benson and Wilson, 1971; Wallace and Benson, 1972), and cardiac output decreases 25% compared to 20% during sleep (Allison, 1965, cited in Kanellakos, 1971; Wallace, 1972). At the same time, blood volume in the forearm may increase during meditation as much as 300% (Reichert, 1967), indicating that while the heart works less, more blood is delivered to the extremities with muscles and blood vessels more relaxed and less resistant to blood flow (Kanellakos, 1971). Indeed, meditators' spontaneous muscle activity was found to drop significantly (Koike and Yumaoke, 1963*)

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*This indicates that this research was done using non-TM meditation subjects.

and muscle tension was found to decrease more than in sleep (Askishige, et al., 1963;* Kambe and Sato, 1962*).

Another study showed that while transcendental meditators evidenced lower blood pressure than controls while resting prior to meditation, during meditation blood pressure did not decrease (Wallace, Benson, and Wilson, 1972). During meditation, skin resistance (GSR) dramatically increases anywhere from two to eight times its usual level depending upon the subject (Wenger, Bagchi, and Anand, 1961;* Wallace, Benson, and Wilson, 1971). In sleep, skin resistance only doubles. An increase in skin resistance has been inversely correlated with tension and emotionality.

Meditators' GSR's both in and out of meditation, habituate significantly more rapidly to an irregularly presented loud auditory stimulus than do non-meditators' GSR's, both in and out of closed-eyed rest (Orme-Johnson, 1971, 1972). Also, meditators emit fewer spontaneous GSR fluctuations both in and out of meditation than do non-meditators in or out of close-eyed rest. Such GSR results that meditators show while meditating have at times been associated with low anxiety, rapid habituation to stress, ego strength, low motor impulsivity, and greater autonomous stability which has been correlated with greater field independence which is associated with the ability to perceive quickly the essential characteristics of the environment (Orme-Johnson, 1971).

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*This indicates that this research was done using non-TM meditation subjects.

Blood lactate level decreases an average of 30% during meditation. This reduced level lasts at least for twenty minutes after the meditation period (Wallace, 1970; Wallace, Benson, Wilson, and Garrett, 1971; Wallace, Benson and Wilson, 1971). Preliminary research suggests that lactate level may positively correlate with anxiety level.

In summary, we may say a number of things about TM as a result of the physiological research. Meditation is correlated with numerous indicators of decreased anxiety and the meditative state is different from hypnosis, sleep, and ordinary rest with eyes closed (Wallace, Benson and Wilson, 1971). EEG brain wave patterns, the rapid reduction in oxygen consumption, carbon dioxide elimination, volume and rate of respiration, blood lactate level, the slight increase in blood acidity due to metabolic slowdown and rapid increase in skin resistance, the low level of spontaneous GSR fluctuations, and rapid GSR habituation to stimuli are some of the signs of decreased anxiety and are all greater or different kinds of changes from those that occur in sleep, hypnosis and ordinary rest. Furthermore, brain wave activity shows the mental state of meditation to be alert, relaxed, and devoid of attendant cognitive and thought activity.

Studies utilizing questionnaire measures suggest that meditation decreases anxiety and psychopathology. Otis (1972) found that regular practice of TM has beneficial effects in the treatment of anxiety neurosis, hypertension, and migraine headaches. Using various

questionnaire measures of anxiety and psychopathology, Fehr et al. (1972), Orme-Johnson et al. (1973), Hjelle (1972), Wallace and Benson (1971) and Shelley (1972) found experienced meditators to be less anxious than beginning meditators and non-meditators. In these studies, however, self selection and social desirability response set were left uncontrolled. Lack of control for self selection becomes especially troublesome in light of research which shows that individuals who choose to meditate and continue to practice meditation show greater tolerance for unrealistic experience and greater capacity for adaptive regression (Maupin, 1962) and score significantly higher on the Fitzgerald Experience Inquiry, a measure of adaptive regression in service of the ego, and Shostrom's Personal Orientation Inventory, a measure of self-actualization (Lesh, 1970).

Using the Cattell Anxiety Scale, Spielberger Anxiety Inventory and Northridge Developmental Scale in pre and post testing, Ferguson and Gowen (1973) found that after six and a half weeks of meditation, meditators, unlike controls, showed a significant decrease in anxiety and neuroticism. In a three month longitudinal study using a self report measure, Brautigam (1973) found that meditators, unlike controls, became less anxious ($p < .10$) and more emotionally stable ($p < .10$). Moreover, in pre and post ratings, three psychologists judged meditators' behavior to be less tense and restless ($p < .001$) after the three months of meditation. Using the Spielberger Anxiety Inventory, Ballou (1973) found that over the first ten weeks of meditation practice, anxiety drops significantly the

first week of practice and stays at, but does not change from, that reduced level with further practice. In pre and post testing Orme-Johnson (1973) found that prisoners who meditated at least half of the prescribed times decreased significantly more on spontaneous GSR, which is an indicator of decreased anxiety, than "irregular" meditators ($p < .0005$) or controls ($p < .05$). Unlike the other above longitudinal studies, Orme-Johnson used a physiological measure which is less susceptible to the confounding influence of social desirability response set.

Numerous TM studies show the meditative state to have effects on perceptual ability. Meditators show significantly faster reaction times by about 30% than non-meditators on a one-point reaction time measure. In addition, meditators' reaction times improved 12% after 20 minutes of meditation while non-meditators' reaction time slowed 10% after 20 minutes of rest (Shaw and Kolb, 1970).

In an unpublished manuscript, Graham (1971) found that after 20 minutes of meditation, meditators improved by 37% in auditory frequency discrimination and by 25% in auditory amplitude discrimination. The same thresholds decreased slightly for non-meditators after reading a book for 20 minutes.

Another study utilizing four perceptual measures--two point threshold determination of skin sensitivity, visual brightness discrimination, simple and complex, or four-choice, visual reaction time determination--showed no significant differences on any measure between meditators after 15 minutes of meditation and non-meditators

after 15 minutes of closed-eyed rest (Brown, et al., 1971). However, various biochemical and physiological measures of both meditators and non-meditators were taken during the 15 minute periods; only three of the eleven meditators had actually shown the physiological changes that operationally define meditation according to the physiological research. These three all had significantly improved on all four perceptual measures after meditation.

Pelletier (1972) found that after three months of meditation, meditators, unlike controls, significantly increased their perceptual scanning ability on the autokinetic effect and significantly improved their performance on the embedded figures test and rod and frame test. According to Pelletier, these changes indicate that meditators had become better able to focus attention upon a point of light in a dark field, which is indicative of improved ability to focus visual attention, and more field independent.

Lastly, Lesh (1970) found that after eight weeks practice of meditation, meditators improved significantly on the Affective Sensitivity Scale (an empathy measure in which the subject views video tapes of psychotherapy client-counselor interactions and chooses what the client is feeling). From this, Lesh concluded that meditation facilitates clear and accurate perception of another's feelings.

Traditional and Modern Views of Perception

Many esoteric philosophies that utilize meditation see ordinary awareness as a personal construction. The Sufi antidote "offer a donkey a salad and he will ask what kind of thistle it is" (Naranjo and Ornstein, 1971, p. 191) illustrates the notion of many meditation traditions, as in those of India, the Sufis and the Zen Buddists, that learned constructs or categories limit one's awareness. This view has been reiterated through history. Plato has stated it in his cave analogy which illustrates how man usually takes for reality only that which he is able to see and rejects all else as being illusionary. More recently, the philosopher Suzanne Langer (1951) has called ordinary perception "abstractive seeing." She means that one tends to "organize the sensory field into . . . patterns . . . to perceive forms rather than a flux of light impressions" (p. 72). Rather than experiencing and perceiving sense data, one habitually and unconsciously abstracts a form from each sensory experience and thus "conceives" or constructs the experience as a whole. In linguistics, Benjamin Whorf (1952) has impressively argued that the contents of human awareness is influenced by language. For example an Eskimo with many different words for that which is called snow in the Continental U.S. perceives "snow" differently than one raised in the Continental U.S. Aldous Huxley (1954) echoes the above theories from the Sufis through Whorf in the following passage:

> Every individual is at once the beneficiary and the victim of the linguistic tradition into which he has been born--the beneficiary in as much as language gives access to the accumulated records of other people's experience, the victim insofar as it confirms him in the belief that reduced awareness is the only awareness and as it bedevils his sense of reality so that he is all too apt to take his concepts for data, his words for actual things. That which in the language of religions is called "this world" is the universe of reduced awareness expressed, and, as it were, petrified by language (p. 23).

Some Modern Psychological Views of Perception--Theory and Research

The above cited views, from the Sufis through Huxley, have also been reiterated in modern psychology. There are many examples and much research showing how a person'a awareness is influenced and limited by his categories, or constructs, and past experience. The value and validity of projective techniques rests on the premise that needs, motivations, and past experience influence human perceptions. In his concept of transference, Sigmund Freud (1933) has illustrated that past experience with significant individuals influences one's experience and perception of others.

Adelbert Ames (1953) and the transactionalist theorists see unconscious inferences or presumptions built up from past experience as the basis of perception. Ittelson and Cantril (1954), two transactional theorists, state that "assumptions . . . which are brought to the present occasion . . . play a principle role in determining how the occasion is experienced" (p. 23). For example, in Ames'

famous distorted room experiment, subjects' ingrained, unconscious assumption based on past experience with usual (i.e., rectangular) rooms led them to see a person in one corner of the distorted room as considerably bigger and taller than a person of equal size in another corner. George Kelly (1955) based his psychological and clinical theories on the hypothesis that one's "personal constructs" and anticipations of events based on past experience influence one's experience and perceptions. In his view, no person ever reacts to a stimulus--he reacts to his conception of the stimulus. Schachtel (1966) speaks of ordinary perception as "cliche recognition." That is, one usually reacts to, experiences, and perceives one's environment in a routine, stereotyped manner. This has the effect of preventing one from experiencing aspects of his environment. Schachtel (1966) says: "Familiar objects remain unknown because their familiarity becomes an easy and convenient way of disposing of them . . . (through) labelling, categorizing or otherwise" (p. 46).

In this discussion of modern psychology's view as to the limited nature of human awareness, it is appropriate to focus on the work of Jerome Bruner and his associates. Bruner and his co-workers have done extensive research which seems to provide strong support for Bruner's theory that expectations shape human awareness.

Bruner (1957) maintains that perception involves acts of categorization. That is, "all perceptual experience is necessarily the end product of categorization processes" (p. 124). He says that if able to perceptually experience stimuli without a categorical

filter, the experience would be unorganized and difficult if not impossible to communicate.

Bruner says that in an attempt to make sense of the impinging mass of stimuli, one learns categories into which all input is sorted. Stimuli is seen in terms of properties of objects as they are conceived to be. In a sense, Bruner says that a person normally ceases to see the stimulus properties of the object and only responds to the category activated. Because of his conceptions and expectations based on past experience, one is set for a limited range of characteristics and events. These predispositions or hypotheses, as Bruner calls them, operate to select, organize and transform the stimulus input. These expectations continue to operate as long as they are confirmed by the outcome of events. Once categorized into a high probability, good fit category, the threshold for recognizing cues contrary to the category is markedly increased; openness to cues and recategorization is drastically reduced, and incongruous cues are normalized or gated out. The stronger the inappropriate expectation, which is partly a function of consistency of past confirmation, the greater the redundancy of stimulus presentation necessary for correct identification.

Evidence consistent with Bruner's theory can be found in physiological research. Spinelli and Pribram (1967) have provided evidence of a physiological mechanism that selectively tunes our awareness. They found that stimulation of different areas of the cortex alters the configuration of the receptive field. Furthermore,

they showed that the brain can rapidly alter the way stimuli are received on the retina. This study gives added support to other research which has shown that efferent (output) traits can suppress or alter information sent toward the brain. Thus, the central nervous system can select and turn on or off incoming sensory information in virtually all sensory modalities (Thompson, 1967; Isaacson, et al., 1965; Butter, 1968, 1969).

Bruner and his co-workers as well as others have produced a good deal of experimental support for his theories. In an experiment performed by Bruner and Postman (1949) and replicated by Lasko and Lindauer (1968), playing cards were tachistoscopically presented to subjects. Some of these cards were incongruent in that the normal black color of the spade or club was changed to red or the red color of the heart or diamond to black.

When presented in a mixed series the average identification threshold was 28 milliseconds for normal cards and 360 milliseconds for the incongruous cards. However, on the first encounter with an incongruous card the average recognition threshold was 420 milliseconds. Some subjects never correctly identified an incongruous card even when it was exposed for one thousand milliseconds.

In this experiment, Bruner attempted to show that a subject's expectation or set based on past experience biases his awareness. That is, perception is a process that occurs in a prepared, biased organism, and perception consists of the experience of an activated category and not of the input per se.

Haber (1965, 1966) and Harris (1969) among others have criticized Bruner's conclusions. They say that his results may have been the product of a response bias and not a perceptual effect. That is, expectancy and experience might just create biases in subjects to refrain from reporting an "impossible" card. Thus, Bruner's results may have nothing to do with perception.

However, the subjects' responses to the stimuli seem to indicate that a perceptual effect was operating. Many subjects evidenced what Bruner called a "compromise reaction." Often subjects reported a red six of spades as a purple six of hearts or a purple six of spades. A black four of hearts was sometimes reported as a "grayish" four of spades or hearts. A red six of clubs was often reported as a six of clubs "illuminated by red light." A response bias interpretation does not explain this effect. In his discussion of the response bias versus perceptual set debate Neisser (1967) concludes that resolution must rest on subjects' phenomenological report. Using this criterion, subjects' reports confirm the presence of a perceptual effect in the Bruner experiment.

Bruner, Postman and Walk (1951) conducted an experiment in which subjects were run under different conditions, each subject being used in one group only. For one group the stimulus was a card on which was printed seven capital letters in a row, with one letter reversed. In another condition, the stimulus had the word "PLASTER" printed on it but with one of its letters reversed. In this second condition, subjects were divided into three groups. For one group

the "P" was reversed; for another "S" was reversed; and for another "R" was reversed. In each of these four groups the stimulus was presented tachistoscopically at a subthreshold exposure. With each succeeding trial, exposure time was systematically increased until all elements of the stimulus were correctly reproduced. In each group the reversed letter was the last one correctly identified. In addition, analysis of responses preceding total correct identification showed that the identification of the reversed letter in PLASTER did not always result from an inference from a meaningful context, i.e., result from recognizing the word to be PLASTER and then correctly identifying the reversed letter from inference. For instance, the reversed letter in PLASTER was often incorrectly rectified in some interesting ways before it was correctly recognized. Thus the reversed P was sometimes reported as T, G, and Q; reversed A as D, E, B, R; and reversed R as E and A. The most striking evidence for the directive influence of a strong hypothesis or expectation comes from responses in which all the letters were reported as reversed. That is, once the hypothesis of reversal is aroused, it may generalize to the whole field, i.e., a subject guesses that all letters of the word are reversed. Similar experiments capitalizing on our past experience with and expectancies of color-object association (Bruner, Postman, and Rodrigues, 1951) the speed, extent, path and consistency of movement of various objects (Jones and Bruner, 1954), and experimentally induced experience with closure (Bruner and Postman, 1952) show similar results.

Bruner and Minturn (1955) showed how a perceiver's past experience as well as the nature of the situation in which the perceiver is operating biases his awareness. Two groups of subjects were shown a broken B stimulus (ꟾ) for short exposure in a tachistoscope. When the stimulus was presented to one group in a series between A and C, it was drawn and presumably seen as B. When it was presented to the other group between a 12 and 14 it was seen as 13.

Two experiments (Postman and Bruner, 1948; and Smock, C. D., 1965) have shown that anxiety or stress inhibit correct identification of an ambiguous stimulus. A visual stimulus object was presented either in an ambiguous stage of formation or at a subthreshold level and was made clearer or exposed longer over successive trials. Subjects under stress showed a tendency to strive for early closure by making premature often nonsensical hypotheses and, consequently, took significantly more time and trials to correctly identify the stimulus than did subjects under relaxed conditions.

From his experiments, Bruner (1964) concluded that although individuals differ in their ability to abandon a well-established, frequently confirmed hypothesis and to shift to a new one, all individuals show resistance in making this shift. The experiments of Galloway (1946), Wyatt and Campbell (1951), Bruner and Potter (1964) and Frederiksen (1967) illustrate this resistance. Their experiments show that initial misinterpretation of an ambiguous stimulus interferes with veridical perception. In their experiments a word was presented in blurred focus. On each trial the stimulus word was

made systematically less blurred, and each subject could guess the stimulus word. In each experiment two groups of subjects were run. In one group, subjects were exposed to the stimulus through fifteen trials, if necessary, in which the word was made clearer on each trial. The second group began their exposure at a later, more intermediate stage of focus. In each experiment, the group beginning at the later stage of focus correctly identified the stimulus word on a significantly earlier trial. In other words, those subjects who had been experimentally manipulated to hold an incorrect hypothesis over fewer trials were able to correctly identify the stimulus on an earlier trial. Using a masked auditory stimulus word in which the masking sound was reduced one decibel each trial, Frederiksen (1967, 1969) again illustrated this effect of early incorrect hypothesis perseveration so as to delay correct recognition. As before, the later starting group correctly identified the masked auditory stimulus at a significantly earlier trial. The degree of significance in differences between the early and late starting groups was greater in Frederiksen's experiment utilizing a masked stimulus than in Frederiksen's experiments utilizing a blurred visual stimulus.

In a massive factor analytic study in which he used subjects' performance in 27 cognitive-perceptual tests and performance on the above visual and auditory recognition tasks, Frederiksen (1967) found that the factor, "cognitive flexibility-rigidity," which he defined as the "capacity to overcome set," significantly correlated with

early identification of the masked stimulus on the auditory tests and the visual test when a wide range of ambiguity was covered.

The Perceptual Mode in Meditation

Meditation seems to be inimical to our habitual mode of perception. TM, as do other schools of meditation* speaks of moving the practitioner away from his habitual mode of perception. Mahareshi (1969), the expositor of TM, describes TM as bringing the individual closer to an aconceptual center from which he can experience the world without preconceived ideas and structures.

The aim of the meditative process is to suspend the ordinary flow of thought and cognitive activity while remaining in a state of receptive, nonreactive detached stillness as one observes one's mental activity. In the process, the percept receives thorough attention. The use of attention for abstract categorizing and thought is

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*In his review of meditation, Naranjo (1971) talks about the practice of meditation as an attempt "to detect and become free from all conditioning, compulsive functioning of mind and body, and habitual emotional reactions that may contaminate the utterly simple situation required by the participant" (p. 9). Ancient schools of meditation talk of seeking to remove the blindness of our usual perceptions, and meditators of all schools speak of a primary aftereffect of "an opening up of awareness," a fresh perception, seeing as a child, or seeing something the 500th time as it was seen the first. The Sufis in effect speak of being free of both the constructs by which we have learned to perceive and the selected, restricted nature of awareness. Zen speaks of meditation as directed toward "casting off the false mask of conceptualization," thereby enabling a different, more direct contact with experience (Maupin, 1963).

prohibited. This attitude, it would seem, facilitates the registering of sense impressions, feelings or mental activity "without reacting to them in action or thought by deed, speech, or mental comment" and enables the meditator to see without the masking of simplifying constructs. As Mahareshi (1969) explains, continuous, effortless focusing on the mantra enables the meditator to "transcend the experience of the subtlest state of the thought and arrives as the source of thought which is pure consciousness" (cited in Coleman, 1971, p. 2), i.e., consciousness without attendant thought activity.

The meditative attitude seems similar to that which Schachtel (1966) hypothesizes is necessary for perception which is more acute and vivid than our usual. This attitude involves "an openness instead of fixed, accustomed perspective, . . . (a) staying with (the object of perception) long enough to come to know it more fully for what it is rather than disposing of it in a familiar way by categorizing it" (p. 46). Thus, it seems reasonable to hypothesize that rather than experiencing an abstract category, a meditator perceives more freshly and clearly and with less bias the stimulus itself and more readily notices features that deviate from the usual. Furthermore, since meditation is a state of low anxiety it seems logical that a meditator would see these deviations quicker because he would have less anxiety to interfere with perception. Operationally, then, it seems that because meditators would be less anxious, set, biased by expectation and inflexible, they would both perceive an incongruity in a familiar stimulus sooner and perseverate

less over trials with an incorrect hypothesis; therefore they would correctly identify a masked stimulus sooner than non-meditators. Moreover, it seems that in the ability to perceive an incongruity and to discard a non-veridical perception meditators after, compared to before, twenty minutes of meditation will improve more than non-meditators after, compared to before, twenty minutes of low arousal voluntary activity. These ideas need to be tested.

Reports and Research Relevant to Perceptual Effects of Meditation

Meditators' phenomenological reports and current research support the above claims. After meditating, meditators often report that they experience a fresher and sharper perception as evidenced in more vivid color perception and greater awareness of beauty and details not previously noticed. The research of Kasamatsu and Hirai (1966) and Wallace (1970) support meditators' reports of clear awareness each time a stimulus is perceived during meditation, and yet the stimulus hardly disturbs them. Both researchers found that in the hypometabolic meditation state almost all meditators, unlike non-meditators, showed no habituation of the alpha blocking response to a repeated sound or light stimulus. The alpha blocking response is part of the orienting reaction. Other physiological correlates of the orienting reaction, however, such as increased spontaneous GSR fluctuation, respiration, and heart rate and decreased skin resistance

(GSR), did not occur along with the alpha blocking in response to the stimulus. Thus, meditators seem to continue to perceive a repeated stimulus without being aroused or disturbed by it.

This research led Tart (1969) to describe meditation as a state of "relaxed awakening with steady responsiveness." Similarly, it led Kasamatsu and Hirai (1966) to describe meditation as a "special state of consciousness in which the cortical excitatory level becomes lower than in ordinary wakefulness but is not lowered as in sleep, and yet outer and inner stimulus is precisely perceived with steady responsiveness" (p. 500). Kasamatsu and Hirai's contention is supported by their subjects' reports that they perceived each stimulus more clearly during meditation than during ordinary wakefulness. Subjects' reports led Kasamatsu and Hirai to describe the perceptual-cognitive mode during meditation as follows:

> . . . (the meditator) perceives the object, responds to it, and yet is never disturbed by it. Each stimulus is accepted as stimulus itself and is treated as such. One Zen master described such a state of mind as noticing every person one sees on the street but of not looking back with emotional curiosity (p. 499).

As mentioned before, an opening up of awareness traditionally has been a commonly reported and sought meditation effect. This non-habituation of the alpha blocking response may help explain meditators' claims of greater awareness and clarity of perception which may be the product of seeing a stimulus without expectation, set and categorizing activity.

Deikman (1963) has produced experimental evidence which is most relevant to and generally consistent with our two hypotheses.

In his research, Deikman (1963) documented that meditation alters perception. Deikman used subjects between the ages of 30 and 40 who were relatively naive in the theory and practice of meditation. He taught four subjects a form of meditation similar to TM in which a vase served as a visual focal object. He had these experimental subjects meditate together for 15 to 30 minutes over 12 sessions. After each session, he had subjects fill out a questionnaire concerning their affect during meditation, perception of the vase, awareness of experimentally-induced background stimuli and perception of the landscape outside. Deikman also used a control group which sat under circumstances similar to the experimental subjects but did not meditate.

Reactions common to his four experimental subjects were (a) perceptual changes relating to the vase (such as changes in vase size and shape, blurring and dissolving of outlines and movements, and increased color, "vividness," "luminosity," and brightness of the vase while all else in the visual field became dark and indistinct), (b) time shortening, (c) difficulty in describing meditation experiences in words, (d) development of stimulus barriers to experimentally induced stimuli, (e) development of personal attachment to the vase, and (f) a feeling that meditation sessions were pleasurable despite occasional anxiety during meditation. Perceptual phenomena which were reported by at least one of the four subjects were

(a) merging with and perceptual internalization of the vase, (b) radiation of particles from the vase which sometimes led to heat or sexual stimulation, and (c) de-differentiation of the landscape such that all the stimuli of the landscape appeared at equal intensity and equally called for attention making it difficult to focus selectively and to organize the visual field into meaningful patterns and normal figure-ground relationships.

Deikman explains these results by hypothesizing that meditation serves to "deautomatize" those psychological structures that organize, limit, select and interpret perceptual stimuli. Hartman (1958) advanced the concept of automatization as follows:

> In well-established achievements they (motor apparatises) function automatically: the integration of the somatic systems involved in the action is automatized, and so is the integration of the individual mental acts involved in it. With increasing exercise of the action its intermediate steps disappear from consciousness . . . not only motor behavior but perception and thinking, too show automatization . . . .
>
> It is obvious that automatization may have economic advantages, in saving attention cathexis in particular and simple cathexis of consciousness in general . . . . Here as in most adaptive processes, we have a purposive provision for the average expectable range of tasks (pp. 88-91).

Gill and Brennan (1959) explain deautomatization as follows:

> Deautomatization is an undoing of the automatizations--both means and goal structures--directed toward the environment. Deautomatization is, as it were, a shake-up which can be followed by an advance or retreat in the level of organization . . . . Some manipulation of the attention directed toward the functioning of an apparatus is necessary if it is to be deautomatized (p. 178).

Thus, we may say that with repeated performance or perception of some set of stimuli, automatization operates so that consciousness of

"intermediate steps" and details disappear from consciousness. In Deikman's view, deautomatization is an undoing of automatization by "reinvesting actions and perceptions with attention" (1966, p. 33). Meditation with its emphasis on focused attention, not thinking and attentive receptivity seems to involve such "manipulation of attention." In contrast to our usual thinking activity that carries us into abstractions and fantasies, the meditative attitude keeps one in close contact with the here and now required to produce at least partial deautomatization. In Deikman's view, this means that cognition is inhibited in favor of perception. While automatization involves the transfer of attention from a percept of action to abstract thought activity or to total unawareness of a percept or action, deautomatization and meditation involve a shift of attention toward perceptual, cognitive and motor experience preceding the analytic, abstract, intellectual mode typical of adult thought.

As Deikman says, a developmental concept is implied. In discussing perceptual development and particularly eidetic imagery in children, Werner (1957) states that developmentally the image:

> . . . gradually changed in functional character. It becomes essentially subject to the exigencies of abstract thought. Once the image changes in function and becomes an instrument in reflective thought its structure also changes. It is only through such structural changes that the image can serve as an instrument of abstract mental activity. This is why of necessity the sensuousness and fullness of detail, color, and vividness of the image must fade (p. 152).

Von Senden's study of the visual experiences of congenitally blind persons after surgery supports the concept of "selective

automatization" and loss of vividness and detail resulting from formal organization and automatization as perceptual learning occurs.

Following Deikman's lead, we may say that as we develop a process occurs in which stimuli and percepts are functionally organized toward a higher level of differentiation at the expense of vividness and variability of perceived sensory stimuli which are characteristic of earlier stages of development. If, as it seems, "developed" perceptual and cognitive organization necessitate increasing selectivity of stimuli, then deautomatization, through meditation, might lead us to an awareness of stimuli that were formerly unavailable to us.

In support, the visual experiences of Deikman's meditation subjects seem to "represent a shift of the normal perceptual processes to aspects of the stimulus array previously screened out--or it may be that these percepts are registered through the operation of new perceptual processes" (Deikman, 1966, p. 113). Moreover, from meditators' reports it seems that meditation allows regression to a primitive cognitive state postulated for the infant in which distinctions between thoughts, actions and objects are relatively blurred. Body immobilization, lack of analytic thought, both relatively little and relatively stable stimulus input (i.e., the vase) are all factors which might facilitate perceptual and cognitive disorganization (to experience this yourself: sit down and repeat a word 100 times to yourself).

In Deikman's research, meditation seemed to produce shifts toward a "primitive" perceptual and cognitive organization preceding the analytic, abstract, intellectual mode typical of adult thought. However, this regression is not back to childhood but seems to represent an adult mind experiencing the world from a different view. As Deikman (1966) says, "rather than speaking of a return to childhood, it is more accurate to say that the undoing of automatic perceptual and cognitive structures permits a gain in sensory intensity and richness at the expense of abstract categorization and differentiation" (p. 34).

In summary, we may say that the perceptual and cognitive organization and automatization functions to select some stimuli qualities to the exclusion of others. When automatization is reversed or suspended, stimuli formerly not noticed might enter consciousness. In Deikman's (1963) words:

> Deautomatization is here conceived as permitting the adult to attain a new, fresh perception of the world by freeing him from a stereotyped organization built up over years and by allowing adult synthetic and associative functions access to fresh materials to create with them in a new way (p. 217).

Meditation, in which non-analytic attention is diverted from its usual channels and restricted to a monotonous focus, may enable the individual to function without "automatic" perception, automatic affective or cognitive structures or controls and enable him to perceive stimuli differently and anew. Indeed, Deikman's experimental evidence consistently supports this contention.

Because meditation seems to unstructure or deautomatize our developed perceptual processes, we may hypothesize that after meditation a meditator will experience more vividness and details in his perceptions, will be more sensitive to and aware of color, and will more readily perceive a stimulus as it is.

STATEMENT OF HYPOTHESES

The purpose of this study is to test the assertion that meditation practice facilitates unbiased perception. The following hypotheses were tested:

Hypothesis 1: Identification of a masked auditory stimulus made clearer over trials will occur earlier for subjects who practice meditation than for subjects who do not.

Hypothesis 2: Identification of a masked auditory stimulus made clearer over trials will occur earlier for subjects who have meditated immediately prior to testing than for subjects who have not meditated for at least five hours or for subjects who do not practice meditation.

Hypothesis 3: Identification of an incongruity in a familiar visual stimulus will occur earlier for subjects who practice meditation than for subjects who do not.

Hypothesis 4: Identification of an incongruity in a familiar visual stimulus will occur earlier for subjects who have meditated immediately prior to testing than for subjects who have not meditated for at least five hours or for subjects who do not practice meditation.

From the above discussion of Deikman's study, it seems reasonable to speculate that meditation increases sensitivity to color as opposed to form. Thus, the following two hypotheses were also tested.

Hypothesis 5: Sensitivity to color as opposed to form will be greater for subjects who practice meditation than for subjects who do not.

Hypothesis 6: Sensitivity to color as opposed to form will be greater for subjects who have meditated immediately prior to testing than for subjects who have not meditated for at least five hours or for subjects who do not practice meditation.

METHOD

The Visual Recognition of Incongruity Task

The visual recognition of incongruity task was modeled after Bruner's test. The MSU Graphics Department produced the normal and trick, or incongruent, playing cards by Diazo process. Eight normal cards (8H, AH, 7S, 3S, 3C, 2C, 6D, 2D) and four trick cards (4H(B), 4S(R), 5H(B), 5S(R)) were prepared. Each card was mounted on a thin piece of black cardboard. Trick cards had the normal red or black color reversed. Because the tachistoscope's window was smaller than the usual playing card size, the playing cards used measured 2 1/8" by 1 1/2". Nevertheless, the normal playing card length to width proportions remained the same. When seen in the tachistoscope the reduced size did not appear incongruent to E and no S ever commented on its size during the experiment.

For any S only one normal and one trick card was used. Each card was presented for three trials at each exposure level until correct recognition occurred on three successive trials. Exposure levels were 10ms., 30 ms., 50 ms., 75 ms., 100 ms., 150 ms., 200 ms., 250 ms., 300 ms., 350 ms., 400 ms., 450 ms., 500 ms., 600 ms., 700 ms., 800 ms., 900 ms., and 1000 ms.

The Recognition of a Masked Auditory Stimulus Task

The recognition of a masked auditory stimulus task was modeled after Frederiksen's test (1967). The five single, poly-syllabic words which were used as items to be recognized were words that had an above average number of prerecognition responses among the 84 words Blake and Vanderplas (1950) investigated and had high correlations with Ss' cognitive flexibility scores in Frederiksen's study (1967).

The masking noise consisted of four voices speaking the masking words and stimulus word simultaneously. The masking was accomplished in the following manner. A master tape was prepared using a four track Sony tape recorder and a Wollansak tape recorder. A 45" tape loop was constructed so that the loop would make one revolution every six seconds through the play back or recording device of the four track recorder. In this way the stimulus word could be recorded on one track and a masking word(s) could be recorded at the same spot on the loop on the other three tracks. Thus, one tape loop had four voices speaking a different word or words (sometimes two short words were used as a masking sound on one or two tracks) at the same time. This procedure was done on a different 45" loop for each of the five sets of masked stimulus words. To ensure that the stimulus word was totally masked by each of the masking words, each masking word(s) began no later and ended no

earlier than the stimulus word. The masking word(s) were randomly selected from a research article.

After the five tape loops were made, each loop was played back on the four track recorder and recorded on the Wollansak recorder. Each loop was allowed to make 19 revolutions. In this way each masked stimulus (i.e., stimulus and three masking word(s) all spoken at the same time) was recorded 19 times with a five second pause between each repetition; the final tape contained five masked stimulus words, each word repeated 19 times with a five second interval between trials.

The same speaker was used to record the entire tape. The speaker attempted to say masking and stimulus words at equal volume. A Sony six channel stereo mic mixer was also used in an attempt to equalize the volume of stimulus words relative to each of their masking words. The E used both the mixer's sound level indicator and his own ear to adjust the volume of each stimulus word relative to its masking words such that the masking and stimulus words were of approximately equal loudness and the stimulus word could not be easily discerned. A Hewlett-Packard attenuator capable of one decibel attenuation levels was used to attenuate the volume of the masking voices.

To get maximum information from the experiment, it was necessary that each of the five masked stimulus words be neither too difficult nor too easy to identify. If too easy or too difficult there might be so little variability in performance that any differences

between Ss might not appear. To prevent this, approximately forty non-meditator, college population practice Ss were run in an attempt to find attenuator rates and volume mixes of stimulus and masking words which would enable the practice Ss to identify each stimulus word between trials 10 and 13 (on the average).

In the experiment all five series of masked stimulus words were presented to each Ss. The S listened to them through a set of Superex stereo headphones. The sound he heard passed from the recorder through the attenuator through the mixer through a Scott stereo amplifier and into the headphones. A random numbers table was used to determine the order of masked stimulus word presentation. The first selected masked word was used as a sample.

Subjects

Sixty one subjects matched on age, sex, and educational level and ranging in ages from 18 to 24 participated in this experiment. All Ss were volunteers, were paid for approximately one hour's participation and were recruited through local TM instructional lectures. The Ss were divided into three groups. The first group (pre-TM) consisted of Ss who were to begin TM instruction within two weeks. Both the second and third groups consisted of beginning meditators (BTM_1 and BTM_2) who had been regularly meditating for 4 1/2 to 7 weeks. Although sixty-one Ss were run in the experiment, for various reasons some Ss could not be used. Equipment malfunction, lack of sufficient

playing card experience, which became apparent during the experiment, or an uncorrected visual or auditory infirmity that was previously overlooked were some of the reasons for the reduced N in the final samples. Thus, the final samples consisted of fifty-six subjects on the auditory measure and fifty-two subjects on the visual measure. In the color sensitivity sample, there were no score for two subjects because they did not give a scorable dominance response.

Recruitment of Subjects

Pre-TM Ss were recruited after the first TM introductory lecture from among those who intended to begin TM. The E announced the following: "Research on TM is being conducted at Michigan State University. We are interested in learning about the perceptual abilities of people who meditate and who choose to meditate. We think that people who choose to meditate may already have special abilities even before they begin meditating. In order to verify this, we need people to participate in our experiment who are planning to begin TM but have not yet begun. The experiment will take about 45 minutes and each of you who participate will be paid $1.75 for your time. If you would like to participate you can make an appointment for any hour morning, noon or evening over the next two weeks. Besides earning some money, I think that you will find the experiment both interesting and fun. To make your appointment, either see me after this meeting or fill out one of these forms and a

researcher will call you in the next couple of days to make an appointment at a convenient time for you."

If there were any questions about what the experiment was about, E said: "I'd rather not tell you more about the experiment now because it might inadvertently bias your performance. After you participate, I will be glad to answer all your questions."

BTM Ss were selected as follows. After the second introductory lecture, E announced the following to those who had chosen to begin TM: "We are doing research at Michigan State University on the perceptual effects of TM. To do this research we need volunteers to participate in the research. Each volunteer will be paid $1.75, and the testing will take about 55 minutes. If you are interested in volunteering for pay, I would like you to fill out one of these sheets that I will pass around. A researcher will call you in about five weeks and an appointment for any hour morning, afternoon or evening at your convenience can be arranged. Filling out your sheet and saying that you are interested in participating puts you under no obligation to participate; you can say no if you wish when the researcher calls. Besides earning some money, I think you will find the experiment both interesting and fun."

If Ss had questions concerning the purpose of the experiment these questions were handled as described above concerning the pre-TM group except that the BTM group was told that the researchers were interested in learning about some perceptual effects of TM.

At the time appointments were made with either pre-TM or BTM Ss, E asked each S the following. He asked S to bring glasses or contact lens with him if he wore them. Secondly, to ensure Ss familiarity with playing cards, E asked S if he had ever played cards regularly during some time in his life or played cards regularly now. If S answered anything but a firm yes, he was asked about his experience with playing cards; he was asked how many card games he knew how to play. If he said two or more he was used. Thirdly, E asked S if he had heard about the procedures of this experiment from another person. If S had heard any information which might bias his performance he was not used. In addition, E asked BTM Ss two other questions. To ensure that all BTM Ss were regular meditators, E asked S how many of the 14 recommended sessions per week he missed last week. If S had missed more than three sessions the last week or missed more than three sessions most weeks, S was not used. In making an appointment, E asked each BTM S to make sure that he had not meditated for at least 5 hours before his appointment.

BTM Ss were recruited from lectures of courses beginning 10/12/73, 10/26/73 and 11/30/73. The two groups of BTM Ss were matched for age, sex and educational experience. Pre-TM Ss were recruited from initial introductory lectures (which take place two weeks before the beginning of the course) which were given 11/29/73 and 1/9/74.

Experimental Procedure
and Instruction

There was a sign on the testing room door asking S to wait in a designated waiting room if he arrived early. The experiment was done in a room approximately 12' by 15'. A two channel Dodge tachistoscope and Scott stereo amplifier was on one table and a Sony six channel stereo mic mixer, a Hewlett-Packard attenuator and Wollansak tape recorder were on an adjacent table.

The E met S outside the testing room and asked him to enter and have a designated seat. Before beginning the testing E asked each S who wore glasses if he had them with him. The E also asked each S if he had heard about this experiment's procedure from another participant. No S said he had heard about the experiment's procedures. In addition, E asked each BTM S the last time he had meditated. If it was within the last 4 1/2 hours S was not used. Lastly, E asked each S not to discuss this experiment with anyone over the next few weeks.

The auditory measure was presented to each S twice; for BTM_1 and pre-TM groups, two masked stimulus words were presented before 20 minutes of rest, light reading or daydreaming (whichever S preferred) and for the BTM_2 group, two masked stimulus words were presented before 20 minutes of meditation. For all groups, the last two masked stimulus words were presented after the 20 minute periods. The visual measure was used only after the 20 minute periods. Thus, two test presentation orders were possible: 1) auditory test -

(treatment) - auditory test - visual test, or 2) auditory test - (treatment) - visual test - auditory test. Each order was used as close to an equal number of times as possible within each group. For the auditory part of the experiment, E sat in front of a table supporting the attenuator and sound mixer. On a table to E's left was the amplifier and on a chair to his right was the tape recorder. The S sat about three feet directly behind E. The Ss was given a pen, a score sheet on which he wrote his responses and a 1/2" thick 16" by 24" piece of cardboard which served as a convenient surface on which to write.

The E said the following instructions to S: "You are going to hear a tape through these earphones. On this tape you will hear four voices speaking at the same time. Each voice will be saying a single word or two words. The voices will repeat themselves nineteen times saying the same thing each time. There will be a five second pause between each time the voices repeat themselves. One thing will change over the nineteen presentations. As we go along, one voice saying one word--and it will be the same voice saying the same word each time--will become louder and clearer relative to the other voices. I want you to try to identify the word that is becoming relatively louder and clearer. Since the voices begin at approximately equal loudness, in the beginning it will probably be difficult to hear which word is loudest or clearest. Nevertheless, on each trial I want to encourage you to guess or wild guess about what that louder word is. If you think you hear a word in the very beginning,

mark it down. A guess cannot hurt, it can only help. The point is for you to identify the word which is becoming louder any way you can--even if it is by wild guessing. If you really are not able to make any guess, then mark a check on your answer sheet. If your guess is the same as on the previous trial, you may mark a ditto mark ("). In any event, be sure to mark something on your answer sheet each time the voices speak so that by the time the voices have repeated themselves nineteen times, you will have marked something after each of the numbers 1 through 19 on your answer sheet. Let's begin by trying a sample. Notice that there are three columns on your answer sheet. For the sample, write down something each time you hear the voices in the column marked SAMPLE (E points to column). Remember, write down a guess, a check or ditto mark each time you hear the voices just as if these were an actual word in our experiment. Also remember, I want to encourage you to make guesses but a check is alright too. Ready? The E then ran the sample. After completion of the sample E said: "How did it go? The word was _____(E tells S the correct stimulus word). Do you have any questions? Now let's do the same thing for two more words."

Following the completion of the auditory pre-test E said the following to pre-TM and BTM_1 groups: "Before doing the second part of the experiment I would like to take a 20 minute break. During this time feel free to relax, rest, daydream or read a magazine (E pointed to two copies of Today's Health which is a popular, non-technical magazine). However, there are four things I would like to

ask you not to do. Please do not leave the room, do not do any physical exercise, do not meditate and do not look at any papers on these shelves because they might contain some information concerning the experiment and might therefore bias your performance. I will be back in about 20 minutes at the end of the break."

Following the completion of the auditory pre-test E said the following to the BTM_2 group: "Before doing the second part of our experiment, I would like you to meditate for 20 minutes. I would like you to begin meditating as soon as I leave the room. How long do you usually take to come out of meditation?" The S would say anywhere from one to three minutes. The E continued: "In 20 minutes I will knock lightly on the door; before coming in I will wait 2 minutes (or E said 2 1/2 to 3 minutes depending on how long S said he usually took to come out of meditation) so that you may come out of meditation and open your eyes undisturbed and at your leisure. Are there any questions?"

Depending on which test order was being used, after the break E said either that he would like to test S again on the word recognition problem, handed S a score sheet and ran through two more masked stimulus word series or read the instructions for the visual exercise. When the word recognition test was used again, E said: "I would like you to try to identify two more words on the tape just as you did before. Ready?" When the playing card experiment was used, E read the following instructions: "I would like you to sit here." The E pointed to seat in front of the tachistoscope so that S could see

clearly the blank illuminated screen on which the stimulus was to be presented. The E continued: "This is an experiment in visual information processing. If you put your head here, you will be able to see an illuminated screen in front of you. A playing card will be flashed on the screen only when you press this button. Please do not press the button until I say 'ready.' Then feel free to press it at your convenience. The card will flash onto the screen once the moment you press the button. I would also like you to keep your eyes focused on the dot in the middle of the screen before pressing the button each time. Do you see the dot?"

"As you probably know, there are three major identifying characteristics of playing cards--suit, color and number. I will be presenting the playing cards one at a time at varying exposure durations. Some presentations will be rapid, and the card will probably appear blurred. Sometimes the presentations will be more lengthy, and the card will be more clear. Sometimes the presentations will be so fast that you will only be able to see one or two of the three identifying characteristics. That is alright. Just tell me exactly how you see the card in terms of the three identifying characteristics. For instance, a card may be presented so quickly that you may only see its color or maybe its suit or number. In these cases tell me only its color or suit or only its number if that was only what you saw. To keep responses uniform, I want you to tell me what you see as best you can in terms of all three identifying characteristics--

suit, color and number. Also, some cards may be presented only a few times; some may be presented many times in succession."

This part of our experiment is asking you to do the opposite of the auditory part. In the auditory part you were encouraged to guess about the word. In this part I want you only to tell me what you actually see or think you see and not to guess. Do you have any questions?"

The E continued: "For this part of the experiment, I am going to turn off the overhead lights and turn on a small light in the corner of the room." The E turned on the small tensor light beneath the table supporting the tachistoscope and turned off the overhead lights. The E sat opposite S behind the tachistoscope. From this position E was easily able to place cards in the tachistoscope, manipulate exposure durations and record S responses without S seeing.

Scoring Procedures

For each test the stimulus identification point was defined as the first trial on which S correctly identified the stimulus without returning to an incorrect hypothesis on a later trial. The trial number on which this occurred constituted S's score for that test. If S did not identify the card or word in the allotted trials, he was given a score one higher than the allotted number of trials for that item (55 on the playing card measure and 20 on the auditory measure). On the word recognition test, S's pre-test and post-test

scores were the sum of the two pre-scores and the sum of the two post-scores. On the playing card test, each S was scored in two ways. One score was simply the score, or trial of identification, for the incongruent card. In addition, each S was classified evidencing color or form dominance or sensitivity. As Bruner and Postman (1949) noted, when tachistoscopically presented with an incongruent playing card, Ss' responses prior to correct identification are either color or form dominant; that is, S denies either the form or the color of the card's suit and either the color dominates and the form is "corrected" to match the color or the form dominates and the color is "corrected" to match the form. By looking at each S's first response which included both form and color each S could be classified as color dominant (i.e., sensitive) or form dominant.

RESULTS

Hypotheses 1 and 2

Pre and post treatment scores for each subject on the auditory task were the dependent variables relevant to Hypotheses 1 and 2. To compensate for the fact that each of the five sets of masked stimulus words were of different difficulty, scores were converted to Z-scores. A 3 x 2 analysis of variance with repeated measures was used to compare groups' pre and post treatment scores.

Hypothesis 1 states that subjects who practice meditation (BTM_1 and BTM_2) will perform significantly better on the auditory pre-test, which measures ability to identify a masked stimulus made clearer over trials, than subjects who do not practice meditation (pre-TM controls). Operationally, Hypothesis 2 states that subjects who have meditated immediately prior to post-testing (BTM_2) will show the greatest improvement from pre to post-testing.

If these hypotheses are valid, results should have yielded: a) a significant group main effect (with pre-TM controls' performance < BTM_1's performance = BTM_2's performance); b) a significant pre-post main effect (overall pre-treatment performance < overall post-treatment performance); and c) a significant interaction effect (in the pre-testing, controls' performance < BTM_1's performance = BTM_2's

performance while in the post-testing controls' performance < BTM_1's performance < BTM_2's performance).

Table 1 shows that neither the main effects nor the interaction effect are significant; thus, neither Hypothesis 1 nor 2 is supported.[1]

Table 1.--Analysis of Variance of Performance on the Auditory Measure: Group by Treatment.

Source	SS	df	MS	F	P
Group (A)	.87	2	.43	.22	.81
Subject within	105.61	53	1.99		
Pre-post (B)	.26	1	.26	.11	.74
AB	5.40	2	2.70	1.17	.32
B x subject within	122.81	53	2.32		

While comparisons of the pre-treatment scores in Table 2 indicates that performances tended to be in the direction predicted by Hypothesis 1, comparisons of the difference (post minus pre-treatment) scores indicate that performances tended to be in the opposite direction predicted by Hypothesis 2.

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[1]Winer (1962) suggests that even if the overall F test is insignificant, specific comparisons which are suggested by the experiment's theoretical basis can be made individually. Thus, appropriate tests were performed, but no significant differences were found.

Table 2.--Sample Sizes, Means and Standard Deviations for Each Group on Pre and Post Treatment Tests on the Auditory Measure.

Groups	Pre-treatment	Post-treatment	Difference between post & pre scores
Pre-TM Control Group (rest treatment)	$N = 21$ $\bar{X} = .25$ SD = 1.77	$N = 21$ $\bar{X} = -.46$ SD = 1.42	-.72 (p = ns)*
BTM_1 (rest treatment)	$N = 17$ $\bar{X} = -.06$ SD = 1.39	$N = 17$ $\bar{X} = .17$ SD = 1.20	+.23 (p = ns)
BTM_2 (meditation treatment)	$N = 18$ $\bar{X} = .00$ SD = 1.53	$N = 18$ $\bar{X} = .20$ SD = 1.27	+.20 (p = ns)

*Positive scores are inversely correlated with ability on this measure.

Hypotheses 3 and 4

Each subject's post-treatment score on the visual task was the dependent variable relevant to Hypotheses 3 and 4. A one-way analysis of variance yielded a significant difference between the three groups ($F = 4.83$; $MS = 1138.61$; $df = 2/48$; $p < .02$). Table 3 shows the mean and standard deviation for scores in each of the three groups.

Table 3.--Sample Sizes, Means and Standard Deviations for Each Group on Post Treatment Tests on the Visual Measure.

Group	Post Treatment
Pre-TM Control Group	$\underline{N}$ = 19 $\overline{X}$ = 25.21 SD = 18.33
BTM_1 (rest treatment)	$\underline{N}$ = 16 $\overline{X}$ = 11.19 SD = 5.08
BTM_2 (rest treatment)	$\underline{N}$ = 17 $\overline{X}$ = 26 SD = 18.06

A Newman-Keuls analysis was used to clarify the significant differences between groups. This analysis showed that the BTM_1 group did significantly better than the pre-TM control group ($\underline{q}$ = 3.74; $\underline{df}$ = 2/48; $\underline{p} < .05$) and thus confirmed Hypothesis 3 that subjects who practice meditation will be able to identify an incongruity in a familiar stimulus sooner than subjects who do not practice meditation.[2]

Contrary to Hypothesis 4, subjects who meditated immediately prior to testing (BTM_2) were not able to identify an incongruity in

[2]On the visual measure, unlike the auditory measure, there was no pre-treatment testing; thus, the BTM_2 subjects, who had just meditated prior to testing on the visual instrument, were not included in the sample consisting of "subjects who practice meditation" which was designed to examine the longitudinal effects of meditation practice.

a familiar visual stimulus sooner than either the pre-TM control subjects (q = .21; df = 2/48; p = n.s.) or BTM_1 subjects. In fact, directly opposite to prediction, the BTM_1 group did significantly better than the BTM_2 group on the task (q = 3.96, df = 3/48; $p < .05$).

Hypotheses 5 and 6

The type of error, whether of a color or form dominant type, that a subject first made prior to correct identification of the incongruent card in the post-treatment testing was the dependent variable relevant to Hypotheses 5 and 6. A chi-square analysis was used to determine if the groups differed significantly in their color to form ratio.

Table 4 shows no differences in ratios between the three groups (X^2 = 1.45; df = 2; p = n.s.). Thus neither Hypothesis 5, which states that subjects who practice meditation (BTM_1) will be relatively more sensitive to color as opposed to form than subjects who do not practice meditation (controls) nor Hypothesis 6, which states that BTM_2 subjects will be relatively more sensitive to color as opposed to form than either BTM_1 subjects or controls, was confirmed.

Table 4.--A Comparison of the Number of Color Dominant and Form Dominant Responses in Each of the Three Groups on the Visual Measure.

Group	Color Dominant	Form Dominant
Pre-TM Control Group	6	12
BTM_1	8	8
BTM_2	5	11

Supplementary Analyses

In an attempt to clarify results on the auditory task, the results for each group were graphed. Inspection of the graphs shows that there was a high within group variance in each group and that there is no consistent pattern of results in any of the three groups.

It was thought that perhaps some pattern on the auditory task might emerge if word order presentation was inspected. Perhaps particular word order presentations consistently produced good or poor performances. Due to a preponderance of particular word orders in a particular group, a group's performance may have been inordinately helped or retarded. Scores for each word order and the sum of scores in the pre and post testing for each S of the pre-TM control group were examined; no word order, however, was found to be particularly helpful or detrimental to performance.

The results of the visual task suggested that meditation experience facilitates visual perception of an incongruity while the immediate short-term effects of a meditation session inhibits this ability. It was thought that perhaps the effect of a meditation session serves to disorganize cognitive-perceptual functioning. If this were true, BTM_1 Ss would have identified normal cards sooner than BTM_2 Ss. Although the BTM_1 group had lower thresholds as predicted, a t-test showed that the difference was not significant ($t = 1.68$, $df = 28$, $p = .15$).

It was also thought that if the short-term effects of a meditation session are disorganizing to cognitive-perceptual functioning, perhaps BTM_2 Ss who were tested on the visual measure immediately (3 to 5 minutes) after a meditation session would perform more poorly than Ss who were tested on the visual measure after the auditory measure and approximately 8 to 10 minutes after their meditation session. A t-test was run comparing normal card thresholds for BTM_2 Ss who were tested immediately after their meditation session and BTM_2 Ss who were tested 8 to 10 minutes after their meditation session. A second t-test compared these groups on trick card thresholds. No significant differences were found.

DISCUSSION

Overview

A task of this discussion must be to answer why five of the six hypotheses were not supported, why one particular hypothesis was supported, and lastly, what these results mean in terms of the major hypothesis that meditation practice facilitates perception which is unbiased by constructs and expectations.

There are several possibilities as to why five of six hypotheses were not supported while one was:

1. The measures were insensitive or inappropriate.
2. A weak experimental design inappropriately permitted the confirmation of the supported hypothesis.
3. The meditators were not experienced enough to evidence the hypothesized effects.
4. Since most of the non-meditators were tested at a different time in the year than most of the meditators, the meditation groups cannot be legitimately compared with the control group.
5. The basic assumptions underlying the hypotheses and much of the literature from which they were derived are in error.

Measures

There is some question as to the appropriateness of the auditory measure. Within each group the variance was so high that any real differences between groups would be minimized and possibly not discovered.

The validity of the visual instrument as a measure of visual perception must also be examined. In this and other studies (Bruner and Postman, 1949; Lasko and Lindauer, 1966) the existence of "compromise responses" and subjects' self-reports suggest that this instrument is at least in part measuring a perceptual effect.

Some subjects, however, reported a response bias effect; that is, they said that they had seen and were aware of the incongruity but had consciously decided not to report it at least for a few trials. Other subjects reported that although they had come to see the incongruity, they had not become aware that their perception of the card had changed, and they did not think to change their response to match what had become a new perception. Thus, they perseverated with their incorrect response. From their reports, it seems that these subjects had perceptually "corrected" the incongruity as expected and then came to perceive the card as it actually was, incongruity and all, but had not become aware of the change, and the new, accurate perception was not reported when first seen.

Another possible problem in the visual measure was that the red of the playing cards was slightly darker than the red of normal playing cards. A few subjects commented on this after the experiment,

and one subject, after incorrectly perseverating with a "black spade" response to a red spade card, continued to say that the red spade looked more like a black spade when he was handed the card and continued to look at it at his leisure. This problem, however, does not seem to be serious. Only two subjects commented on the discrepancy of the red color from the red of normal playing cards.

Weakness of Experimental Design

The experimental design used in this study did not permit as strong a test of the hypotheses as one might normally like. Although the three groups were matched on age, sex, and educational experience, there may be other relevant variables on which these groups were not matched and which influenced groups differently. If true, the significant result may have been an artifact of differences between groups which were independent of meditation practice effects.

A repeated measures design or longitudinal study would have controlled for this possibility. However, due to severe and unpredictable practice effects on the visual measure, a repeated measures design or longitudinal study would not have been appropriate.

A second weakness in the experimental design was that almost one-half of the pre-TM control subjects did not begin the TM course which two weeks earlier they had said they intended to begin. Most of these subjects said that while they intended to take the course

at a later date, they lacked the financial means or were too busy to begin the course now. Only two pre-TM control subjects said they were no longer interested in beginning the course. As mentioned before, Maupin (1962) and Lesh (1971) found that people who choose to begin meditation and stay with it show greater tolerance for unrealistic experience, greater capacity for adaptive regression and score higher on the POI, a measure of self-actualization. To the extent that the control group was actually less inclined toward meditation than the meditation groups, self selection may have biased this study's results.

A third weakness in the experimental design may lie in the fact that unlike the BTM_2 group, the BTM_1 and control groups did not have their eyes closed during their twenty minute rest period. This variable, and not meditation, may account for the superior performance of the BTM_1 group on the visual measure. Perhaps having eyes closed before being tested on the visual measure decreases performance. If true, this would mean that the scores of the BTM_2 group were artificially depressed relative to the scores of BTM_1 and control groups. If true, this would mean that immediately following a meditation session performance on the visual measure would be enhanced as Hypothesis 4 suggests.

There would be disadvantages, however, to having the control and the BTM_1 subjects spend their twenty minutes rest with eyes closed. First spending twenty minutes alone with eyes closed would be a novel, and possibly anxiety-provoking, experience for control

subjects but it would not be for meditators. Thus, it was thought that having the control subjects spend their rest period with their eyes closed might create uncontrolled problems in this research. Secondly, to have the BTM_1 subjects close their eyes during their rest period might spontaneously trigger meditation and uncontrollably affect the results.

Meditation Experience of Sample

It is possible that if meditators were more experienced, then more hypotheses would have been confirmed.

This, of course, is possible but, not very probable. The fact that significant results were found on the visual measure suggests that 4 1/2 to 7 weeks experience is enough to show the effects of meditation practice. However, it may be questioned that although 4 1/2 to 7 weeks is long enough to show meditation effects on the visual measure, it is not long enough to show effects on the auditory measure. This is possible but there is no apparent, reasonable explanation to support this contention.

Secondly, past meditation research suggests that 4 1/2 to 7 weeks is adequate for validating the effects of meditation practice and a meditation session (Ballou, 1973; Ferguson and Gowan, 1973; Deikman, 1963; Wallace, 1973). Ballou's study suggests that over the first ten weeks of meditation practice, a significant drop in anxiety occurs the first week of practice and remains at that level

over the next nine weeks of practice. Moreover, Wallace found that the physiological changes which occur during meditation are just as great the first weeks of practice as they are a couple of years later.

Lastly, in light of the above mentioned research by Maupin (1962) and Lesh (1970) it seemed important to control for self-selection when comparing meditators with non-meditators. Therefore, it was important to test the meditation groups before any appreciable number of the meditation group had dropped out. In a group of 15 meditators, which E had followed prior to this research, over 90% continued to practice TM for at least eight weeks after instruction. At twelve weeks 20 percent of the beginners had dropped out. Thus, to safely control for self-selection, it was thought that the meditation groups should be tested prior to eight weeks of experience.

Dates of Testing

About three-fourths of the meditation groups were tested during the last five weeks of Fall term at Michigan State University. The other one-fourth and 18 of the 21 pre-TM control subjects were tested between the second and fifth weeks of the winter term. That is, most meditation subjects but only a few control subjects were tested close to or just before an exam period which is presumably a period of greater stress. Since Postman and Bruner (1948) and Smock (1965) have shown that experimentally induced stress inhibits correct identification of an ambiguous stimulus, it may be that the predicted

differences between the control group on the one hand and the meditation group on the other may have been minimized due to the period in the school year each group was tested.

Assumptions

Similar to most meditation literature, this study assumed, erroneously it seems, that the effects of meditation practice would be of the same nature immediately following a meditation session as compared to four to six hours after a meditation session. That is, it was assumed that regular meditation practice would have a unitary effect which was merely intensified immediately following a meditation session. The results of this study, however, suggest that distinctions must be made between effects occurring during a meditation session, immediately following a meditation session, and the longitudinal effects of meditation practice; this study found that the immediate effects of a meditation session seem to be of a different nature than the longitudinal effects of meditation practice.

The fact that results were discovered on the visual but not on the auditory measure needs explanation. Perhaps meditation practice affects visual and auditory perception differently or perhaps the ability to identify an ambiguous auditory stimulus entails different cognitive factors than the ability to identify an incongruity in a familiar visual stimulus, thus, there would be no reason to expect that performance on the visual and auditory measures are

correlated. Indeed, Frederiksen (1966) found no significant correlation between the ability to identify a masked auditory stimulus made clearer over trials and the ability to identify a blurred visual stimulus made clearer over trials. He found that this low correlation could be partially explained by the existence of factors such as spatial orientation and visualization which significantly related to the visual recognition task only and spatial scanning which significantly related to the auditory task only.

In addition, in his factor analysis of 27 cognitive tests and subsequent analysis of intercorrelations between the resulting factors and performance on the auditory and visual tasks, Frederiksen (1966) found two cognitive flexibility factors, flexibility of closure and cognitive flexibility-rigidity (hereafter referred to as cognitive flexibility) which affected performance on his visual and auditory tasks differently. In each of his two auditory task conditions and two visual task conditions Frederiksen found that while one type of flexibility, whether it be flexibility of closure or cognitive flexibility, was associated with early recognition, the other type of flexibility would be associated with late recognition. Moreover, in the auditory measure which was nearly identical to the one used in this study, Frederiksen found that the flexibility factors served opposing functions. While flexibility of closure, which may be defined as the ability to pick out and perceive a particular item embedded in a field (Frederiksen, 1966) and is functionally equivalent to Witkins' (1964) field dependence-independence factor, was

associated with late recognition, cognitive flexibility, which is defined as the ability to overcome a "set" (Frederiksen, 1966), was associated with early recognition. Thus, a subject high in both flexibility of closure and cognitive flexibility would tend to have a mediocre score on the auditory task because the effects of these two abilities would cancel each other. As Frederiksen points out, high flexibility of closure enables a subject to hear embedded words contained in the masking noise which, in turn, interferes with subsequent recognition of the masked word and thus works against cognitive flexibility.

As mentioned before, Pelletier (1973) has shown that a longitudinal effect of meditation practice is increased field independence. Pelletier did not document the immediate effects of a meditation session. Frederiksen's study shows that a field independent style, or high flexibility of closure, contributes to poor performance on the auditory task. In our study, while the BTM_1 and the BTM_2 groups did not differ on the auditory task, the BTM_1 group significantly out-performed the BTM_2 group on the visual task. From this it seems that regular meditation practice or a meditation session influences some other factor(s) which counterbalances the hindering effects of increased field independence on the auditory measure (and thus accounts for the lack of difference between the BTM_1 and BTM_2 groups on the auditory measure) but facilitates performance of the BTM_1 group on the visual measure (and thus accounts for the superior performance of the BTM_1 group on the visual measure).

If meditation practice increases cognitive flexibility while a meditation session decreases it, the results on both the auditory and visual measures would be explained. Restated in terms of our previous discussion, if meditation practice facilitates both field independence, as Pelletier has shown, and cognitive flexibility while a meditation session either does not or immediately decreases both of these abilities, this would lead to the results found in this study--no differences between the pre-TM control, BTM_1 and BTM_2 groups on the auditory measure and the superior performance of the BTM_1 group as compared to the BTM_2 and control groups on the visual measure. This explanation would also mean that the two flexibility factors affected the visual and auditory measures differently. Another look at the performances on the visual task and at the cognitive flexibility factor show that this is likely.

Unlike the auditory measure, the visual measure did not present an embedded figures situation. Thus, on the visual measure it would seem that the field dependence-independence factor had less effect on performance. On the other hand, in light of Frederiksen's discussion of cognitive flexibility the cognitive flexibility factor seems to have had more effect on the visual than on the auditory task.

From his study Frederiksen concluded that cognitive flexibility is a primary factor in perceptual recognition "where an opportunity is given for an erroneous initial perception of the ambiguous stimulus." In response to the trick card during the early stages of rapid exposure almost all subjects gave a normal card

response which matched the trick card on one or two of the three card characteristics. That is, for almost all subjects, regardless of whether they were field-independent, the visual measure elicited a similar, common erroneous set in the first few trials. This coupled with the fact that the visual measure did not present an embedded figures situation suggests that in contrast to the auditory measure the visual measure was less susceptible to the confounding influence of field independence and was a more valid indicator of cognitive flexibility and the ability to perceive and identify features of a stimulus that are contrary to expectation.

One might argue that the immediate effects of a meditation session also increase field independence and that this explains the lack of difference in performance between the BTM_1 and BTM_2 groups on the auditory measure. This possibility, however, does not seem to fit the facts. First, if this were true, it does not explain the results of the visual measure. Secondly, the meditation literature suggests that immediately after a meditation session a subject is more field dependent.

Witkin (1964) defines field dependence as a tendency to perceive "surroundings in a relatively global (and non-analytic) fashion, passively conforming to the prevailing field or context (p. 35) and to "experience items as fused with their background" (p. 80). Meditators, including Deikman's meditation subjects, seem to have experienced this. Mahareshi, the leading teacher of TM, talks of experiencing the world without preconceived ideas and

structures; Zen speaks of meditation as directed toward "casting off the false mask of conceptualization;" and the Sufis speak of meditation as facilitating freedom from constructs by which we have learned to perceive. During meditation Deikman's subjects reported visual phenomena such as blurring and dissolving of outlines and movements, changes in vase size and shape, merging with the perceptual internalization of the vase, and immediately after the meditation session such changes as dedifferentiation of the landscape such that all stimuli of the landscape appeared at equal intensity and equally called for attention making it difficult to focus selectively and organize the visual field into meaningful patterns and normal figure-grouped relationships. Based on these reports Deikman hypothesized that a process occurs which serves to deautomatize those psychological structures that organize perceptual stimuli. Thus, from the claims of meditation schools and the evidence in Deikman's research it seems that a meditation session facilitates a field dependent perceptual style and that increased field independence immediately following a meditation session cannot explain the matching performances of the BTM_1 and BTM_2 groups.

Another possible explanation of the results is that meditation practice and a meditation session differently affect various factors in such a way as to result in no differences between the BTM_1 and BTM_2 groups on the auditory measure but a superior performance by the BTM_1 group on the visual measure. Although this is possible, at this point there is little evidence to explain which

factors would be so affected and how they would combine to give the results found in this study.

While the most reasonable explanation of this study's results concerning Hypotheses 1 through 4 is that meditation practice increases cognitive flexibility while a meditation session immediately decreases it, the introduction of this paper implies just the opposite. It implies that deautomatization and an aconceptual, less structured, biased perception, and a more flexible cognitive-perceptual style occurs during a meditation session. In terms of Deikman's discussion, since a meditation session serves to deautomatize or unorganize psychological structures which limit our awareness of unexpected as well as color aspects of a stimulus, meditation practice and, even more, a meditation session would facilitate perception of unexpected stimulus aspects and stimulate color sensitivity as stated in the six hypotheses. It may be, of course, that the reasoning in the introduction is wrong. Or it may be that it is correct but that the deautomatization process may have consequences which are different from those that this study hypothesized.

One unexpected consequence may be that the deautomatizing or unstructuring effect of a meditation session would immediately disorganize perception such that it would disorganize and retard form perception and make it more difficult to perceive an incongruity in a familiar visual stimulus. Deikman's report of his subjects' perceptual distortions, such as changes in vase size and shape,

blurring of outlines and movements as well as dedifferentiation of the landscape such that it becomes difficult to organize the field into meaningful patterns, suggest that this may be true. Over time, however, the deautomatization effect may dissipate such that it would be more helpful, rather than detrimental, in perception of an incongruity. This would explain the findings that meditation experience facilitates, while a meditation session immediately hinders, perception of an incongruity in a familiar stimulus. Consistent with the above explanation is the finding that identification thresholds for normal cards tend to be lower for the BTM_1 group than the BTM_2 group ($\underline{t}$ = 1.68, $\underline{df}$ = 28, $\underline{p}$ = .15). This explanation, however, does not explain the lack of support for both hypotheses tested on the auditory measure. Other possibilities which were discussed above, such as meditation practice affects visual and auditory perception differently or that the auditory and visual measures tap different and unrelated abilities, may explain this.

A second unexpected consequence may be that while deautomatization occurs during a meditation session, due to a "rebound effect" the effects of deautomatization cannot be seen immediately after a meditation session. For example, previous meditation research suggests that after having decreased during a meditation session from the pre-session level, some variables such as spontaneous fluctuation of GSR (Orme-Johnson, 1973) "rebound" immediately after the session to a level which is higher than before the session. The results on the visual measure show this pattern and suggest that

deautomatization may occur during a meditation session but that the effects cannot be seen immediately after a meditation session. For a number of reasons, however, this explanation does not seem likely. First, it does not explain the lack of support for both hypotheses tested on the auditory measure. Other possibilities, however, which are mentioned above may explain this. Secondly, because most of the physiological research does not show this rebound effect, it may be concluded that although a rebound effect might have occurred in this research, it is not likely. Thirdly, some of Deikman's subjects sometimes reported supposed deautomatization effects immediately after meditating. Thus, the possibility that deautomatization occurs during meditation but that its effects cannot be seen immediately after a meditation session because of a rebound effect is not entirely consistent with Deikman's evidence.

A third possible unexpected consequence of deautomatization which may explain the apparent contradiction between the introduction's discussion of meditation and this study's results is that deautomatization occurs only in some sessions and even then occurs in different degrees across subjects. It may be that deautomatization occurred in too few subjects to show up in this study's results. Past research strongly suggests this. In Deikman's research no subject reported effects which were supposedly indicative of deautomatization every session. Similarly, Maupin (1962) found that subjects differed greatly in their ability to experience significant effects while meditating. Those subjects who did experience

profound changes during some meditation sessions tended to continue meditation practice while those subjects who reported few or no such effects chose not to continue meditation practice. If as Deikman's and Maupin's evidence suggest, only some individuals experience the traditionally reported effects of meditation and that these effects are not experienced in every session, it is possible that both the traditionally claimed effects of meditation practice and this study's results are valid. That is, although the traditionally claimed effects of meditation practice may occur in some individuals, too few subjects may have experienced these effects for these effects to appear in this study's results.

Of the above three possible unexpected consequences of deautomatization this last one seems to be the most logical and consistent with past research and thus the most probable. However, there is also a serious piece of evidence which argues against the validity of this possibility. If, indeed, meditation practice affects two few subjects in the hypothesized ways to create a significant group difference, then none of this study's hypotheses should have been confirmed.

Concluding Remarks

At this point, there are three important questions still to be answered: 1) Are this study's results inconsistent with a deautomatization process? 2) Can the inconsistency between this study's

results and meditators' common self-reports be explained? 3) What do this study's results mean in terms of the hypotheses that this study originally attempted to test?

Are These Results Inconsistent with a Deautomatization Process

The results of this study clearly fail to support but not disprove Deikman's explanation of meditation as a deautomatization process. First, as Deikman said, a major corrollary of a deautomatization process is that actions and aspects of a stimulus previously screened out are reinvested with attention and are perceived. The results of Hypotheses 2 and especially 4 suggest that immediately following a meditation session this does not happen. Secondly, the results of Hypotheses 5 and 6, which suggest that neither meditation practice nor a meditation session facilitates color sensitivity, calls into question Deikman's explanation of meditation and deautomatization.

Deikman suggests that deautomatization implies and meditation sustains a shift of attention to perceptual and cognitive experiences preceding the analytic, intellectual mode typical of adult thought, thereby increasing color sensitivity. While the absence of increased color sensitivity immediately following a meditation session is not inconsistent with the concept of deautomatization, it seems to be inconsistent with the developmental implications which Deikman draws from the concept of deautomatization.

While the results of this study fail to support Deikman's assertion that meditation involves a deautomatization process, the results do not disprove Deikman's hypothesis that deautomatization occurs during meditation. The most that can be firmly concluded from this study's results is that as Deikman describes the deautomatization process and as this study attempted to measure the supposed effects of a deautomatization, the results fail to support the assertion that meditation involves a deautomatization process. This study's results raise a number of possible conclusions: either Deikman is not justified in his assumptions about deautomatization, deautomatization does not occur during meditation, deautomatization does occur but, as discussed above, has consequences which are different than this study supposed, subjects were not meditating properly as happened in Brown's study (1971), or due to weaknesses in the experimental measures or design or due to chance the null hypothesis was not rejected. Because the BTM_2 subjects were not measured for physiological changes during their meditation session, the question of whether these subjects were meditating properly cannot be answered. The possibility that weaknesses in the experimental design permitted an erroneous acceptance of the null hypothesis can only be determined through future research as will be discussed later.

Can the Inconsistency Between This Study's Results and Meditators' Common Self-Reports be Explained?

As implied above, it is possible that meditators' assertions that meditation facilitates color sensitivity and a "clear" and altered perception are true and that due to weaknesses in the experimental measures or design or due to the inconsistent nature of meditation's effects the assertions were not confirmed in this study.

Moreover, even if this study's results are valid, this does not necessarily negate meditators' reports that they experience increased color sensitivity, vividness, etc. as a result of meditation practice; this study merely suggests that in fact meditation practice does not facilitate color as opposed to form sensitivity.

It is also possible that the traditionally claimed effects of meditation such as increased color sensitivity, vividness, and clarity of perception do occur in some sense but that as they are operationally defined in this study they do not occur. Since the meditation literature tends to describe the effects of meditation practice in global terms, it is possible that what the meditation literature means when it talks about the various perceptual effects of meditation and how this study interpreted and operationally defined these effects are quite different.

What Do This Study's Results Mean in Terms of the Hypotheses that This Study Originally Attempted to Test?

This study originally attempted to test the idea that meditation practice facilitates unbiased auditory and visual perception; that is, meditation practice facilitates the ability to see a stimulus as it is rather than how one expects or conceives it to be and thus facilitates the ability to notice aspects of a stimulus which are contrary to expectation and common conception and are normally not noticed. From past research and theory, it also seemed that meditation practice facilitates the experience of raw sense data and increases color sensitivity.

Because the visual measure seemed to be a less contaminated, or a more valid, measure of the ability to perceive and identify features of a stimulus which are contrary to expectation and common conception, this study provides some support for the possibility that meditation practice facilitates the ability to identify and perceive features of a stimulus which are contrary to expectation, while a meditation session immediately decreases this ability.

On the other hand, it may be that this study's results cannot be interpreted so simply. From Frederiksen's study (1966) it seems that to be able to see a stimulus as it is rather than how one expects or conceives it to be implies at least two different abilities. To see something without expectation implies a freedom from expectation or set and thus high cognitive flexibility. To see something without constructs implies a field dependent perceptual style. Therefore,

in terms of Frederiksen's study, the hypothesis could be stated as: a meditation session immediately increases field dependence and cognitive flexibility. From the above discussion of results, it seems most likely that while a meditation session immediately increases field dependence it does not increase cognitive flexibility and that the longitudinal effects of meditation practice increases both field independence and cognitive flexibility. In terms of the original claims that this study attempted to test the most likely, although highly tentative, conclusions are as follows. First, a meditation session for a short time after the session decreases the operation of constructs in perception and, therefore, increases the experience of raw sense data; however, this is not translated into enhanced color sensitivity or ability to identify unexpected aspects of a stimulus as originally supposed. Secondly, the longitudinal effects of meditation practice and not the immediate effects of a meditation session decreases the operation of expectations in perception. On the other hand, the longitudinal effect of meditation practice does not seem to decrease the operation of constructs in perception. Lastly, it seems that decreasing the influence of expectations is the key variable in enhancing ability to perceive and identify features of a stimulus which are contrary to expectation and common conception. Contrary to the assumptions in this introduction, decreasing the operation of constructs does not necessarily lead to enhanced ability to perceive unexpected or idiosyncratic features of a stimulus.

Implications and Conclusions Concerning Present Meditation Theory and Research

In considering the effects of meditation, this study cautions against the tendency to draw overly general conclusions from the research and especially the self-report literature. This research suggests that more attention should be given to possible differences between the effects occurring during a meditation session, the immediate effects of a meditation session and the longitudinal effects of meditation practice. Secondly, it seems that claims made for meditation tend to be too general. For instance, this study suggests that the common claims made for the effect of meditation on perception as evidenced in this study's introduction are entirely too global and that it cannot be said that meditation practice facilitates perception as some literature suggests. It can only be said that meditation practice facilitates certain aspects of perception and hinders other aspects of perception; even these changes, however, vary depending on whether one is considering effects during, immediately after, or hours after a meditation session. Thirdly, this study raises serious question as to the validity of self-report data in the study of meditation. The basis for this study's hypotheses which were for the most part not confirmed, came largely from self-report data. This study suggests that much of this data is either invalid or too general. In addition, the mystical and sometimes evangelical beliefs often attached to meditation practice would seem to make self-report data especially suspect.

Areas for Future Research

The above explanations of this study's results are extremely tentative and need to be tested. For example, it would be important to test the immediate effects of a meditation session on field dependence-independence and cognitive flexibility and the longitudinal effects of meditation practice on cognitive flexibility. Given that there exists a number of validated tests of field dependence and cognitive flexibility, this would be convenient to research. Secondly, the effects of spending twenty minutes with eyes closed prior to being tested on the visual measure needs to be examined. If spending twenty minutes with one's eyes closed decreased performance on this study's measures then Hypotheses 2 and 4 may be valid after all.

Weaknesses in the experimental design contribute to the tentative nature of this study's results. For example, some variables on which subjects were not matched may have significantly affected the results, or subjects may not have had enough meditation experience to show results in this study. A longitudinal design in which subjects were tested every few months for a year or more would solve the problems of matching, would show the effects of various levels of meditation experience on the dependent variables and would answer such questions as whether all or only some subjects benefit from meditation in the predicted ways.

As mentioned earlier, this study suggests that perhaps some effects from a meditation session may not occur consistently from

session to session and thus may be overlooked using a design in which subjects are tested after only one session. Using a longitudinal design with repeated testings would control for this possible inconsistency of effects and better test the actual effects of a meditation session.

This study has also suggested that the changes immediately following a meditation session and the changes hours after a meditation session involve some different variables and when the same variables are involved, these variables are affected in opposite ways. For instance, this study suggests that while the immediate effects of a meditation session are less cognitive flexibility, less field independence and less ability to identify an incongruity in a familiar stimulus, the effects hours after a meditation session are greater cognitive flexibility, greater field independence and greater ability to identify an incongruity in a familiar visual stimulus. By testing meditators or matched groups of meditators at various intervals from minutes to hours after a meditation session future researchers could more specifically document the effects of a meditation session as they change over time.

Finally, this study suggests that future researchers of perceptual and cognitive effects of meditation should test specific perceptual and cognitive variables using tests which already have research validation. In contrast to the present study in which it is not entirely clear what the instruments were measuring, this kind of research would yield less ambiguous results.

APPENDIX A

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Prior to beginning formal instruction, the beginning meditator must have abstained from non-prescription drug usage for fifteen days, and he must have paid his course fee which is $45 for students and $75 for non-students.

Unlike most meditation instructors, TM instructors emphasize that the meditator need not adhere to any particular belief system to obtain maximum benefits from TM practice. But as Smith (1973) has noted, a number of beliefs are emphasized in TM lectures. First, TM instructors teach that virtually anyone can meditate and to benefit from TM no particular philosophical or religious belief system is required. Secondly, they teach that everyone has an "innocent or neutral center" from which he can experience the world without preconceived ideas and structure (Wallace and Benson, 1971). Thirdly, they teach that the body absorbs stress which adversely affects our physiological and psychological functioning. Fourthly, TM instructors maintain that changes in psychological functioning resulting from TM practice are experienced gradually and subtly over time, and that practice of TM twice a day results in a number of healthful benefits, one of which is more relaxed, efficient functioning in all one's activity owing to "stress release" which occurs during meditation. Fifthly, TM instructors say that worldly achievement and

pleasure are valid ends. TM practice is not designed to divert the practitioner from worldly achievement or pleasure. On the contrary, the aim is to increase efficiency and enjoyment in daily activity. Lastly, TM instructors teach that the use of drugs other than those medically prescribed impede the progress and beneficial results of meditation.

In order to ensure that he is meditating properly, the beginning meditator, at the conclusion of the four day instruction period, is encouraged to make monthly "checking" appointments with a personal instructor. In addition, the initiate is told that he may attend free lectures and films discussing TM theory. TM "retreats" are also available. At the same time, TM instructors emphasize that these lectures and retreats are not necessary for the successful practice of meditation. In fact, only a minority of meditators attend many of these events.

REFERENCES

REFERENCES

Abrams, A. I. Paired associate learning and recall--a pilot study comparing transcendental meditators with non-meditators. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Akishige, Y. An historical survey of the psychological studies of Zen. In Kyushi Psychological Studies, No. 5, Akishige, Y. (Ed.), Bulletin of the Faculty of Literature of Kyushu University, No. 11, Kyushu University, Fukuoka, Japan, 1968.

Akishige, Y., Yamaoka, T., Matsumoto, H., Matsumoto, A., Takayama, T., Abe, Y., and Nakamusa, S. Psychological studies on breath regulation and mind-regulation. Proc. 29th convention of JAAP, 1962, 11.

Allison, J. Respiratory changes during the practice of the technique of transcendental meditation, The Lancet, 1970, 1 (No. 7651) 833-834.

Ames, A., Jr. Reconsideration of the origin and nature of perception. In Ratner, S. (Ed.). Vision and Action. New Brunswick, N.J.: Rutgers University Press, 1953.

Anand, B. K., Chhina, G. S., Singh, B. Some aspects of EEG studies of Yogis. Electroencephalograph and Clinical Neurophysiology, 1961, 13, 452-456.

Ballou, D. Transcendental meditation research: Minnesota State Prison. Research report, 1973. Abstract in Kanellakos, D. and Ferguson, P. C. The Psychobiology of Transcendental Meditation: An Annotated Bibliography. Los Angeles: Mahareshi International University, International Center for Scientific Research, 1973.

Banquet, J. P. EEG and meditation. Electroencephalograph and Clinical Neurophysiology, 1972, 33, 449-455.

Benson, H., and Wallace, R. K. Decreased blood pressure in hypertensive subjects who practiced meditation, Supplement II to Circulation, XLV and XLVI, Oct., 1972.

Blake, R. R. and Vanderplas, J. M. The effect of pre-recognition hypotheses on veridical recognition. Thresholds in auditory perception: Journal of Personality, 1950, 19, 95-115.

Blasdell, K. The effect of transcendental meditation upon a complex perceptual motor task. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Broadbent, D. E. Work-frequency effect and response bias. Psychological Review, 1967, 74, 1-15.

Brown, F. M., Stewart, W. S., and Blodgett, J. I. EEG Kappa rhythms during transcendental meditation and possible perceptual threshold changes following. Paper presented to the Kentucky Academy of Science, November 13, 1971, 1-5.

Bruner, J. S. Perceptual theory and the Rorschach test. Journal of Personality, 1948, 17, 157-168.

Bruner, J. S. Personality and the process of perceiving. In Blake, R. R. and Ramey, G. V. (Eds.), Perception; An Approach to Personality. New York: Ronald Press Company, 1961.

Bruner, J. S. On perceptual readiness. Psychological Review, 1957, 64, 123-152.

Bruner, J. S. Going beyond the information given. In Contemporary Approaches to Cognition, A Report of a Symposium at the University of Colorado. Cambridge, Mass.: Harvard University Press, 1957.

Bruner, J. S. and Goodman, C. C. Value and need as organizing factors in perception. Journal of Abnormal and Social Psychology, 1947, 42, 33-44.

Bruner, J. S. and Jones, E. E. Expectancy in apparent visual movement. British Journal of Psychology, 1954, 45, 157-165.

Bruner, J. S. and Minturn, A. L. Perceptual identification and perceptual organization. Journal of General Psychology, 1955, 53, 21-28.

Bruner, J. S. and Postman, L. On the perception of incongruity: a paradigm. Journal of Personality, 1949, 18, 206-233.

Bruner, J. S., Postman, L., and Rodrigues, J. Expectation and the perception of color. American Journal of Psychology, 1951, 64, 216-227.

Bruner, J. S., Postman, L., and Walk, R. The perception of error. British Journal of Psychology, 1951, 42, 1-10.

Bruner, J. S. and Potter, M. C. Interference in visual recognition. Science, 1964, 144, 424-425.

Brunswick, E. Systematic and representative design of psychological experiments. Berkeley: University of California Press, 1947.

Butter, Charles M. Neuropsychology: The study of the brain and behavior. Belmont, California: Brooks/Cole Publishing Co., 1969.

Deikman, Arthur J. Experimental meditation. Journal of Nervous and Mental Disorders, 1963, 136, 329-343.

Deikman, Arthur J. Deautomatization and the mystic experience. Psychiatry, 1966, 29, 324-338.

Deikman, Arthur J. Implications of experimentally induced contemplative meditation. Journal of Nervous and Mental Disorders, 1966, 142, 101-116.

Dember, W. The psychology of perception, New York: Holt, 1960.

Erickson, C. W. Unconscious processes. In Jones, M. R. (Ed.), Nebraska Symposium on Motivation. Lincoln, Nebraska: University of Nebraska Press, 1958, 169-227.

Fehr, T., Nersteheimer, J. and Torper, S. Utersuchung von 49 praktizierrenden der transzendentalen meditation mit dem freiberger personlichkeitsinventar, 1972, unpublished report cited in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Ferguson, P. D. and Gowan, J. The influence of transcendental meditation on anxiety, depression, aggression, neuroticism, and self-actualization. Prepublication abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Frederiksen, J. R. A study of perceptual recognition in two sense modalities. (Research Bulletin, 66-32), Princeton, N.J.: Educational Testing Service, 1966.

Frederiksen, J. R. Cognitive factors in recognition of ambiguous auditory and visual stimuli. Journal of Personality and Social Psychology, 1967, Monograph 7, (1 Whole No. 639).

Frederiksen, J. R. Response perseveration in auditory word recognition. Journal of Experimental Psychology, 1969, 79, 48-55.

Frenkel-Brunswick, E. Intolerance of ambiguity as an emotional and perceptual personality variable. Journal of Personality, 1949, 18, 108-143.

Furst, C. Automatization of visual attention. Perception and Psychophysics, 1971, 10, 65-70.

Gill, M. and Brenman, M. Hypnosis and related states: Psychoanalytic studies in regression. New York: International Universities Press, 1959.

Goleman, D. Meditation as meta-therapy: Hypotheses toward a fifth state of consciousness. Journal of Transpersonal Psychology, 1972, 1, 1-44.

Graham, J. Auditory discrimination in meditators. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Haber, R. N. Effect of prior knowledge of the stimulus on work recognition processes. Journal of Experimental Psychology, 1965, 69, 282-286.

Haber, R. N. The nature and effect of set on perception. Psychological Review, 1966, 73, 335-355.

Haber, R. N. Contemporary theory and research in visual perception. New York: Holt, Rinehart and Winston, 1968.

Harris, L. Comments on "experience with congruity in the perception of incongruity." Psychonomic Science, 1969, 15, 2.

Hartmann, H. Ego psychology and the problem of adaptation. New York: International Universities Press, 1958.

Hjelle, L. A. Transcendental meditation and psychological health. Prepublication abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Huxley, A. Doors of perception and heaven and hell. New York: Harper and Row, 1954.

Isaacson, R. L., Hult, M. C., Blair, and Molton, L. Psychology: The science of behavior. New York: Harper and Row, 1965.

Ittelson, W. H. The Ames demonstrations in perception. New Jersey: Princeton University Press, 1952.

Ittelson, W. H. and Cantril, H. Perception. Garden City, New York: Doubleday, 1954.

Kambe, T. and Sato, K. Medical and psychological studies on Zen electroencephalogram and electromyogram during Zen practice. Proc. 26th Convention of JPA, 1962, 289.

Kanellakos, D. P. Transcendental meditation and the psychobiology of consciousness. Proc. of the First International Symposium on The Science of Creative Intelligence, Los Angeles: MIU-ICSR, 1971.

Kanellakos, D. P. and Ferguson, P. C. The psychobiology of transcendental meditation: An annotated bibliography. Los Angeles: MIU-ICSR, 1973.

Kasamatsu, A. and Hirai, T. An electrocephalographic study on the Zen meditation (Zazen). Folio Psychiat. & Neurolog. Japonica, 1966, 20, 315-336. In Tart, Altered States of Consciousness, 489-501.

Kasamatsu, A., Hirai, T., and Izawa, H. Medical and psychological studies in Zen. Proc. 26th Convention of JPA, 1962, 33. Cited in Akishige, A Historical Survey of the Psychological Studies in Zen, 1968, 35.

Kasamatsu, A., Hirai, T., and Izawa, H. Medical and psychological studies in Zen. Proc. 27th Convention of JPA, 1963, 347. Cited in Akishige, A Historical Survey of the Psychological Studies in Zen, 1968, 36.

Kelly, G. A. The psychology of personal constructs. New York: Norton, 1955.

Koike, K. and Yamaoke, J. Psycho-physiological studies on Zazen. Bull. Fac. Phil., Nihon Univ., 1963, 2, 1-10. Cited in Akishige, A Historical Survey of the Psychological Studies in Zen, 1968, 31.

Langer, S. K. Philosophy in a new key. New York: The New American Library of World Literature, 1951.

Lasko, W. J. and Lindauer, M. S. Experience with congruity in the perception of incongruity. Psychonomic Science, 1968, 12, 59.

Lehmann, D., Beeler, G. W., and Fender, D. H. EEG responses during observation of stabilized and normal retinal images. Electroencephalography and Clinical Neurophysiology, 1967, 22, 136-142.

Lesh, T. V. Zen meditation and the development of empathy in counselors. Journal of Humanistic Psychology, 1970, 10, 39-83.

Mahareshi, M. Y. On the Bagavad Gita. Baltimore: Penguin Books, 1969.

Maupin, E. W. Individual differences in response to a Zen meditation exercise. Journal of Consulting Psychology, 1965, 29, 139-145.

Maupin, E. W. On meditation. In Tart, Altered States of Consciousness.

Naranjo, C. and Ornstein, R. On the psychology of meditation. New York: Viking Press, 1971.

Neisser, U. Cognitive psychology. New York: Appleton-Century-Crofts, 1967.

Nidich, S., Seeman, W., and Dreskin, T. Influence of transcendental meditation on a measure of self-actualization: A replication. Journal of Counseling Psychology, 1973, 20, 556-566.

Orme-Johnson, D. W. Antonomic stability and transcendental meditation. Psychomatic Medicine, 1973, 35, 341-349.

Orme-Johnson, D. W., Kiehlbauch, R., Moore, R., and Bristol, J. Personality and autonomic changes in meditating prisoners. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Otis, L. S. Changes in dry usage patterns and other benefits derived by practitioners of transcendental meditation. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Pelletin, K. R. Altered attention deployment in meditation. Unpublished dissertation, University of California, Berkeley, California, 1972.

Postman, L. and Bruner, J. S. Perception under stress. Psychological Review, 1948, 55, 314-323.

Postman, L. and Bruner, J. S. Hypothesis formation and the principle of closure: The effect of frequency and recency. Journal of Psychology, 1952, 33, 113-125.

Riechert, H. Plethysmographische untersuchungen bie konsentrations and meditation suburgen artiliche forsche. Antliche Forsch, 1967, 21, 61-65. Cited in Wallace, Benson, and Wilson, A wakeful hypometabolic physiologic state, 1971.

Schachtel, E. G. Experiential foundations of Rorschach's test. New York: Basic Books, 1966.

Shaw, R. and Kolb, D. One-point reaction time involving meditators and non-meditators. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Shelly, M. W. A theory of happiness as it relates to transcendental meditation. Abstract in Kanellakos and Ferguson, The Psychobiology of Transcendental Meditation.

Siegel, S. Non-parametric statistics for the behavioral sciences. New York: McGraw-Hill, 1956.

Smith, Jonathon. Meditation and anxiety. Unpublished paper. Michigan State University, 1973.

Smoch, C. D. The influence of psychological stress on the "intolerance of ambiguity." Journal of Abnormal and Social Psychology, 1955, 50, 177-182.

Smoch, C. D. The influence of stress on the perception of ambiguity. Journal of Abnormal and Social Psychology, 1955, 50, 354-356.

Spinelli, D. N. and Pribram, K. H. Changes in visual recovery functions and unit activity produced by frontal and temporal cortex stimulation. Electroencephalography and Clinical Neurophysiology, 1967, 22, 143-149.

Tart, C. T. (Ed.) Altered states of consciousness. New York: John Wiley and Sons, Inc., 1969.

Thompson, R. F. Foundations of physiological psychology. New York: Harper & Row, 1967.

Wallace, R. K. Physiological effects of transcendental meditation. Science, 1970, 167, 1751-1754.

Wallace, R. K. and Benson, H. The physiology of meditation. Scientific American, 1972, 226 (2), 84-90.

Wallace, R. K. and Benson, H. Physiological effects of a meditation technique and a suggestion for curbing drug abuse. Mental health program reports - 5, December 1971, Thorndike Memorial Laboratory, Harvard University, School of Medicine.

Wallace, R. K., Benson, H. and Wilson, A. A wakeful hypometabolic physiologic state. American Journal of Physiology, 1971, 221 (3), 795-799.

Wallace, R. K., Benson, H., Wilson, A. F., and Garrett, M. D. Decreases in blood lactate during transcendental meditation. Federation of American Society for Experimental Biology, reprint from federal proceedings, 1971, 30.

Wenger, M. A., Bagchi, B. K., and Anand, B. K. Experiments in India on "voluntary" control of the heart and pulse. Circulation, 1961, 24, 1319-1325. Cited in Wallace and Benson, 1972.

Whorf, B. L. Language, mind and reality. Etc., 1952, 2, 167-188.

Winer, B. J. Statistical principles in experimental design, 2nd Ed., New York: McGraw-Hill, 1971.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., and Karp, S. A. Psychological differentiation: Studies of development. New York: Wiley, 1962.

Wyatt, D. F. and Campbell, D. T. On liability of stereotype or hypothesis. Journal of Abnormal and Social Psychology, 1951, 46, 496-500.