PERCEPTION OF ILLUSIONS AND DEPTH DURING A "TRANSCENDENTAL STATE"

A Thesis

Presented to

the Faculty of the Department of Psychology

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Janice Lynn Hartgrove

August, 1975

ACKNOWLEDGMENTS

I am deeply grateful for the aid and encouragement of those without whose help my road would have been longer and more difficult. First, I thank my chairman, William G. Braud, for his ideas, time, patience, and support. His help is without price.

I thank my other committee members, Douglas L. Chute and Steven J. Cool, for their time and beneficial criticism.

I thank Penny Kemp, whose assistance, especially with the companion study, enabled this one to be finished on time.

I thank the International Meditation Society, whose members contributed time and effort in both acquiring and being subjects for the research.

I thank Mary Lou Badger for her aid in preparation of the manuscript under time pressure and my anxiety.

I thank Marvin W. Rasmussen, my husband, for his technical assistance and encouragement. My weakness with equipment is his strength.

Finally, I acknowledge the contribution of the late Betty A. Wieland, who started me on the road I now follow. She is greatly missed and dearly remembered.

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ABSTRACT

The experimenter employed an experimental group of 14 practitioners of Transcendental Meditation (TM) and a control group of 14 persons solicited from introductory lectures on TM to examine the effects of regular practice of a meditation technique on three tasks involving geometric illusions and one task involving secondary cues to depth. The meditators were asked to meditate and the non-meditators were asked to relax for twenty minutes. After this period they were presented with a counterbalanced sequence of the Müller-Lyer, Ponzo, and Poggendorff illusions and a depth cue task involving seven figures containing differing amounts of depth information. There were no significant differences between the groups on any one task, but, collapsing across tasks, the experimental group showed significantly less error than the control group. ($p < .05$). On the illusion tasks there were significant differences ($p < .00003$) between the two directions of change of the variable part of each stimulus. On the Müller-Lyer illusion there was a significant difference ($p < .01$) between the first and second presentations of the task. The experimenter discussed the possible effect of dissimilar drug histories of the two groups on the results.

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CHAPTER I

INTRODUCTION

The human organism exists in various states at various times. Each of these states is identified by a different set of biochemical, physiological, and psychological characteristics. The major states which have been delineated include the waking, deep sleep, and dreaming states. The hypnagogic state, the transition state which occurs as one goes into sleep, and the hypnopompic state, the transition state which occurs as one wakes from sleep, are more often now included with the previously listed states. Besides these states, there are a group of conditions referred to as altered states of consciousness (ASCs) which satisfy the definition of a state but which only emerge under certain conditions, usually involving some type of external stimulus. The altered states most commonly studied and referred to as such are those associated with hypnosis, drugs, sensory deprivation, certain clinical conditions, and meditation. The last of these is the particular focus of this study.

Much research has been done on the physiological characteristics associated with the various states of consciousness. Jouvet (1967) has shown, for example, that with the cat, the waking, deep sleep, and dreaming states differ in electrical activity in the cortex, sub-cortical regions, and neck muscles, in the rate of eye movements, heart and respiratory

activity, and in plethysmographic index. Barron, Jarvik, and Bunnell (1964), reviewing observable physiological and psychological changes associated with the intake of hallucinogenic drugs, report that in general the physiological effects are characteristic of mild excitement of the sympathetic nervous system. Effects include pupil dilation, constriction of peripheral arterioles, an increase in systolic blood pressure, EEG patterns similar to those associated with alertness along with the disappearance of rhythms associated with sleep, and in some cases, an increase in the excitability of certain spinal reflexes (such as the knee jerk).

In addition to such physiological indices, the above researchers report changes in perception following the intake of hallucinogens. With eyes open, brightness, color, and space perception are affected. They report, for example, a subjective increase in the vividness of colors and more clearly defined surface detail. With eyes closed, often elaborate visual displays occur. In regard to auditory experience, hallucinations often occur, including such complex hallucinations as fully orchestrated music. Olfactory and gustatory hallucinations have also been reported. According to their observations there is also a change in the perception of self; boundary perception between subject and object breaks down.

It is a logical step to infer that perceptual differences would occur between states of consciousness. Perception,

which is an aspect of nervous system functioning, would reflect changes in that system, in addition to certain changes in other systems of the body. The above review of Barron's, Jarvik's, and Bunnell's observations demonstrates on the basis of subjective report that changes occur between the waking state and the altered state induced by hallucinogenic agents.

The various techniques of meditation have been the subject of an increasing amount of research in the past several years. Three techniques in particular have been studied--Yoga, Zen, and transcendental meditation. Studies have focused both on the physiological correlates and the experience of the meditator. Physiological data has suggested certain similarities across the types of meditation mentioned above. Anand, Chhina, and Singh (1961) showed that their Yogi subjects exhibited prominent alpha activity with increased amplitude during meditation. In an earlier study, Bagchi and Wenger (1957) concluded that the meditative state with its prominence of alpha activity and absence of delta activity differed from drowsiness, light sleep, dreaming, dreamless deep sleep, and coma of any origin. Neither did they find the flattening of waves found in hibernating animals. Kasamatsu and Hirai (1966) looked at the EEG of Zen practitioners and found four stages of EEG activity. The first is characterized by the appearance of alpha activity in all regions in spite of the fact that the eyes are open. The second is characterized by an increase in the amplitude of alpha waves,

primarily in the frontal and central regions. The third is characterized by a decrease in alpha frequency. The fourth is characterized by the appearance of a rhythmical theta train; this stage is not always present. EEG studies of transcendental meditation have shown a similar increase in slow alpha activity (Wallace, 1970a, 1970b; Wallace, Benson, and Wilson, 1971; Wallace and Benson, 1972).

Respiration is another physiological correlate which has produced striking results with the three types of meditation under discussion. In their Yogi subjects, Bagchi and Wenger (1957) found a decrease in respiration to a level as low as 50%-60% of the rate during the control period. At times they reported that respiration was so shallow as to be uncountable. Kasamatsu and Hirai (1963) and Goyeche, Chihara, and Shimizu (1972) report a similar decrease in respiration rate in Zen practitioners. Both groups of researchers suggest that energy metabolism is decreased during Zazen. Wallace and his colleagues in the studies cited above with practitioners of transcendental meditation report a decrease in O_2 consumption, CO_2 elimination, and respiration rate. Wallace and Benson (1972) compare oxygen consumption during meditation with that during hypnosis and sleep. According to that study, no significant change occurs during hypnosis; during meditation the decrease is greater and occurs more rapidly than during sleep.

Table I summarizes the physiological correlates of the

TABLE 1

PHYSIOLOGICAL CORRELATES OF STATES OF CONSCIOUSNESS

State	EEG During	Blocking	Respiratory Rate	O_2 Consumption; CO_2 elimination	Energy Metabolism	Skin Resistance	Spon. GSR	EMG	Blood Lactate	EKG (Heart Rate)	Blood Pressure	Blood pH	Characteristics
TM	↑ slow α (8-9 cps) No δ or sleep spindles	α : no habituation	↓	↓	↓	↑	↓			↓	↓	↓	Eyes closed; Sitting
Zen	↑ amp. α ↓ freq. α rhythmical θ train α -longer lasting than in hypnagogic st.	α : no habituation θ: reappears spontaneously	↓	↓	↓		↓			many ↓ some ↑		↑	Eyes open; Sitting; (EEG: same-Walking)
Yoga	↑ amp. α ↓ freq. α	α : no habituation before; no blocking during	↓ during meditation; ↑ during asanas	↓ during meditation; ↑ during asanas	↓	↑		except in asanas ↓			variable		Eyes Closed; Sitting; Several Positions
Sleep	rhythmical θ train; recedes; spindle bursts; δ present	θ : α arousal reaction	↓	after several hours ↓	↓	Some people ↑							
hypnagogic	predominance of α & θ												
hypnosis	no definite differences		C.E.*	no change		C.E.*				C.E.*	CE*		
waking	predominance of β	α :habituation											

*Conflicting Evidence

three types of meditation under discussion and compares them with other states on some indices. The physiological data suggest that meditation produces a state separate from the other delineated states (Kanellakos and Lukas, 1974). Deikman (1963) was perhaps the first to come to this conclusion; he did so on the basis of experiential data from his technique of experimental meditation. (For example, he describes a change in perception of self--a "deautomatization" of the differentiation between self and object.) This state has been called the transcendental or TC-state (Deikman, 1963, 1966a, b; Kanellakos and Lukas, 1974).

If the meditative condition exists as a unique state, exhibiting its own unique characteristics, one would expect differences in perception between that state and other states. Deikman (1963, 1966b) reports subjective changes in the perception of the blue vase which is the object of meditation in his experimental technique. For example, under waking state conditions adaptation to color involves a gradual but never total loss of saturation, no change in hue, and an increase in intensity (Cohen, 1946). Deikman's subjects, however, reported an increase in saturation of the vase and a shift in hue towards purple. A darkening of the visual field was in accord with the Hochberg et al (1951) experiments involving color adaptation in a Ganzfeld; however, Deikman's subjects reported an increased "luminous" and "vivid" quality of the vase--a phenomenon which is not in keeping with Hochberg's

results.

The above cited studies are among the few which have focused on the changes in perception which occur during or following a period of meditation. Much of the comment that is found in the literature is subjective--a description of the phenomena being experienced. The purpose of the present study was to examine perception during the "transcendental" state in a more objective manner; specifically, the purpose was to study performance on certain perceptual tasks involving illusions and depth for which we already have not only a fair amount of data on performance under, in most cases, a variety of conditions, but also some theoretical notions.

A problem which poses theoretical difficulties for any study of performance in the TC-state is the difficulty, if not near impossibility, of actually testing performance during meditation. The philosophy of most meditation systems, however, states that the effects of meditation extend beyond the actual meditation period, and the length of this extension increases with amount of experience in the technique. Robbins and Fisher (1972) suggest this in their handbook on transcendental meditation.

> "Of course, the longer an individual meditates, the longer the mind can stay on this level of deep consciousness, until a level of skill is reached at which the mind can stay on this plane of total relaxation constantly, even during consciousness."
> (p. 29)

Some physiological indices suggest that after a period of meditation the body returns rapidly to its previous state

while other indices suggest that the return is much slower. Pre-meditation, meditation, and post-meditation values on several indices for a group of transcendental meditators can be compared in Table 2 which is reproduced from Wallace, Benson, and Wilson (1971). As can be seen, systolic blood pressure actually increases in the post-control period, while respiratory rate stays at the level attained during the meditation period. Since the differences on physiological indices do not resolve the issue and since we would expect the body to require a certain amount of time to complete the transition between states, we can look at the experiential data which suggest a carry-over of aspects of the meditation state into the post-meditation period. But because of the theoretical issue involved, it is proposed that any differences obtained in this study reflect changes which occur after, rather than during, a period of meditation or relaxation.

The hypothesis was that there would be a difference in performance on four perceptual tasks between meditators and non-meditators.

Deikman (1966b) suggests some mechanisms which may operate during meditation and would cause changes in perception. He suggests a "de-automatization" of usual modes of perceptual functioning. De-automatization is an undoing of automatization, a process of efficiency whereby intermediate steps are eliminated from awareness. He extends this concept into

TABLE 2

PHYSIOLOGIC CHANGES

BEFORE, DURING, AND AFTER MEDITATION

Reprinted from Wallace, Benson, and Wilson (1971)

WAKEFUL PHYSIOLOGIC HYPOMETABOLISM

TABLE 1. *Physiologic changes before, during, and after meditation*

Measurement	No. of Subjects	Precontrol Period, mean ± SD	Meditation Period, mean ± SD	Postcontrol Period, mean ± SD
Oxygen consumption, ml/min	20	251.2 ±40.6	211.4 ±43.2*	242.1 ±45.4
CO_2 elimination, ml/min	15	210.7 ±41.5	186.8 ±35.7*	217.9 ±36.1
Respiratory quotient	15	0.85 ±0.03	0.87 ±0.04	0.86 ±0.05
Respiratory rate, breaths/min	5	13 ±3	11 ±3†	11 ±3
Minute ventilation, l/min	4	6.08 ±1.11	5.14 ±1.05†	5.94 ±1.50
Blood pressure, mm Hg				
Systolic	6	106 ±12	103 ±12	111 ±10
Diastolic	6	57 ±6	59 ±5	60 ±5
Mean	9	75 ±7	75 ±7	70 ±7
pH	10	7.421 ±0.022	7.413 ±0.024†	7.429 ±0.025
P_{CO_2}, mm Hg	10	35.7 ±3.7	35.3 ±3.7	34.0 ±2.9
P_{O_2}, mm Hg	10	103.9 ±6.4	102.8 ±6.2	105.3 ±6.3
Base excess	10	−0.5 ±1.5	−1.3 ±1.5*	−1.0 ±1.8
Blood lactate, mg/100 ml	8	11.4 ±4.1	8.0 ±2.6*	7.3 ±2.0
Heart rate, beats/min	13	70 ±8	67 ±7†	70 ±7
Rectal temperature, °C	5	37.5 ±0.4	37.4 ±0.3	37.3 ±0.2
Skin resistance, kilohms	15	90.9 ±46.1	234.6 ±58.5*	120.5 ±92.0

P is the probability of the mean value of the precontrol period being identical to the mean value of the meditation period. *$P < 0.005$. †$P < 0.05$.

a theory of "perceptual expansion," in which a de-automatization of filtering and gating processes allows the intake of more and different external stimuli. In some cases this would cause a breakdown of percepts towards a more primitive perceptual experience, such as the loss of the third dimension of the vase, sometimes reported by his subjects. Deikman relates this to perceptual development. He suggests that during the maturation process, learning occurs such that percepts are organized towards higher levels of differentiation. He postulates that meditation could reverse this process.

> If, as evidence indicates, our passage from infancy to adulthood is accompanied by an organization of the perceptual and cognitive world that has as its price the selection of some stimuli to the exclusion of others, it is quite possible that a technique could be found to reverse or undo, temporarily, the automatization that has restricted our communication with reality to the active perception of only a small segment of it. Such a process of de-automatization might then be followed by an awareness of aspects of reality that were formerly unavailable to us.
>
> (Deikman in Aaronson and Osmond, 1970, p. 316)

To examine this hypothesis, the current experimenter chose four tasks which demonstrate differential perception as a function of age or learning. The three illusions demonstrate changes in magnitude of error as a function of age. The secondary depth cues involve learned stimulus relations. The first task concerns the Müller-Lyer illusion in which two lines of equal length are perceived as being unequal because of the direction of inclination of diagonals (forming

arrowheads) attached to the extremes of each line (Figure 1). The line with the outward-directed diagonals is perceived as being longer than the line with the inward-directed diagonals. Illusions represent a conflict between the physical nature and the perceptual interpretation of a stimulus. Several mechanisms have been hypothesized to explain illusions. In regard to the Müller-Lyer illusion, one theory (Gregory, 1966) postulates that we see the two lines in depth; the line with the out-ward diagonals gives a retinal image similar to that of an inside corner of a room while the line with the inward diagonals gives a retinal image similar to that of the outside corner of a building. According to size constancy, the farther appearing inside-corner line would appear longer. Age difference studies with the Müller-Lyer illusion suggest a U-shaped developmental curve, with the magnitude of error greatest during childhood and old age (Comalli, 1965; Frederickson and Guerin, 1973; Wapner, Werner, and Comalli, 1960).

The second task concerns the Ponzo illusion in which the vertical line near the open end of an angle formed by two appears shorter than the vertical line nearer the apex of the angle (Figure 2). Gregory (1966) suggests that the same mechanism underlies the Ponzo illusion that underlies the Müller-Lyer illusion--inappropriate constancy scaling. The converging lines of the angle suggest the percept of parallel lines receding in the distance (linear perspective). A developmental study (Leibowitz and Judisch, 1967) reveals a pattern of change with age which is consistent

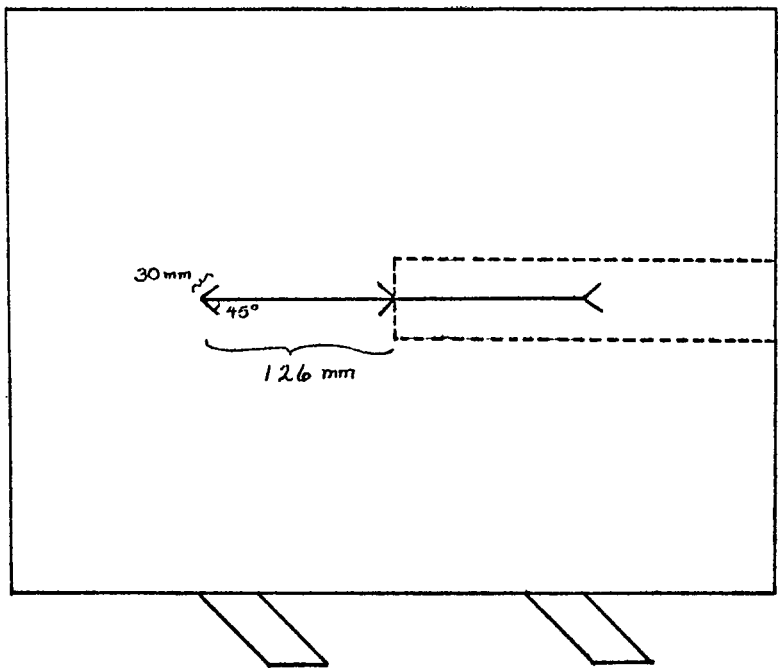


FIGURE 1

STIMULUS FOR TASK A

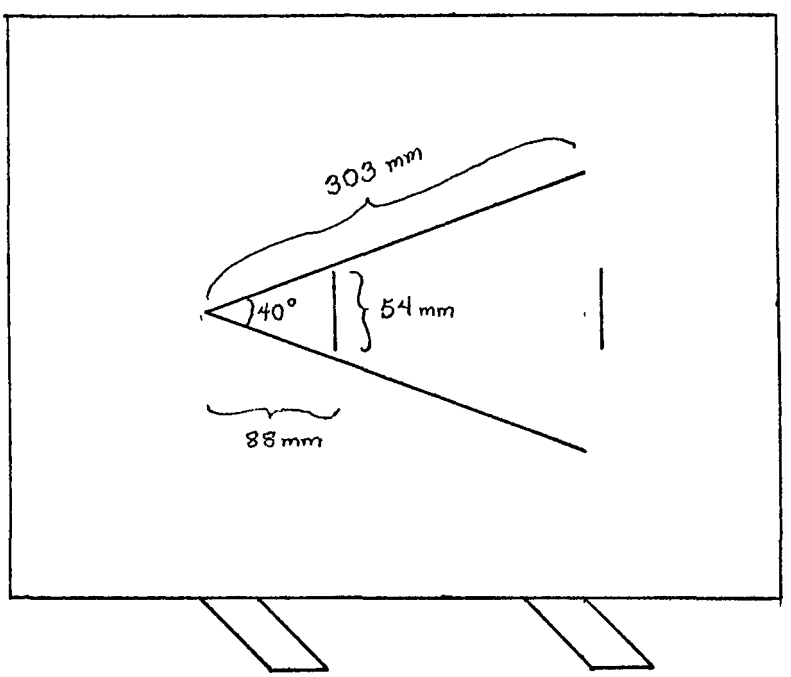


FIGURE 2

STIMULUS FOR TASK B

with this theory. The magnitude of error increased rapidly up to about 13 years of age and decreased again after about age 50. One could hypothesize that, if the same mechanism underlies both the Müller-Lyer and Ponzo illusions, then developmental studies of the Müller-Lyer illusion follow the pattern found in the Leibowitz and Judisch study cited above. The Müller-Lyer illusion studies cited previously conflict with this hypothesis.

The third task concerns the Poggendorff illusion in which two diagonals separated by a central area appear to be discontinuous when in fact they are continuous (Figure 3). Green and Hoyle (1963) have suggested that the mechanism of the illusion is misplaced constancy. However, this, like the other mechanisms which have been proposed, does not satisfactorily deal with much of the data. In a developmental study by Leibowitz and Gwozdecki (1967), the illusion decreased with age, levelling off at about age 10. In the second part of the same study, using a population of institutionalized mental defectives, the investigators examined whether intellectual or experiential factors caused the observed developmental pattern. They observed that mental age rather than chronological age was related to the pattern observed in the normal population.

In a study of hypnotically induced age-regression, Parrish, Lundy, and Leibowitz (1968) presented the Ponzo and Poggendorff illusions to subjects at various stages of age

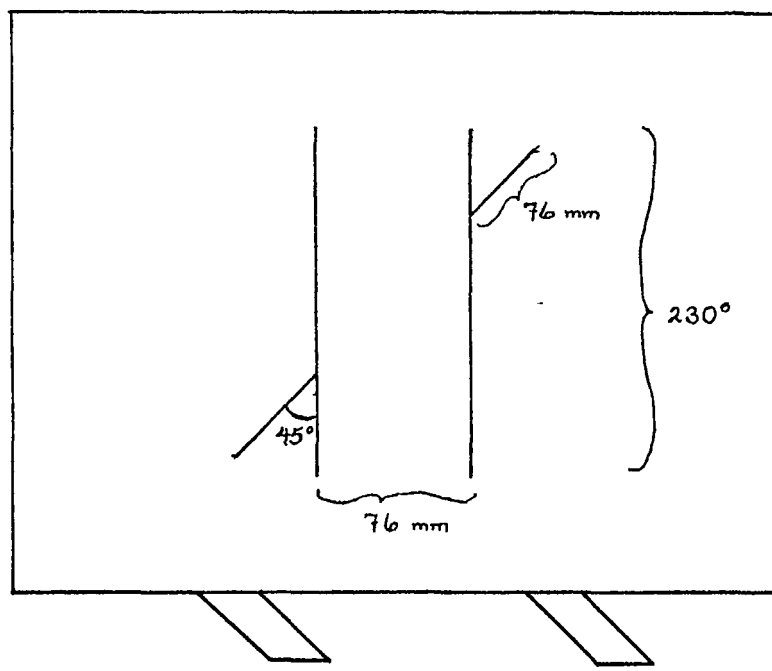


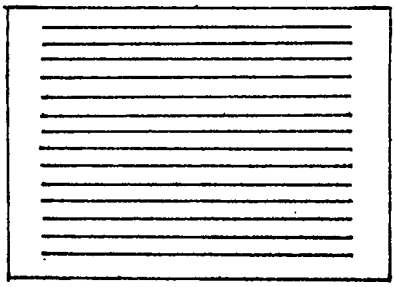
FIGURE 3

STIMULUS FOR TASK C

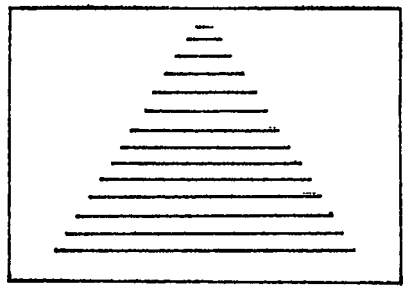
regression. The data obtained under hypnotically induced age regression was more typical of younger ages than of the chronological ages of the subjects.

The fourth task concerns the secondary or environmental cues to depth--those cues which deal with information contained within the stimulus, such as linear perspective, as opposed to those which deal with physiological mechanisms of the perceiving organism (primary or organismic cues). In this task the independent variable was the amount of depth information (in terms of number of cues) in a two-dimensional array. (Figure 4). The secondary depth cues appear to be learned perceptual organizations (Gregory, 1966). In one study, Olson (1975) presented pictures with varying amounts of secondary depth information to children. The children, from 40 to 62 months of age, appeared to utilize the available depth information. Olson concludes that the children had attained a cognitive and experiential level sufficient to utilize the available information. He refrains from suggesting an innate capacity to organize secondary depth information because younger children have not yet been tested with his paradigm and because other studies support the importance of experience (Bower, 1966; Miller, 1973).

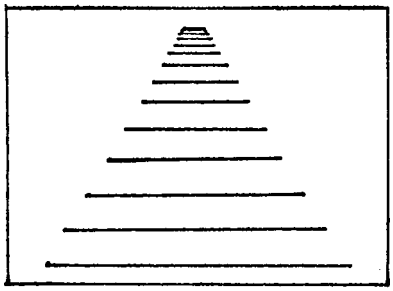
If the Deikman hypothesis of perceptual expansion and de-automatization is valid, then percepts which result from certain higher levels of differentiation should be replaced by, possibly, more primitive percepts or percepts based on



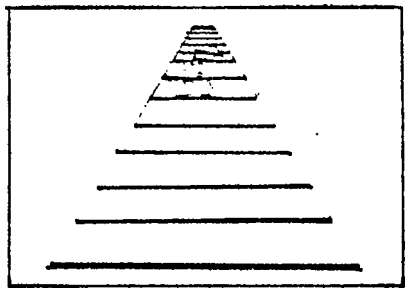
no cues



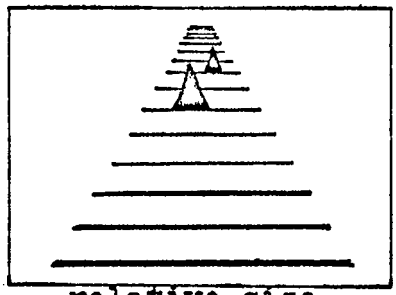
linear perspective



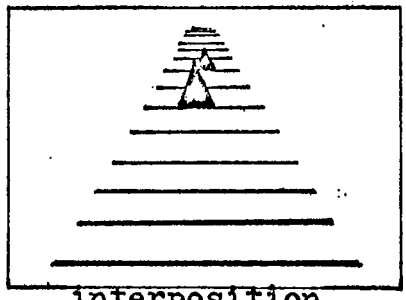
density gradient



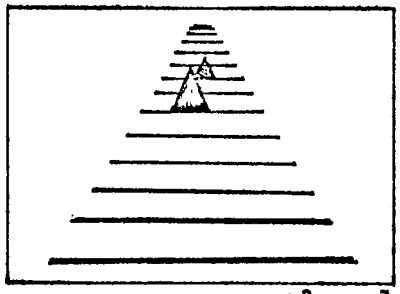
texture gradient



relative size



interposition



warm vs. cool colors

FIGURE 4

STIMULI FOR TASK D

the increased availability of, or attention to, external stimuli. If the transcendental state does influence the post-meditation period, then the response to tasks involving higher levels of learned differentiation should show patterns of response characteristic of earlier stages of perceptual development.

CHAPTER II

METHOD

In this experiment, subjects in two groups meditated or relaxed for a given period of time after which each was presented with a series of perceptual tasks. The two groups were as follows (Table 3).

1. Experimental group--practitioners of Transcendental Meditation for a minimum of 18 months.
2. Control group--persons having no experience with a meditation technique.

There were 14 subjects in each group.[1] Subjects ranged in age from 18 through 32; all were male. The experimenter solicited subjects for the experimental group from the International Meditation Society's headquarters, Houston, Texas. The experimenter solicited subjects for the control group from several occurrences of the first in a series of two introductory lectures on Transcendental Meditation, given by the International Meditation Society, Houston.

Since little is known about the influence of long and short term drug effects, relaxation and mind control technique effects, and personality variables on the transcendental state, the experimenter conducted a pilot study to examine current and past drug usage among meditators. In addition, she examined involvement among meditators with other relaxation and mind control techniques. Assigning a binary score (yes, has used or no, has not used) to each category of drug

TABLE 3

DESCRIPTION OF GROUPS

Group	Description of Subjects	Where Subjects Obtained	Sex	Number	Mean Age
E	Practitioners of Transcendental Meditation for a minimum of 18 months	International Meditation Society, Houston, Texas	M	14	25.3 years
C	Persons having no experience with a meditation technique	Introductory lectures on Transdendental Meditation, part one	M	14	25.7 years

listed on the form given to subjects, E found a significant difference in the direction of decreased usage between the period before initiation into Transcendental Meditation and the period since initiation ($p < .0011$, one-tailed, Wilcoxon matched-pairs signed-ranks test). Using the same method, E also found a significant difference in the direction of decreased involvement with other relaxation or mind control techniques ($p < .01$, one-tailed, Wilcoxon test). Ideally, experimental and control groups in the primary study should have been matched on these variables. This was unfeasible because it was difficult to find control subjects with the same pattern of drug involvement as the experimental subjects but who had not been involved with some other relaxation or mind control technique. The experimenter required that subjects in the control group have no experience with other techniques which could have been employed during the period of relaxation and thus would have confounded the results. Data was collected for a post hoc analysis of drug and technique involvement and a comparison of groups (Appendix, Forms A-I and B-I). The form which subjects completed at the conclusion of the session also contained a section on drug usage in the 24 hours prior to the session (Forms A-III and B-III). The analysis of this data is included in Chapter III.

The experiment was conducted in two rooms joined by a one-way mirror. The subject remained in room #1 during the experiment. The experimenter and the equipment for stimulus

presentation remained in room #2. Figure 5 shows the arrangement of the two rooms.

E presented the stimuli for all tasks through the one-way mirror such that they were visible in the subject's room (room #1). E kept both rooms dark and presented lighted stimuli on a black background in order to create a reduction situation, which minimized cues from the environment. The stimuli for tasks A, B, and C were fluorescent green on a black background. The horizontal lines of the stimuli for task D were fluorescent green; the triangles were fluorescent orange and green. E placed a box with openings on two ends against the window and blacked out the remainder of the window; she presented the stimuli at the end of the box which opened into her room. E operated a shutter which moved up and down behind the open end of the box which was against the window. An ultraviolet lamp inside the box lighted the stimuli from a distance of two feet. Table 4 describes the apparatus and Table 5 summarizes the method of presentation for each task.

E presented the tasks in a counterbalanced order to control for progressive error. The overall sequence of tasks was ABCDDCBA. Each session was recorded. Subjects received no feedback for any response.

Task A

The stimulus for task A was a free-standing structure composed of layers of wood, which depicted the Müller-Lyer

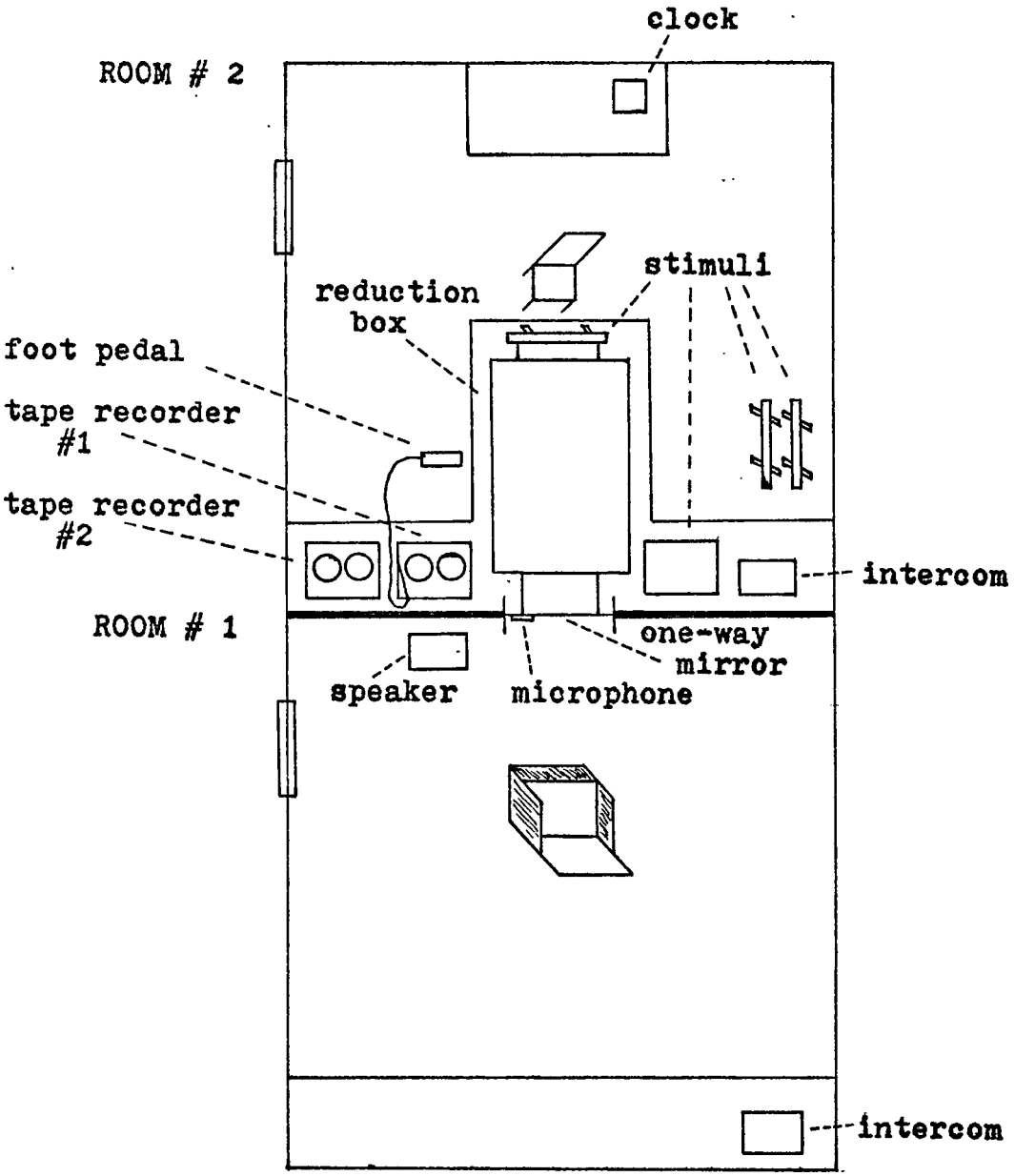


FIGURE 5

ARRANGEMENT OF EXPERIMENTAL ROOMS

TABLE 4

EQUIPMENT

Item	Purpose
Room #1--subject's room	
Easy chair	Seating for subject
Speaker	Transmission of instructions; connected to tape recorder #1
Microphone	Transmission of responses; connected to tape recorder #2
Intercom	Direct communication between subject and experimenter
Room #2--experimenter's room	
Chair	Seating for experimenter during presentation of illusions
Table and Ledge	Location of reduction box, stimuli, and communication equipment
Tape recorder #1	Transmission of instructions
Tape recorder #2	Taping of responses
Tape #1	Transmission of instructions
Tape #2	Taping of responses
Foot pedal	Control of tape recorder #1
Intercom	Direct communication between subject and experimenter
Reduction box	Presentation of stimuli; one open end against one-way mirror
Müller-Lyer illusion	Task A
Ponzo illusion	Task B
Poggendorff illusion	Task C and task D (depth cue boards placed in tracks)
Depth cue boards	Task D
Clock	Timing
Between rooms	
One-way mirror	Presentation of stimuli into room #1
Hook-up between tape recorder #1 and speaker, tape recorder #2 and microphone, intercoms	Transmission of instructions and taping of responses

METHOD OF PRESENTATION FOR EACH TASK

	Name of Task	Source	Response variable	No. of Stimuli	Method of Presentation	Time of Presentation of each stimulus	Equipment
A	Müller-Lyer illusion	Müller-Lyer (1889)	Judgment of subjective equality of length of line halves	1	Direct presentation of stimuli; right half manipulated by E	Until equality of lines reported	Wooden stimulus Reduction box UV light Tape equipment Intercom
B	Ponzo illusion	Leibowitz & Judisch (1967)	Judgment of subjective equality of two vertical lines	1	Direct presentation of stimuli; right line manipulated by E	Until equality of lines reported	Wooden stimulus Reduction box UV light Tape equipment Intercom
C	Poggendorff illusion	Leibowitz & Gwozdecki (1967)	Judgment of continuity of two diagonal lines	1	Direct presentation of stimuli; right line manipulated by E	Until continuity of lines reported	Wooden stimulus Reduction box UV light Tape equipment Intercom
D	Secondary cues to depth	Developed by Hartgrove on basis of literature on depth cues	Amount of Information necessary for perception of depth	7	Direct presentation of stimuli; E presents boards in predetermined order	5 sec.	7 wooden boards reduction box UV light Tape equipment Intercom

TABLE 5

illusion. A single divided line formed the horizontal bar of each part and the arrowheads which distinguished each part were placed accordingly. A movable slat of wood formed the right half of the illusion. E moved the slat left to lengthen and right to shorten the movable part (Figure 1). The two counterbalanced sequences given each subject were identical. Within each sequence, E presented the stimulus twice, once moving the slat from the longest to the shortest point and once from the shortest to the longest point. Half of each group of subjects saw the movable slat at the longest point first and half saw it at the shortest point first. E conducted a pilot study to determine the likely range of subject responses. This study and the characteristics of the apparatus determined the starting point for each direction. The form of the task followed the psychophysical method of ascending and descending limits, with E moving the slat in discrete 0.5 cm intervals. E moved the slat at a rate of one unit (0.5 cm) per second. Table 6 illustrates the stimulus sequence.

Green fluorescent tape formed the lines of the illusion on a black background. For presentation, E moved the apparatus against the open end of the box. E asked subjects to say "stop" when the right half of the figure between the arrowheads was equal to the left half between the arrowheads.

The response variable was the point at which the two sides of the illusion appeared to be equal. Each subject made

TABLE 6

STIMULUS SEQUENCE - TASK A

Group		Starting point for task A_{1a}, A_{2a}		Starting point for task A_{1b}, A_{2b}	
		longest point	shortest point	shortest point	longest point
E	1/2	7			
	1/2				7
C	1/2	7			
	1/2				7

Task Location: $\underline{A}_1 B_1 C_1 D_1 D_2 C_2 B_2 \underline{A}_2$

a total of four responses to the stimulus.

Task B

The stimulus for task B was a free-standing structure composed of layers of wood, which depicted the Ponzo illusion. A movable slat of wood caused the change in length of the vertical bar on the right. E used the form of the illusion employed by Sickels (1942). In that study, Sickels found the parameters for maximum strength of the illusion with an angle of 40 degrees. In a pilot study, E found a difference significant only at the .10 level (Student's t, one-tailed test) for greater error when the illusion opened to the right rather than to the left. However, this was sufficient to justify construction of the stimulus opening to the right. E, therefore, constructed the stimulus according to the parameters for maximum strength reported by Sickels (1942) and opening to the right (Figure 2).

Unlike the stimuli for tasks A and C, the amount of movement of the slide did not equal the amount of change in length of the vertical bar on the right. A movement of 2.5 cm according to the scale on the reverse side of the stimulus caused a change in bar length of 0.5 cm. Therefore, the experimenter moved the slat in discrete units of 2.5 cm. E moved the slat left to lengthen and right to shorten the vertical bar. The two counterbalanced sequences given each subject were identical. The presentation within each sequence was like task A, with half of each group seeing the variable bar at its longest

point first in the two presentations within each sequence and half seeing it at its shortest point first. As with task A, the pilot study and the characteristics of the apparatus determined the starting point for each direction. Employing the method of ascending and descending limits, E moved the slat at a rate of one unit per second (2.5 cm movement of slat, equaling 0.5 cm change in length of the vertical bar). Table 7 illustrates the stimulus sequence.

Green fluorescent tape formed the lines of the illusion on a black background. The method of presentation was equivalent to that of task A. E asked subjects to say "stop" when the vertical bar on the right was equal in length to the vertical bar on the left.

The response variable was the point at which the two vertical bars in the stimulus appeared to be equal. Each subject made a total of four responses to the stimulus.

Task C

The stimulus for task C depicted the Poggendorff illusion and was similar in construction to those of tasks A and B. The movable slat caused the slanted bar on the right to move up or down. E used the form and ratio of dimensions employed by Leibowitz and Gwozdecki (1967) and Parrish, Lundy, and Leibowitz (1968). Unlike those studies, however, in the veridical position the slanted bars did not have their endpoints at the same horizontal level as the endpoints of the two bars forming the central area. E modified this

TABLE 7

STIMULUS SEQUENCE - TASK B

Group		Starting point for task B_{1a}, B_{2a}		Starting point for task B_{1b}, B_{2b}	
		largest point	smallest point	smallest point	largest point
E	1/2	7			
	1/2				7
C	1/2	7			
	1/2				7

Task Location: $A_1 \underline{B}_1 C_1 D_1 D_2 C_2 \underline{B}_2 A_2$

aspect to prevent subjects from using the level of the end-points as a direct cue. In a pilot study, E found no significant difference in magnitude of error (Student's t) between employing the slanted bar on the left or that on the right as the variable bar. E made the slanted bar on the right variable to be consistent with the stimuli of tasks A and B and with the studies cited above. Figure 3 gives the stimulus dimensions.

E moved the slat to the right to lower and to the left to raise the position of the slanted bar. E presented the counterbalanced sequences and the two presentations within each sequence in the same fashion as she presented them in tasks A and B, with half of each group seeing the variable bar at its highest point first within each sequence and half seeing it at its lowest point first within each sequence. As with tasks A and B, the pilot study and the characteristics of the apparatus determined the starting point for each direction. Again employing the method of ascending and descending limits, E moved the slat at the rate of one unit per second (one unit equaled 0.5 cm). Since 0.5 cm was the limit of accuracy for the stimulus this was the smallest increment of movement which could logically be employed. Table 8 illustrates the stimulus sequence.

Green fluorescent tape formed the lines of the illusion on a black background. The method of presentation was equivalent to that of tasks A and B. E asked subjects to say "stop"

TABLE 8

STIMULUS SEQUENCE - TASK C

Group		Starting Point for task C_{1a}, C_{2a}		Starting Point for task C_{1b}, C_{2b}	
		highest point	lowest point	lowest point	highest point
E	1/2	7			
	1/2				7
C	1/2	7			
	1/2				7

Task Location: $A_1B_1\underline{C}_1D_1D_2\underline{C}_2B_2A_2$

when the slanted bar on the right appeared to be a continuation of the slanted bar on the left.

The response variable was the point at which the two slanted bars appeared to be part of one continuous line which disappeared behind the central area between the two vertical bars and reappeared on the other side. Each subject made a total of four responses to the stimulus.

Task D

The stimuli for task D consisted of seven sequenced figures. Beginning at the extreme of least information, each stimulus after the first in the sequence introduced a new secondary (or environmental) cue to depth and thus contained more depth information than the previous one. The task was presented in the form of a 7 X 7 Latin square. A different sequence was used for each of the two presentations in the counterbalanced order. Table 9 illustrates the task design.

The stimuli were constructed on boards painted black. The horizontal lines in each figure were constructed of green fluorescent tape. The triangles were constructed of green or orange fluorescent poster board. E asked subjects to give a quantitative judgment of depth for each figure using a scale of 0 to 5, with 0 indicating no impression of depth and 5 indicating a strong impression of depth.

The response variable was the quantitative judgment of depth perceived in each two-dimensional array. The stimulus sequence in terms of amount of depth information is illustrated

TABLE 9

STIMULUS SEQUENCE - TASK D

N		Order of presentation						
		first	second	third	fourth	fifth	sixth	seventh
E	C							
2	2	1	3	6	4	5	7	2
2	2	6	4	3	2	1	5	7
2	2	2	5	7	1	4	3	6
2	2	4	7	2	5	3	6	1
2	2	5	6	1	3	7	2	4
2	2	3	2	4	7	6	1	5
2	2	7	1	5	6	2	4	3

Task Location: A_1 B_1 C_1 $\underline{D}_1$ $\underline{D}_2$ C_2 B_2 A_1

Board number	Cues employed
1	None
2	1 + linear perspective
3	2 + density gradient
4	3 + texture gradient
5	4 + relative size
6	5 + interposition
7	6 + warm vs. cool colors

in Figure 4.

The subjects were seated in room #1 and instructed by tape recorder to meditate or relax for 20 minutes. Each subject was alone in the room and the room was dark. At the end of this period they were given general instructions after which the task sequence began. The shutter was raised at a specific point after each set of instructions began. After the session subjects went to another room for a second study involving the same groups and an electromyograph (EMG). This second study functioned as a manipulation check on the study discussed here. After the second study the subjects filled out a questionnaire (Forms A-III and B-III) concerned with recent experience, experience during the session, and experience with the stimuli. After this was completed, subjects were debriefed concerning the purpose of the study.

Instructions to Subjects

Before coming to the experiment each subject was told that this was an experiment in relaxation. He was asked the questions necessary to determine if he met the basic subject criteria and was given Forms A-I and A-II (experimental group) or Forms B-I and B-II (control group). Upon arrival at the experimental setting, the person was taken to room #1 and asked to sit down in the chair; he was introduced to the speaker, microphone, and intercom and told that he would a) meditate or b) relax for 20 minutes, after which he would be asked

questions about some things which he would see through the window. He was told that he would see the same things again. The following are the instructions which were given by tape recorder after this point. The shutter was down during instructions until the point noted. The points at which the shutter was raised are indicated by an asterisk; the shutter was lowered after each response. The bracketed and indented sections describe what occurred between and within each set of instructions. The instructions are arranged in two columns where the instructions for the two groups differ.

C control	E experimental
THIS EXPERIMENT IS CONCERNED WITH RELAXATION. DURING THE NEXT TWENTY MINUTES YOU WILL	
RELAX	MEDITATE
AFTER WHICH YOU WILL BE ASKED QUESTIONS ABOUT SEVERAL THINGS WHICH YOU WILL SEE THROUGH THE WINDOW IN FRONT OF YOU. YOU WILL RECEIVE ADDITIONAL INSTRUCTIONS AT THE APPROPRIATE TIME. FOR THE NEXT TWENTY MINUTES YOU ARE TO	
RELAX	MEDITATE
SIT COMFORTABLY AND CLOSE YOUR EYES BUT DO NOT GO TO SLEEP AND DO NOT LEAVE THE CHAIR. AT THE END OF THE PERIOD I WILL TELL YOU TO OPEN YOUR EYES. THEN THERE WILL BE A COUPLE OF MINUTES BEFORE THE NEXT INSTRUCTIONS. ARE THERE ANY QUESTIONS?	
Stop tape to answer any questions; questions will be answered by intercom.	
YOU MAY BEGIN.	

20 minute period

SLOWLY OPEN YOUR EYES.

2 minute period

RELAX AND REMAIN IN THE CHAIR. LOOK AT THE WINDOW IN FRONT OF YOU. YOU WILL SEE SEVERAL DIFFERENT THINGS THROUGH THE WINDOW. BEFORE EACH TASK YOU WILL BE GIVEN INSTRUCTIONS. RESPOND LOUDLY AND CLEARLY TO ANY QUESTIONS. ARE YOU READY?

The tasks begin at this point.

IN THIS PART YOU WILL BE SHOWN ONE FIGURE. (*) THE RIGHT SIDE OF THE FIGURE WILL CHANGE IN LENGTH. WHEN THE RIGHT HALF OF THE FIGURE BETWEEN THE ARROWHEADS APPEARS EQUAL IN LENGTH TO THE LEFT HALF BETWEEN THE ARROWHEADS, SAY "STOP". ARE THERE ANY QUESTIONS?

pause

ARE YOU READY?

pause
task A_{1a}

AGAIN, (*) WHEN THE RIGHT HALF OF THE FIGURE BETWEEN THE ARROWHEADS APPEARS EQUAL IN LENGTH TO THE LEFT HALF BETWEEN THE ARROWHEADS, SAY "STOP".

task A_{1b}

IN THIS PART YOU WILL SEE A SINGLE FIGURE. (*) THE VERTICAL BAR ON THE RIGHT WILL CHANGE IN LENGTH. WHEN THE VERTICAL BAR ON THE RIGHT IS EQUAL IN LENGTH TO THE VERTICAL BAR ON THE LEFT, SAY "STOP". ARE THERE ANY QUESTIONS?

pause

ARE YOU READY?

pause
task B_{1a}

AGAIN, (*) WHEN THE VERTICAL BAR ON THE RIGHT IS EQUAL IN LENGTH TO THE VERTICAL BAR ON THE LEFT, SAY "STOP".

task B_{1b}

THIS PART CONSISTS OF ONE FIGURE. (*) THE SLANTED BAR ON THE RIGHT WILL CHANGE IN POSITION. SAY "STOP" WHEN THE SLANTED BAR ON THE RIGHT APPEARS TO BE A CONTINUATION OF THE SLANTED BAR ON THE LEFT. WHEN YOU SAY "STOP" THE TWO SLANTED BARS SHOULD APPEAR TO BE PART OF ONE SLANTED LINE WHICH DISAPPEARS BEHIND THE CENTRAL AREA BETWEEN THE TWO VERTICAL BARS AND REAPPEARS ON THE OTHER SIDE. ARE THERE ANY QUESTIONS?

pause

ARE YOU READY?

pause
task C_{1a}

AGAIN, (*) SAY "STOP" WHEN THE SLANTED BAR ON THE RIGHT APPEARS TO BE A CONTINUATION OF THE SLANTED BAR ON THE LEFT.

task C_{1b}

IN THIS PART YOU WILL BE SHOWN A SERIES OF FIGURES. ON A SCALE OF ZERO TO FIVE, MAKE A JUDGMENT OF THE STRENGTH OF THE DEPTH EFFECT GIVEN BY THE FIGURE. A JUDGMENT OF ZERO MEANS THAT THE FIGURE GIVES NO IMPRESSION OF DEPTH AT ALL. A JUDGMENT OF FIVE MEANS THAT THE FIGURE GIVES A STRONG IMPRESSION OF DEPTH. TRY TO MAKE EACH JUDGMENT INDEPENDENT OF PRIOR JUDGMENTS. YOU MAY USE ANY NUMBER BETWEEN ZERO AND FIVE

AND A NUMBER MAY BE USED MORE THAN ONCE. YOU MAY RESPOND AS SOON AS YOU SEE EACH FIGURE. ARE THERE ANY QUESTIONS?

pause

ARE YOU READY?

pause (*)
task D_1

At this point, the tasks are repeated in reverse order: D_2, C_{2a}, C_{2b}, B_{2a}, B_{2b}, A_{2a}, A_{2b}. The instructions are the same.

THE EXPERIMENT IS NOW OVER. THE EXPERIMENTER WILL BE WITH YOU IN A MINUTE.

CHAPTER III

RESULTS

Tables 10 through 14 summarize the means for each group on each task. For tasks A through C, the tables give the means of each group for the direction of change of the variable part of the stimulus. For all tasks, the tables give the means of each group for first and second presentations.

Collapsing the data across direction of change and order of presentation, E used the Mann-Whitney U test (Siegel, 1956) to test the significance of differences between the experimental and control groups on each task. There were no significant differences between the two groups on any of the four tasks. The direction of difference between the two groups, however, was the same for all tasks; in each case the experimental group had a lower mean score, indicating less error in judgment. Employing the Mann-Whitney U test on the sum of the ranks across all tasks for each subject, E tested the significance of the difference between the groups collapsing across tasks. The difference was significant at $p < .05$ ($U=52$, $n_E=n_C= 14$, two-tailed).

Collapsing across groups and order of presentation, E used the Wilcoxon matched-pairs signed-ranks test (Siegel, 1956) to test the significance of differences on tasks A through C between the two directions of change of the variable part of

TABLE 10

SUMMARY OF STATISTICS - TASK A

Muller-Lyer Illusion	Direction of Presentation Starting at Indicated Extreme		Order of Presentation			Task	
Group	Shortest	Longest	First	Second	Significance	Mean	Significance
E	-34.29	-14.11	-27.50	-20.18	P 0.01	-24.20	N.S.
C	-37.50	-14.23	-27.12	-24.23	N.S.	-25.67	
$\bar{X}$	-35.90	-14.17	-27.31	-22.20			
Significance (Collapsing E & C)	$p < 0.00003$		$p < 0.01$				

TABLE 11

SUMMARY OF STATISTICS - TASK B

Ponzo Illusion Group	Direction of Presentation Starting at Indicated Extreme Largest	 Smallest	Order of Presentation First	 Second	Task Mean	 Significance
E	11.50	8.11	9.54	10.07	9.80	N.S.
C	15.73	7.27	10.92	12.08	11.50	
$\bar{x}$	13.62	7.69	10.23	11.08		
Significance (Collapsing E & C)	$p < 0.00003$		N.S.			

TABLE 12

SUMMARY OF STATISTICS - TASK C

Poggendorff Illusion	Direction of Presentation Starting at Indicated Extreme		Order of Presentation		Task	
Group	Lowest	Highest	First	Second	Mean	Significance
E	-23.57	-9.46	-16.61	-16.43	-16.52	N.S.
C	-26.15	-10.00	-18.46	-16.92	-17.69	
$\bar{x}$	-24.86	-9.73	-17.54	-16.68		
Significance (Collapsing E & C)	$p < 0.00003$		N.S.			

TABLE 13

SUMMARY OF STATISTICS - TASK D

Depth Cues	Order of Presentation			Task	
Group	First	Second	Significance	Mean	Significance
E	3.26	3.24	N.S.	3.25	N.S.
C	3.50	3.42	N.S.	3.46	
$\bar{x}$	3.38	3.33			
Significance (Collapsing E & C)	N.S.				

TABLE 14

GRAND MEANS AND TOTAL RANKS

Groups	TASKS				Total Ranks
	Muller-Lyer	Ponzo	Poggendorff	Depth Cues	
E	-24.20	9.80	-16.52	3.25	713
C	-25.67	11.50	-17.69	3.46	911
Significance	N.S.	N.S.	N.S.	N.S.	$p < 0.05$

the stimulus (Table 15). For each of the three tasks involving geometric illusions, the differences were significant beyond the .00006 level ($T_A = 0$, $T_B = 21$, $T_C = 0$, $N_A = 28$, $N_B = N_C = 27$, two-tailed). In each case, the direction of change having the greater error had its starting point in the direction of the perceptual error. For example, in task A, movement of the slat beginning at the shortest point produced the greater error, and the movable side of the illusion tends to be underestimated.

Collapsing across groups and direction of change, E used the Wilcoxon test to test the significance of differences between the first and second presentations of each task (Table 16). The difference between the presentations was significant at the .01 level for the Müller-Lyer illusion, with the greater error during the first presentation ($T = 37$, $n = 25$, two-tailed) and insignificant for the other tasks. Testing separately the data for each group on the Müller-Lyer illusion, the experimental group showed a significantly greater error during the first presentation ($T = 1.5$, $n = 13$, p .01, two-tailed) and the control group did not (Table 10).

Concerning drug history (Table 17), the experimental group showed a significant decrease in drug use between the period prior to initiation into Transcendental Meditation and the period since initiation (Wilcoxon test, $T = 4$, $n = 9$, $p < .025$, one-tailed). The control group did not show a significant difference in drug use between the period prior

TABLE 15

EFFECT OF DIRECTION OF PRESENTATION

Illusion	Direction of Presentation: Starting Point in Direction of Illusion	Direction of Presentation: Starting Point in opposite Direction of Illusion	Significance
Müller-Lyer	-35.90	-14.17	$p < 0.00006$
Ponzo	13.62	7.69	$p < 0.00006$
Poggendorff	-24.86	-9.73	$p < 0.00006$

TABLE 16

EFFECT OF ORDER OF PRESENTATION

Task	Order of Presentation: First	Order of Presentation: Second	Significance
Müller-Lyer	-27.31	-22.20	$p < 0.01$
Ponzo	10.23	11.08	N.S.
Poggendorff	-17.54	-16.68	N.S.
Depth Cues	3.38	3.33	N.S.

TABLE 17

DRUG HISTORY OF GROUPS

Group	TIME PERIOD			
	Earlier[1]	Later[2]	Significance	Last 24 Hours
E	5.82	3.27	$p < 0.025$	0.38
C	2.50	3.17	N.S.	1.15
Significance	$p < 0.01$	N.S.	--[3]	N.S.

Notes: 1 E: before initiation into TM
C: prior to past 18 months

2 E: since initiation into TM
C: past 18 months

3 Testing E_{later} Vs. $C_{earlier}$: N.S.

to the past 18 months and the period encompassed by the past 18 months. The experimental group showed a significantly greater drug involvement than the control group for the earlier period of the drug history (Mann-Whitney U test, U = 19, n_E = 11, n_C = 12, $p < .01$, one tailed). The experimental group showed no significant difference from the control group for the more recent period of the drug history. In addition, the experimental group since initiation showed no significant difference from the control group during the period prior to the past 18 months. There was no significant difference between the two groups in drug usage during the 24 hours prior to the session, although the difference approached significance at $p < .05$ (Mann-Whitney U test, U = 52.5, $n_E = N_C$ = 13, one-tailed). The meditators indicated such recent involvement with two classes on the list: alcohol and caffeine. The non-meditators indicated such recent involvement with five classes: alcohol, caffeine, marijuana, nicotine, and tranquilizers.

Concerning prior experience with the tasks (Table 18), the two groups showed no significant differences in prior experience on any of the tasks. For each group, the experience with the Müller-Lyer illusion was significantly greater than with any other task (E: $T_{AB} = T_{AC} = T_{AD} = 0$, n_{AB} = 11, $n_{AC} = n_{AD}$ = 10; C: $T_{AB} = T_{AC} = 0$, $T_{AD} = 2$, n_{AB} = 7, n_{AC} = 6, n_{AD} = 11, $p < .005$, one-tailed).

On Forms A-III or B-III, subjects rated themselves on

TABLE 18a

GROUPS' MEAN EXPERIENCE WITH TASKS

	TASKS				
Group	Müller-Lyer Illusion	Ponzo Illusion	Poggendorff Illusion	Depth Cue Illusions	Significance
E	3.07	1.79	1.64	1.64	N.S.
C	2.62	1.77	1.92	1.46	
Significance	N.S.	N.S..	N.S.	N.S.	

TABLE 18b

COMPARISON OF MÜLLER-LYER

WITH OTHER TASKS : EXPERIENCE

Group	Significance of Müller-Lyer Illusion Vs.		
	Ponzo Illusion	Poggendorff Illusion	Depth Cue Illusions
E	$p < 0.005$	$p < 0.005$	$p < 0.005$
C	$p < 0.005$	$p < 0.005$	$p < 0.005$

their general level of relaxation and on level of relaxation during the session using a five-point scale, with one indicating very tense and five indicating very relaxed (Table 19). Studies by Braud and Braud (1974) indicate a high correlation between subjects' self-judgment of physical state and actual physical state as measured by EMG. Thus, subjects' self-ratings of level of relaxation were employed as a manipulation check in the current study. The experimental group showed a significantly higher rating for both judgment of general level of relaxation and level of relaxation during the study (Mann-Whitney U test, $U = 43$, $U = 46.5$, $n_E = n_C = 14$, $p < .01$, one-tailed).

TABLE 19

SUMMARY OF STATISTICS :

SELF-RATING ON LEVEL OF RELAXATION

Self-Rating of Level of Relaxation		
Group	In General	During Session
E	4.07	4.29
C	3.00	3.31
Significance	$p < 0.01$	$p < 0.01$

CHAPTER IV

DISCUSSION

Although the difference between the experimental and control groups was not significant for any one task, the overall difference was significant. A replication of the study should involve larger subject groups; if the difference is real, larger subject groups would eventually yield significant results on one or more of the tasks.

Besides the overall level of significance, the fact that the meditator group consistently differed in the same direction from the non-meditator group suggests some effect of meditation on the mechanism or mechanisms underlying all of the tasks. Each task involves a conflict between the veridical aspects of the stimuli and the mechanisms of perceptual processing. If the Deikman (1966b) theory is valid, the results suggest a mechanism of perceptual development which would increase efficiency of information processing at the price of misinterpretation of stimulus relations in some cases--those phenomena which are called illusions. Higher level differentiations would occur with development and experience which would serve to filter out certain stimuli and emphasize others; thus, with development, the organism would process this theoretically more important information in a more efficient manner. The more efficient system, however, would lead to misinterpretation of certain information under

certain conditions. Within this theory, illusions function as results of an adaptive and efficient information processing system. The specific information they convey is not as vital to the organism as certain other information whose most efficient processing conflicts with a veridical perception of the illusory phenomena. The relationship between the illusion tasks and the depth cue task could exemplify this, assuming the validity of the misplaced constancy explanation for the illusions (Gregory, 1966). The mechanism which underlies the organization of depth information in a two-dimensional array causes the misinterpretation of stimulus relations seen in the illusions. Continuing in this theoretical framework, meditation causes a breakdown of these higher level differentiations which results in a more veridical perception of what is, under normal waking consciousness, an illusory situation.

The studies cited in the first chapter suggest that meditation is a state of deep relaxation. Wallace, Benson, and Wilson (1971) report that the physiological changes induced by meditation characterize a wakeful hypometabolic state. Blasdell (cited in Kanellakos and Lukas, 1974) found that practitioners of TM performed faster and more accurately than non-meditators on mirror tracing. Kolb (cited in Kanellakos and Lukas, 1974) found that practitioners had a faster reaction time after a period of meditation than before. These and other studies demonstrating improved

functioning in areas generally considered adaptive imply that the TC-state has a functional role. The necessity of sleep for optimal functioning during the waking state suggests a functional relationship between those two states of consciousness. The TC-state appears to have a similar relationship with the waking state. Extending this to the theory discussed above, the state of perceptual de-automatization may be a "rest phase" leading to more efficient perceptual processing in the waking state.

The consistent direction across tasks of the difference between the groups conflicts with the developmental studies cited previously. One possible explanation is that the children tested were beyond the early levels of perceptual development. The differential direction of change could imply differential development of the specific organizations underlying each illusion. A second explanation is that children at the young ages tested may not have understood the tasks.

The decreased usage of drugs since initiation into TM supports the findings of Benson and Wallace (1970) and others (Kanellakos and Lukas, 1974). The comparison of the experimental group with the control group reveals that the meditators involved in the study tend to have been heavier drug users before initiation than the control subjects either prior to or during the past 18 months. The drug histories of the meditators since initiation more closely resemble the drug histories of the non-meditators. Because of the dearth

of information about long or even short term drug effects, and because of the possible personality differences suggested by the differing drug histories in spite of controls, these results should be considered in any assessment of the results of this study.

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FOOTNOTE

FOOTNOTE

1 Due to the failure of several control subjects to show for the experiment, a statistical subject was used as the fourteenth subject in the control group. In each case, this subject's scores were the mean of the scores for the rest of the control group.

APPENDIX

Form A-I

No. _____

June, 1975

University of Houston
Psychology Dept.
J. L. Hartgrove

The following questionnaire is being administered as part of a study being conducted through the Psychology Department at the University of Houston. Do not put your name on the questionnaire (Form A-I). The completed questionnaire will be identified by a number which will be cross-referenced with Form A-II. Only the directors of the study will see the completed questionnaires. The questionnaires will be kept strictly confidential and will be destroyed after the study is completed. To help you with part C, a list of drug categories and some of the specific drugs which fall into each is given.

PART A. GENERAL BACKGROUND

Age _____

Education (Check if completed. If not, give number of semesters completed).

high school _____

undergraduate college _____ major _____

graduate school _____ degrees _____

other (specify) _____

Occupation _____

How long have you been meditating? _____ years _____ months

NOTES ON PARTS B AND C

1. Place checks under "yes" or "no" columns as appropriate.
2. "Prescribed" means prescribed by a medical or paramedical person.
3. The "average usage" section is divided into two columns. The first column concerns your involvement with each item before initiation into TM. The second column concerns your involvement since initiation into TM. You may use the "comments' column for any more specific comments you wish to make on degree or type of involvement or changes in involvement which may not be reflected by the before-after initiation division.
4. In the "average usage' columns, a number is sufficient if you respond in terms of times per month. In some cases, times per month is impractical, so specify the time period which applies (for example, 2 times per year, 10 times per day, once.)

Form A-I, p.2 B. techniques	yes	no	prescribed (check if yes)	length of time of involvement	average usage before initiation into TM	average usage since initiation into TM	Comments:
relaxation (Muscular, progressive, systematic, fractional, etc.)							
autogenic training							
hypnosis							
Silva							
Alpha-Dynamics							
ARE							
other mind control techniques Specify: _____							
_____							
formal meditation techniques Specify: _____							

Form A-I, p.3 C. drugs	yes	no	prescribed (check if yes)	length of time of involvement	average usage before initiation into TM	average usage since initiation into TM	Comments:
alcohol							
amphetamines							
antidepressants							
barbiturates							
caffeine							
cocaine							
hallucinogenic drugs							
inhalants							
marijuana							
muscle relaxants							
narcotics							
nicotine							
tranquilizers							

DRUG CATEGORIES

alcohol

- beer
- distilled spirits
- wine

amphetamines

- Benzedrine
- Dexedrine
- Methedrine
- Preludin

antidepressants

- Elavil
- Ritalin
- Tofranil

barbiturates

- chloral hydrate
- Doriden
- Nembutal
- Phenobarbital
- Seconal

caffeine

- coffee
- cola
- No-Doz
- tea

cocaine

- cocaine

hallucinogenic drugs

- DMT
- LSD
- mescaline
- nutmeg
- psilocybin
- scopolamine
- STP

inhalants

- aerosols (Freon)
- airplane glue
- amyl nitrite
- nitrous oxide

marijuana (cannabis)

- hashish
- marijuana
- THC

muscle relaxants

- Librium
- Valium
- Soma

narcotics

- codeine
- Demerol
- heroin
- Methadone
- morphine
- opium
- Percodan

nicotine

- chewing tobacco
- cigarettes
- cigars
- pipes
- snuff

tranquilizers

- Librium
- Meprobamate
- Miltown/Equanil
- Thorazine
- Quaalude

Form A-II No. _____

If you were to be called to participate in other parts of this project would you be willing to participate? The other parts would involve the following:

1. You would need to come to the University of Houston to participate. The time and date will be set at your convenience (day, night, week-ends), but the study will be completed as soon as possible. Those involved in the study will try to give you any transportation help you might need.
2. The other parts of the project are concerned with relaxation and should take a maximum of two hours.

Are you willing to be called concerning these parts of the study? Yes____ No ____

If yes, please give the following information:

Name _____
(If you wish, you may leave out your last name if phone contacts can be made without it.)

Phone- day _____

night _____

Form A-III

No.
Hartgrove-Kemp Project

How were your meditations during these two sessions?

first session _____

_____

_____

_____

second session _____

_____

_____

_____

Previous to the two sessions within which you have just meditated, when was the last time you meditated?_____

_____

On a scale of one to five, how would you rate yourself on the following items? Circle the appropriate number.

one = very tense five = very relaxed

In general, how would you describe yourself?

1 2 3 4 5

How would you describe yourself during these sessions?

first session 1 2 3 4 5

Have you had any stressful experience recently? _____

_____

Are you anticipating any stressful situation in the near future? _____

Were any aspects of the experiment stressful for you? _____

_____

Have you had any other experience with experiments? _____

_____

Form A-III, p.2

How long have you been meditating? years_____ months _____

Are you a teacher of TM? _____ How long? _____

checker? _____ How long? _____

How long do you usually meditate? _____

Have you attended any advanced courses? _____

How many? _____

Have you received any advanced techniques? _____

Which ones?

Form A-III, p.3

During the first session you were shown several things. For each one illustrated below, check the columns which most accurately describe your prior experience with that particular item.

	no experience	seen once or twice	seen several times	have some knowledge of this from reading or talks
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
the moving object	_____	_____	_____	_____

Have you ever had any ESP experiences? _____

If yes, when did it/they occur and what was the nature of the/each experience?

_____

_____

_____

_____

_____

Form A-III, p.4

DRUG USE DURING THE LAST 24 HOURS

Drugs	yes	no	prescribed (check if yes)	number of hours ago taken
alcohol				
amphetamines				
antidepressants				
barbiturates				
caffeine				
cocaine				
hallucinogenic drugs				
inhalants				
marijuana				
muscle relaxants				
narcotics				
nicotine				
tranquilizers				

Form B-I

No. _____

June, 1975

University of Houston
Psychology Dept.
J. L. Hartgrove

The following questionnaire is being administered as part of a study being conducted through the Psychology Department at the University of Houston. Do not put your name on the questionnaire (Form A-I). The completed questionnaire will be identified by a number which will be cross-referenced with Form A-II. Only the directors of the study will see the completed questionnaires. The questionnaires will be kept strictly confidential and will be destroyed after the study is completed. To help you with part C, a list of drug categories and some of the specific drugs which fall into each is given.

PART A. GENERAL BACKGROUND

Age _____

Education (Check if completed. If not, give number of semesters completed).

high school _____

undergraduate college _____ major _____

graduate school _____ degrees _____

other (specify) _____

Occupation _____

How long have you been meditating? _____ years _____ months

NOTES ON PARTS B AND C

1. Place checks under "yes" or "no" columns as appropriate.
2. "Prescribed" means prescribed by a medical or paramedical person.
3. The "average usage" section is divided into two columns. The first column concerns your involvement with each item before initiation into TM. The second column concerns your involvement since initiation into TM. You may use the "comments' column for any more specific comments you wish to make on degree or type of involvement or changes in involvement which may not be reflected by the before-after initiation division.
4. In the "average usage' columns, a number is sufficient if you respond in terms of times per month. In some cases, times per month is impractical, so specify the time period which applies (for example, 2 times per year, 10 times per day, once.)

Form B-I, p.2 B. techniques	yes	no	prescribed (check if yes)	length of time of involvement	average usage: past 18 months	average usage: prior to past 18 months	Comments:
relaxation (Muscular, progressive, systematic, fractional, etc.)							
autogenic training							
hypnosis							
Silva							
Alpha-Dynamics							
ARE							
other mind control techniques Specify: _____							
_____							
formal meditation techniques Specify: _____							

Form B-I, p.3

C. drugs	yes	no	prescribed (check if yes)	length of time of involvement	average usage: prior to past 18 months	average usage: past 18 months	Comments:
alcohol							
amphetamines							
antidepressants							
barbiturates							
caffeine							
cocaine							
hallucinogenic drugs							
inhalants							
marijuana							
muscle relaxants							
narcotics							
nicotine							
tranquilizers							

DRUG CATEGORIES

alcohol

beer
distilled spirits
wine

amphetamines

Benzedrine
Dexedrine
Methedrine
Preludin

antidepressants

Elavil
Ritalin
Tofranil

barbiturates

chloral hydrate
Doriden
Nembutal
Phenobarbital
Seconal

caffeine

coffee
cola
No-Doz
tea

cocaine

cocaine

hallucinogenic drugs

DMT
LSD
mescaline
nutmeg
psilocybin
scopolamine
STP

inhalants

aerosols (Freon)
airplane glue
amyl nitrite
nitrous oxide

marijuana (cannabis)

hashish
marijuana
THC

muscle relaxants

Librium
Valium
Soma

narcotics

codeine
Demerol
heroin
Methadone
morphine
opium
Percodan

nicotine

chewing tobacco
cigarettes
cigars
pipes
snuff

tranquilizers

Librium
Meprobamate
Miltown/Equanil
Thorazine
Quaalude

Form B-II

No. _____

If you were to be called to participate in other parts of this project would you be willing to participate? The other parts would involve the following:

1. You would need to come to the University of Houston to participate. The time and date will be set at your convenience (day, night, week-ends), but the study will be completed as soon as possible. Those involved in the study will try to give you any transportation help you might need.
2. The other parts of the project are concerned with relaxation and should take a maximum of two hours.

Are you willing to be called concerning these parts of the study? Yes____ No ____

If yes, please give the following information:

Name _____
(If you wish, you may leave out your last name if phone contacts can be made without it.)

Phone- day _____

night _____

Form B-III No.
Hartgrove-Kemp Project

How was your relaxation during these two sessions?

first session _____

_____

_____

_____

second session _____

_____

_____

_____

On a scale of one to five, how would you rate yourself on the following items? Circle the appropriate number.

one = very tense five = very relaxed

In general, how would you describe yourself?

1 2 3 4 5

How would you describe yourself during these sessions?

first session 1 2 3 4 5

second session 1 2 3 4 5

Have you had any stressful experience recently? _____

_____

Are you anticipating any stressful situation in the near future? _____

Were any aspects of the experiment stressful for you?

_____

Have you had any other experience with experiments?

_____

Form B-III, p.2

During the first session you were shown several things. For each one illustrated below, check the columns which most accurately describe your prior experience with that particular item.

	no experience	seen once or twice	seen several times	have some knowledge of this from reading or talks
	____	____	____	____
	____	____	____	____
	____	____	____	____
	____	____	____	____
the moving object	____	____	____	____

Have you ever had any ESP experiences? _____

If yes, when did it/they occur and what was the nature of the/each experience?

_____

_____

_____

_____

_____

Form B-III, p.3

DRUG USE DURING THE LAST 24 HOURS

Drugs	yes	no	prescribed (check if yes)	number of hours ago taken
alcohol				
amphetamines				
antidepressants				
barbiturates				
caffeine				
cocaine				
hallucinogenic drugs				
inhalants				
marijuana				
muscle relaxants				
narcotics				
nicotine				
tranquilizers				

DATA COLLECTION FORM

Pre-subject check-list Group _____ No. _____
Date _____
Time began: _____
Time ended: _____

check all stimuli _____
tell people running Ss _____
turn on intercoms _____
turn on tape recorders _____
put on response tape _____
put on instruction tape and set beyond identifier _____ and to correct set of instructions _____
select correct presentation order for each task _____
fill in all order sections of this sheet _____
put depth cues in order for first presentation _____
set Muller-Lyer to correct position for first presentation _____
after S in room: put sign on doors of 626, 626A, and 626B _____

check UV light _____
fill in all extremes section of this sheet _____

Data

A_1 A_2

order:
longer-shorter/shorter-longer _____
shorter-longer/longer-shorter _____

extremes:
longest point _____ shortest point _____
first: _____

response: (+/- X mm)
1: _____mm 1: _____mm
2: _____mm 2: _____mm

questions:

comments:

B_1 B_2

order:
larger-smaller/smaller-larger _____
smaller-larger/larger-smaller _____

extremes:
largest point _____ shortest point _____
first: _____ _____

response:

1: $\frac{\text{--------cm X 10}}{5}$ + $\frac{\text{--------mm}}{a}$

$\frac{\text{--------mm}}{a}$ - 54mm = _____mm

2: $\frac{\text{--------cm X 10}}{5}$ = $\frac{\text{--------mm}}{a}$

$\frac{\text{--------mm}}{a}$ - 54mm = _____mm

1: $\frac{\text{--------cm X 10}}{5}$ = $\frac{\text{--------mm}}{a}$

$\frac{\text{--------mm}}{a}$ - 54mm = _____mm

2: $\frac{\text{--------cm X 10}}{5}$ = $\frac{\text{--------mm}}{a}$

$\frac{\text{--------mm}}{a}$ - 54mm = _____mm

questions:

comments:

C_1 C_2

order:
highest-lowest/lowest-highest _____
lowest-highest/highest-lowest _____

extremes:
highest point _____ lowest point _____
first: _____ _____

response: (+/- X mm)

1: _____mm 1: _____mm

2: _____mm 2: _____mm

questions:

comments: