INTELLIGENCE AND HIGHER STATES OF CONSCIOUSNESS: A LONGITUDINAL STUDY[i]

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When William James (1890) introduced the concept of consciousness into American psychology, he argued that beyond the range of normal waking consciousness there is the possibility of exceptional states of consciousness that are completely "discontinuous" with discursive thought. He argued that these heightened states of awareness could be induced under specifiable conditions, could influence thought and behavior profoundly, and could be adaptive for the individual. He challenged psychology to investigate these states scientifically.

The onset of the behaviorist revolution almost completely overshadowed this field of psychology (Hilgard, 1980). However, some groups of investigators continued to investigate these states, particularly the Jungian school (1956, 1960, 1980); Abraham Maslow (1968, 1977) and his school of humanistic psychology; and the movement known as transpersonal psychology (Grof, 1983; Rothberg, 1986; Sutich, 1976; Wilber, 1980). These experiences, called "peak experiences" by Maslow, have also been referred to as "transpersonal experiences," "flow," and others. Recently, a larger number of researchers have again begun to recognize and investigate these phenomena (e.g., Alexander, Davies, et al., in press; Alexander, Druker, & Langer, in press; Csikszentmihalyi, 1982; Hilgard, 1980; Hunt, 1989; Kramer, in press; Pascual-Leone, in press-a, in press-b; Pribram, 1986; Shapiro & Walsh, 1984; Wilber, Engler, & Brown, 1986).

James (1902/1960, p. 386) suggested that exceptional states could be systematically cultivated, and he pointed to the ancient Indian tradition of yoga as a source of such practices. He thus anticipated a promising research area: the experimental investigation of meditation and associated psychophysiological changes.

In 1957 Maharishi Mahesh Yogi introduced Transcendental Meditation (TM) as a simple mental technique derived from the Vedic tradition of India (Maharishi, 1963, 1969; 1972a). He proposed that through this procedure [Editors Note: See discussion by Charles Alexander in the Lucid Dreaming and Higher States of Consciousness Panel Discussion for a brief explanation of the procedure], a "fourth major state of consciousness" can be regularly experienced. This fourth state is referred to in Maharishi's Vedic psychology as transcendental consciousness (Maharishi, 1969; Orme-Johnson, 1988) because it is said to transcend or be discontinuous with the three

ordinary states of waking, dreaming, and sleep, as typically described conceptually and psychophysiologically (e.g., see Natsoulas's sixth definition of "normal" waking consciousness: 1983, p. 49; see also, Gackenbach, 1987; Rechtschaffen & Kales, 1968).

Transcendental consciousness is traditionally described as "pure" consciousness (Dillbeck, 1983; Maharishi, 1969) in that it is said to be experienced as a content-free, silent state of awareness, in which all mental activity is transcended and there are no localized boundaries of awareness. In this state the knower, the known, and the process of knowing are said to converge in one unified field of consciousness, in which subjects report a self-referral state of simply being aware of awareness itself (Alexander, Davies, et al., in press; Alexander, Langer, Newman, Chandler, & Davies, 1989). The following is a report of an experience of transcendental consciousness, provided by a subject:

> During the TM technique my mind settles down, thoughts become less, and then suddenly all thought activity ceases and I slip into a state of awareness which is pure, perfectly peaceful, wide awake, and infinitely extended beyond space and time. Simultaneously my body settles down, breathing becomes nil and I feel relaxed.

A series of studies on long-term meditators (Badawi, Wallace, Orme-Johnson, & Rouzere, 1984; Farrow & Hebert, 1982) found that experiences of pure consciousness (as indicated by subsequent button press during TM) are highly correlated with enhanced bilateral and homolateral alpha electroencephalographic (EEG) phase coherence in frontal and central regions (suggestive of heightened alertness), virtual respiratory suspension without compensatory hyperventilation, decreased heart rate, stable phasic Galvanic Skin Response (GSR), and heightened basal GSR, indicating a quiescent physiological condition. These and earlier studies led researchers to propose that during TM, deep rest and heightened awareness are experienced as complementary aspects of a state of "restful alertness," which is especially distinct during reported subperiods of pure consciousness (Alexander, Cranson, Boyer, & Orme-Johnson, 1987: Wallace, 1970).

Transcendental Consciousness as the Basis of Higher States of Consciousness

Maharishi's Vedic psychology proposes that repeated experience of transcendental consciousness through regular practice of the TM technique and the more advanced TM-Sidhi techniques, in alteration with daily activity, fosters growth of higher states of consciousness beyond the ordinary endpoint of human development (Alexander et al., 1989; Maharishi, 1963, 1969; Orme-Johnson, 1989) The TM and TM-Sidhi programs are said to promote neutralization of accumulated stress in the nervous system and refine mental and physiological functioning, giving rise to a new style of functioning

that is capable of sustaining transcendental consciousness along with the waking, dreaming, and deep sleep states (Alexander, Davies, Dillbeck et al., 1989; Maharishi, 1972; Wallace, 1986). In this experience, called witnessing, transcendental consciousness becomes a silent, uninvolved witness to mental processes (Alexander et al., 1987; Gelderloos & Van den Berg, 1989; Maharishi, 1969; Orme-Johnson, 1988)

The following is a typical experience of witnessing the state of deep sleep (Cranson, 1989a):

> Often during deep sleep I am awake inside. It's a very restful, peaceful state -- a state of bliss, unboundedness. My body is asleep and inert, breathing goes on regularly and mechanically, and inside I am just aware that I am.

Development of a permanent style of physiological functioning that spontaneously maintains witnessing at all times during the three ordinary states of consciousness defines the fifth state of consciousness, termed cosmic consciousness in Maharishi's Vedic psychology (Alexander et al., 1987; Maharishi, 1969, 1972b; Orme-Johnson, 1988). Cosmic consciousness (CC) is traditionally described as a state of unshakeable inner peace and self-realization in which individual awareness remains permanently identified with the unbounded silence of pure consciousness (Dillbeck, 1983; Maharishi, 1969, 1972b).

The realization of this higher state of consciousness is also referred to as the integration of personality, in which the innermost Self, pure consciousness, is experienced together with the contents of the mind and senses (Maharishi, 1963, 1969). Cosmic consciousness is said to be a state of inner freedom, of maximum creativity and intelligence, maximum capacity to love, ideal social behavior, and perfect health (Cranson, 1989b; Maharishi Mahesh Yogi, 1963, 1969, 1972b).

Witnessing the state of deep sleep is considered the most unambiguous subjective indicator of the growth of cosmic consciousness (Maharishi Mahesh Yogi, 1969, 1972a; Alexander et al., 1987). In previous research conducted on the student population at Maharishi International University (MIU), subjects who practiced the TM and TM-Sidhi program for several years reported clear experiences of witnessing deep sleep. In several student samples, more than 80 percent of the subjects reported having had the experience at least once, and in one study 7.7 percent reported having it regularly (Dillbeck & Orme-Johnson, in press; Gackenbach, Cranson, & Alexander, 1986). In a longitudinal study by Alexander (1982), frequency of witnessing sleep increased in TM practitioners versus wait-list controls and non-meditators. The study used a broad measure of higher states of consciousness, rather than focusing on witnessing sleep. To date no other controlled longitudinal research has been conducted to verify longitudinal

increases in frequency of witnessing sleep.

Several studies indicate significant correlations between frequency of witnessing deep sleep and higher performance on a wide range of physiological, personality, and cognitive-perceptual measures (Alexander, C.N., Boyer, and Alexander, V.K., 1987), including non-verbal intelligence, principled moral reasoning, and academic achievement (Nidich, Ryncarz, Abrams, Orme-Johnson, & Wallace, 1983); creativity (Orme-Johnson & Granieri, 1977; Orme-Johnson & Haynes, 1981; Vogelman, 1978); faster recovery of the H-reflex, and increased efficiency of concept learning (Dillbeck, Orme-Johnson, & Wallace, 1981). Furthermore, several longitudinal studies indicate improvements in IQ scores (Aron, Orme-Johnson, & Brubaker, 1981; Dillbeck, Assimakis, Raimondi, Orme-Johnson, & Rowe, 1986; Shecter, 1978), creativity (Shecter, 1978; Travis, 1979), and simple reaction time (Appelle & Oswald, 1974), and choice reaction time (Holt, Caruso, & Riley, 1978) among practitioners of the TM and TM-Sidhi programs. However, to date there have been no longitudinal studies linking growth of higher states of consciousness with improved cognitive performance, specifically intelligence and choice reaction time measures. At the same time, conventional efforts to improve such cognitive abilities through teaching of problem-solving strategies and learning skills in the ordinary waking state have been on the whole disappointing or inconclusive (Brody, 1985; Caruso, Taylor, & Detterman, 1982; Jensen, 1969, 1988; Royce, Darlington & Murray, 1983; Spitz, 1986).

Some investigators have expressed skepticism that higher states of consciousness achieved through TM are truly more adaptive than the three ordinary states of consciousness (Holmes, 1984; Smith, 1976). Other studies employing quantitative meta-analysis to statistically compare the effects of TM with other techniques and control conditions provided evidence contradicting these arguments (Dillbeck & Orme-Johnson, 1987; Eppley, Abrams, & Shear, 1989; Ferguson, 1981).

The present study attempted to address the above issues by measuring practitioners of the TM and TM-Sidhi program on frequency of witnessing deep sleep (Higher States of Consciousness, HSOC), IQ, and simple and choice reaction time (RT) measures in a two-year longitudinal design with a non-meditating control group. In addition to measuring change in the above measures, the investigators measured correlations between the HSOC variable and the other dependent variables.

Method

Subjects

Subjects were students who enrolled in introductory psychology classes at two

universities in Iowa. The experimental group consisted of 25 males and 20 females at Maharishi International University (MIU). Mean age was 25.2 years, Standard Deviation (*SD*) = 6.74. The comparison group consisted of 22 males and 33 females at another university in Iowa (University of Northern Iowa, UNI).[ii] Mean age was 19 years, *SD* = 1.8.

Variables

The independent variable was participation or non-participation in the educational program at MIU, whose main innovative feature is the twice daily practice of the TM and TM-Sidhi programs. The TM and TM-Sidhi program are designed to unfold higher states of consciousness, develop the intelligence of the individual, and improve all aspects of his or her life: physiological, psychological, sociological, and ecological (Maharishi Mahesh Yogi, 1963, 1967, 1972a).

The dependent variables were: reported frequency of witnessing deep sleep as measured by a HSOC questionnaire, Cattell's Culture Fair Intelligence Test (CFIT) scores, simple and choice reaction time (RT) using Hick's 1-light and 8-light configurations, and intra-individual *SD* of Hick's 8-light RT.

Design

The design for comparing the experimental group and the comparison group was an untreated nonequivalent control group design with pretest and posttest. The experimental group (MIU first-year students) received pretest on the above variables, then received two years of education at MIU, including twice-daily practice of the TM and TM-Sidhi program.

The comparison group received pretest concurrent with the experimental group, and posttest after the first two years of a standard university education.

Instruments

A self-report Higher States of Consciousness (HSOC) questionnaire was used to measure frequency of witnessing deep sleep. The key question asked was, "During dreamless sleep, have you experienced a quiet, peaceful inner awareness or wakefulness?"[iii] The subject was asked to check a box next to the number which most accurately represented how frequently the experience occurred. The subject was also asked to write down a concrete example of the experience from memory on a space provided on the reverse side of the questionnaire, in order to show that he or she understood the concept. The examples provided by the subjects were blind-scored

independently by two researchers, and marked "yes" or "no," signifying whether or not the subject understood the concept. Responses which did not include a sample experience were treated as missing data. Inter-rater reliability for scoring sample experiences was .96.

Apparatus

The apparatus for measuring reaction time (RT) consisted of a panel, 13 in. x 17 in., painted black and tilted at a 30 degree angle. At the lower center of the panel was a red pushbutton, 1/2 in. in diameter, called the "home" button. Eight red pushbuttons, all equidistant (6 in.) from the "home" button, were arranged in a semicircle around the "home" button. A 1/4 in. green light was mounted half an inch above each of the buttons in the semicircle. The console was connected to an Apple IIe computer, and a computer clock (Mountain Hardware Apple model) was used to measure RT.

Procedure

For the Hick's reaction time tests, subjects were instructed to place the index finger of the preferred hand on the home button. This caused an auditory warning signal (a high pitched tone of 1 second duration) to sound, followed (after a random interval of from one to four seconds) by one of the eight green lights going on. The subject was previously instructed to turn off the light as quickly as possible by pressing the red button directly below it. In the one-light condition, on each trial the same light went on, the one just to the right of top center. In the eight-light condition, the particular light that went on in each trial was random and hence unpredictable by the subject. RT is the time the subject takes to remove his finger from the home button after the green light goes on. Thus RT was measured independently of the time taken to move the finger from the home button to the button under the green light. On each trial RT was measured in milliseconds by the computer clock and recorded. Upon completion of the 20-trial set for each subject, the mean RT and standard deviation of RT for 20 trials were computed and recorded by the computer.

Each subject was given 5 practice trials in the one-light condition (the same light came on for every trial), and subsequently 20 trials in that condition. Then each subject received 5 practice trials in the eight-light condition (any one of the eight lights came on randomly) and 20 trials in that condition.

Cattell's CFIT was administered according to the standard procedure given in the test instructions.

Results

Covarying for Demographics

As mentioned in the design section, potential confounds related to performance on IQ tests and other measures were tested as covariates. These covariates were: level of interest in meditation, frequency of dream recall, subject's age, subject's education level, father's education level, and father's annual income.

To test for an effect of interest in meditation on posttest scores of the control group on each dependent variable, stepwise regressions were performed with pretest scores and level of interest in meditation as the covariates. The alpha level was .05 to enter and .05 to remove. Pretest scores entered the stepwise regressions first. Interest in meditation was not kept in any of the regressions; therefore the effect of interest in meditation was not significant in any of the regressions. Hence, for the control group, who did not meditate, it was concluded that level of interest in meditation had no effect on posttest scores on any of the measures.

To test for the effect of dream recall on HSOC scores, a stepwise regression was performed for experimental and control groups combined, with pretest scores and frequency of dream recall at pretest as covariates. The alpha level was .05 to enter and .05 to remove. Pretest scores entered the stepwise regression first, and dream recall was not kept in the regression. Hence, the result indicated that frequency of dream recall had no effect on HSOC posttest scores.

Next, stepwise regressions were performed to assess the importance of potential covariates. These analyses combined experimental and control groups and were performed for each of the dependent variables: frequency of witnessing sleep (HSOC scores), Cattell's CFIT, Hick's 1-light RT, and Hick's 8-light RT. Subject's age, education level, and father's education level were included as predictor variables, in addition to pretest scores for the appropriate dependent variable. Since data on father's annual income was available for only about half the subjects, a separate stepwise regression was performed for each dependent variable using pretest scores and father's annual income as predictors, in order to maximize the number of available cases for analyses using the other predictors.

For each variable, pretest scores entered the stepwise regression first. Subject's age and father's education were also kept in the regression for posttest scores on Hick's 8-light choice reaction time at the $p<.05$ level; father's education was kept for posttest scores on the CFIT. Hence age and father's education were entered as covariates into the test

of the assumption of homogeneity of slopes in preparation for one-way multiple analysis of covariance (MANCOVA) on posttest scores for HSOC, CFIT, 1-light RT and 8-light RT. Neither subject's education nor father's annual income were kept in any of the regressions at $p<.05$, and therefore these two covariates were dropped from further analysis.

For the group of variables, in the test of the assumption of homogeneity of slopes there were no statistically significant interactions between subject's age or father's education and the grouping variable. Hence, age and father's education were dropped from the analysis. Pretest scores for Cattell's CFIT, Hick's 1-light RT and Hick's 8-light CRT were not statistically significant as covariates; however, they were all kept in the analysis.

MANCOVA for posttest scores on the dependent variables was performed with pretest scores as the covariates. Wilks' lambda was 0.355 and the F-statistic was 18.657 ($p<.0001$, DF=4,41). Hence, the null hypothesis of no effect of the grouping variable on the four dependent variables was rejected. The effect was in the direction of improvement on the four dependent measures in the experimental group (MIU).

Separate 1-way analyses of covariance (ANCOVA'S) were then performed for posttest scores on the HSOC measure, CFIT, 1-light RT, 8-light RT and SD of 8-light RT, with pretest scores as the covariate in each case.

The assumption of homogeneity of slopes was supported for all dependent variables with the exception of HSOC scores. Hence, for HSOC scores, repeated measures analysis of variance (ANOVA) was performed with group (MIU or UNI) as the grouping factor and pretest-posttest scores as the trials factor. Results indicated that the main effect for group was significant ($F=15.34$, $p<.0001$, DF=1,58), the main effect for pretest-posttest was not significant ($F=2.14$, $p=.149$, DF=1,58), and the interaction between pretest-posttest and group was significant ($F=11.35$, $p<.001$, DF=1,58). Hence, the result showed that there was a significant pretest-posttest change in HSOC scores for at least one of the two groups -- either the MIU group or the control group, or both. To further verify whether this result could be attributed to positive change in MIU scores, negative change in UNI scores, or a combination of these two, independent t-tests on pretest/posttest scores were performed separately for the MIU and UNI groups. The results indicated that scores for the MIU group did change significantly ($t=3.12$, $p<.0025$, one-tailed test), while UNI scores did not ($t=1.48$, $p=.149$, two-tailed test). The MIU mean for HSOC pretest scores was 2.9 and the posttest mean was 4.7. Pretest mean for UNI was 2.2 and posttest mean was 1.6. Hence, the results showed that performance on the HSOC measure improved significantly from pretest to posttest for the MIU group compared with the UNI group, and it did not change significantly for

the UNI group.

Table 1 presents results of the other individual ANCOVA's. The F-test value was converted to a t-test value in order to obtain one-tailed p-values for testing the directional hypothesis of an improvement in the experimental group relative to controls (See Rosenthal and Rosnow, 1984, p. 244).

Results for HSOC scores, CFIT scores, Hick's 8-light RT, Hick's 8-light intraindividual SD, and Hick's 1-light RT were all statistically significant in the predicted direction. Figure 1 presents pretest-posttest change in HSOC scores for experimental and control groups.

Since pretest means for the CFIT were identical for the experimental and control groups, regression to the mean was discounted as an alternative hypothesis to explain the results.

Figure 3 shows pretest-posttest change in scores on Hick's 8-light RT.

The pretest mean for the experimental group (X=350.57 msec.) is consistent with findings of other researchers (Jensen, 1985a, Pg.163; Frearson & Eysenck, 1986). A statistically significant negative correlation was found between Hick's 8-light RT and HSOC scores ($N = 72$, $r = -.400$, $p < .0001$), and a significantly negative correlation was found between Hick's 8-light RT and CFIT posttest scores ($N = 79$, $r = -.290$, $p < .005$).

Figure 4 presents pretest-posttest change in SD of 8-light RT. The Pearson correlation between SD of RT and CFIT posttest scores was -.256 ($N = 79$, $p < .01$).

The possibility of attrition affecting posttest scores was considered. Because of the size of the attrition rate, MANOVA was performed with group and pre-post completion/non-completion as the independent variables. The results showed no significant differences on pretest scores or covariates, between groups that completed the study and those that did not.

Table 1

One-Way Analyses of Covariance for Effect of Group on CFIT,

Hick's 1-and 8-Light RT, and *SD* of 8-Light RT

Variable or Covariate	Group	x pre	SD pre	x post	SD post	Adj.x post	df	F	t	p
Cattell's CFIT	Exper.	26.82	5.19	29.03	5.26	29.17				
	Control	27.32	3.84	27.02	4.34	26.91	88		2.79	<.005
Pretest Covariate	Exper. Control						88	50.24		<.0001
Hick's 1-light RT	Exper.	311.46	46.52	278.70	47.23	275.62				
	Control	300.61	57.71	290.39	36.86	292.98	78		2.11	<.025
Pretest Covariate	Exper. Control						78	26.05		<.0001
Hick's 8-light RT	Exper.	350.57	47.11	320.14	30.53	335.05				
	Control	467.27	107.11	492.75	76.03	480.21	77		9.10	<.0001
Pretest Covariate	Exper. Control						77	8.65		<.004
SD of Hick's RT	Exper.	106.63	136.51	45.25	19.90	45.30				
	Control	263.22	167.45	289.73	112.13	289.67	66		11.4	<.0001
Pretest Covariate	Exper. Control						66	.000		.992

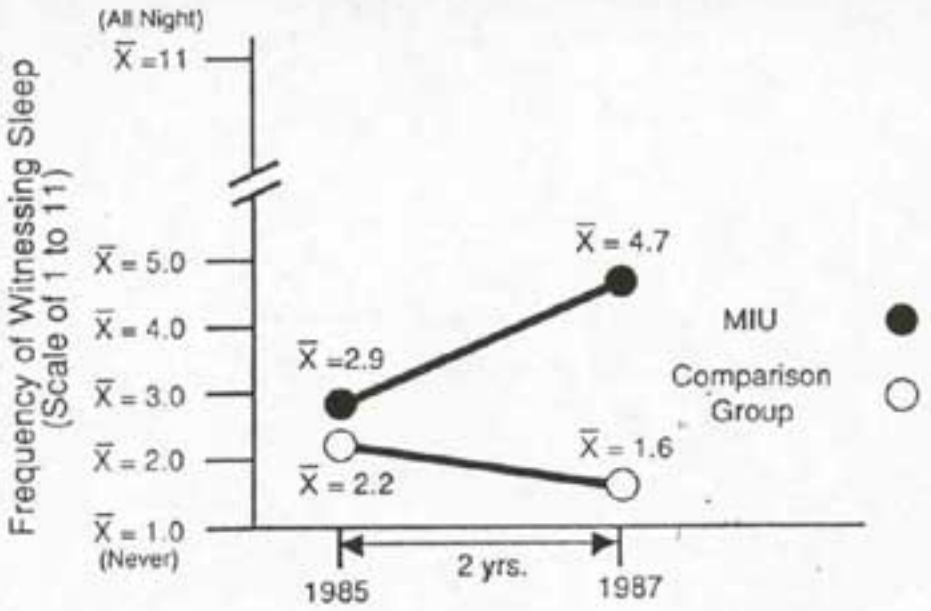

Figure 1: Change in reported frequency of witnessing sleep over two years for experimental group (MIU) and comparison group

Figure 2 shows pretest-posttest change in CFIT scores.

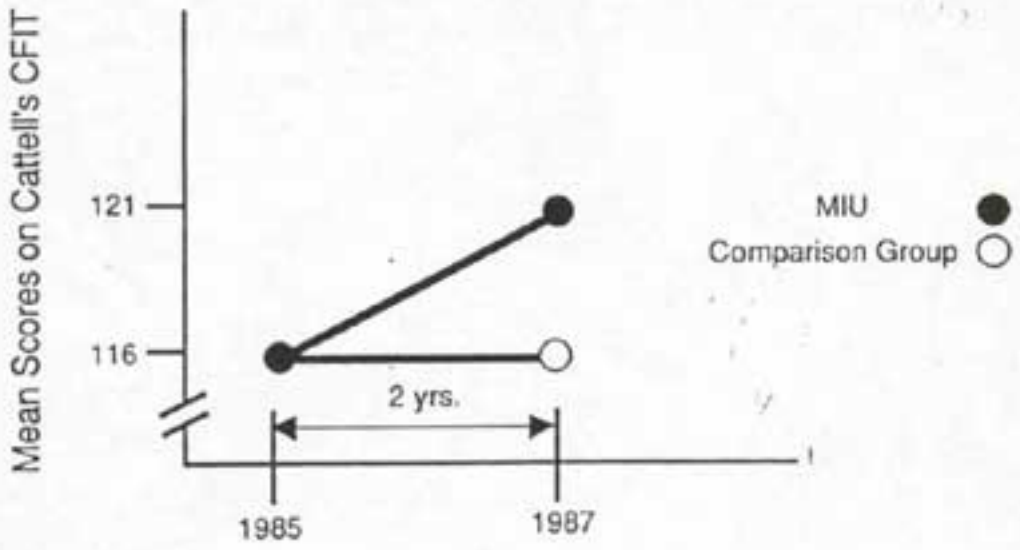

Figure 2: Change in scores on Cattell's Culture Fair IQ test over two years for experimental group (MIU) and comparison group.

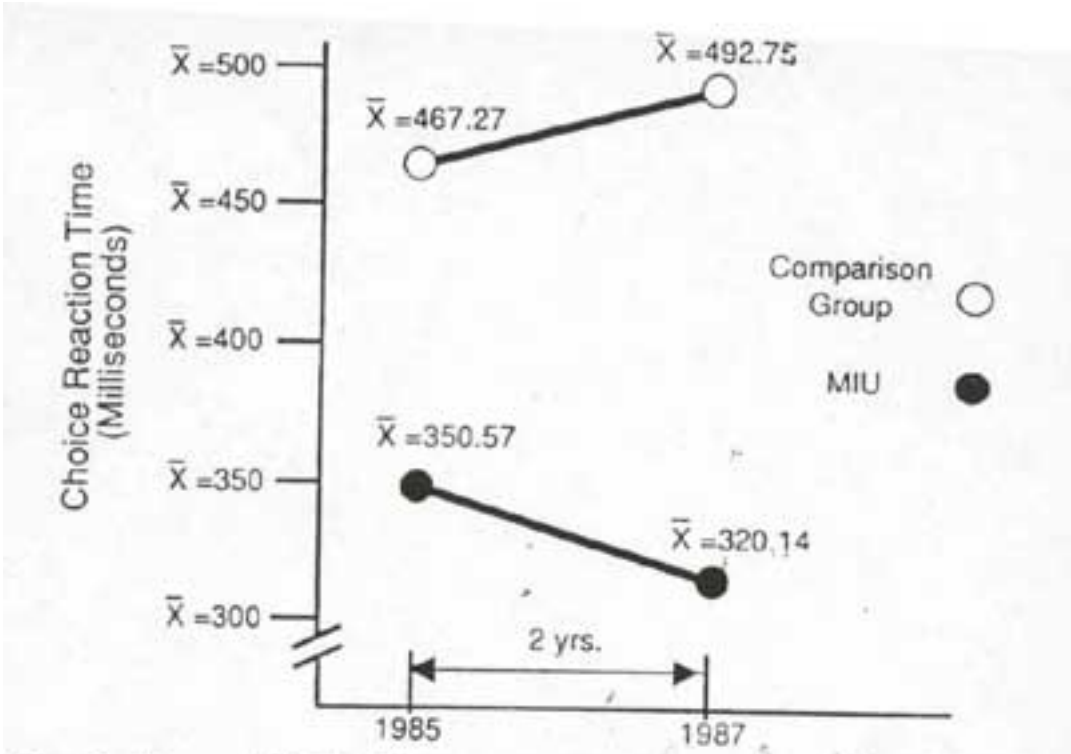

Figure 3: Change in Hick's 8-light reaction time over two years for experimental group (MIU) and comparison group.

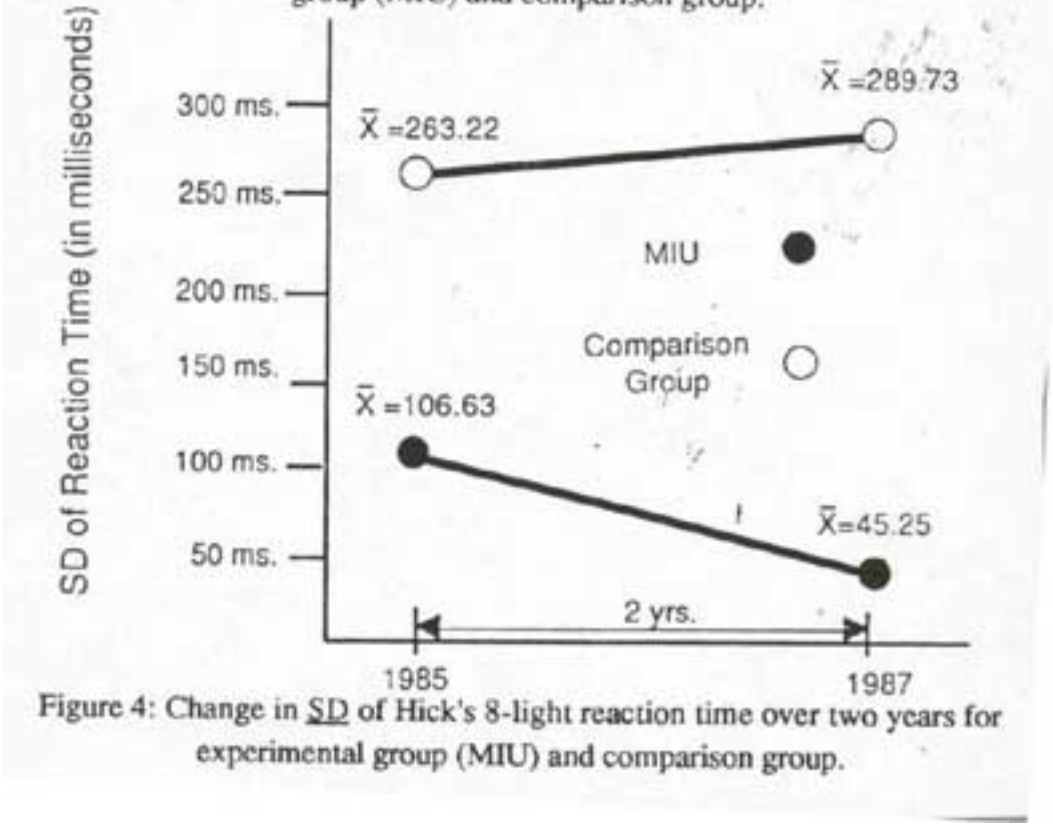

Figure 4: Change in SD of Hick's 8-light reaction time over two years for experimental group (MIU) and comparison group.

Discussion

The results indicate that participation in the curriculum at Maharishi International University, which includes twice daily practice of the TM and TM-Sidhi programs, resulted in increased reported frequency of witnessing deep sleep, while witnessing did not increase in the control group. Witnessing is considered an indicator of the growth of higher states of consciousness. Furthermore, frequency of witnessing deep sleep was significantly correlated with IQ and choice reaction time, which also improved in the MIU group compared to the control group. Previous research (Barrett, Eysenck & Lucking , 1986; Eysenck 1986, 1988; Frearson & Eysenck, 1986; Jensen, 1979, 1982a, 1982b, 1985a, 1985b; Smith and Stanley, 1987; Vernon, 1983, 1987) indicates the measures used here are correlated with the theoretical construct "g", or general intelligence.

It may be claimed that improvements in the dependent measures were caused by the teaching methods and academic information given students at MIU rather than their practice of the TM and TM-Sidhi program. The academic knowledge taught at MIU does include elements which relate the student's experience of the development of consciousness through the TM and TM-Sidhi programs to the laws of nature studied by traditional academic disciplines. However, a study by Shecter (1978), indicated that improvements in IQ test scores resulted from the direct experience of the TM techniques rather than intellectual study of the development of consciousness. In Shecter's study, high school students were randomly assigned to three groups: one group learned TM; a second group took a 14-week Science of Creative Intelligence course in which they studied development of consciousness but did not learn the TM technique; and a third group took both courses. A fourth matched group took neither course. Those practicing the TM technique (either with or without the Science of Creative Intelligence course) showed significantly greater improvement on IQ test scores than those who did not practice the TM technique (either with or without the Science of Creative Intelligence course).

Both the IQ measure and choice reaction time have been shown to be related to general intelligence, or "g". A theoretical model of how TM could improve intelligence is provided in the well-established principle from developmental biology and neurology, that the process of experience stimulates neural growth (Blakemore & Cooper, 1970; Edelman, 1987; Hubel & Wiesel, 1979; Milgram, MacLeod, & Petit, 1987; Pearson, Finkel, & Edelman, 1987). An example of the principle is that animals raised in enriched environments develop greater brain weight than animals raised in deprived environments (e.g., Bennet, Diamond, Krech, & Rosenzweig, 1964; Diamond, Ingham, Johnson, Bennet, & Rosenzweig, 1976; Wallace, 1986, pp. 216-217). According to

Maharishi's Vedic psychology, meditation provides the direct experiences of abstract levels of mental processes that stimulate neurophysiological growth through the sequence of higher states of consciousness (Maharishi, 1969, Wallace, 1986).

Physiological evidence that the experience of transcendental consciousness (TC) stimulates development can be found in longitudinal experiments showing that practice of TM increases EEG coherence (Dillbeck & Bronson, 1981; Gaylord, Orme-Johnson & Gelderloos, 1988; Gaylord, Orme-Johnson, Willbanks, & Travis, 1988; Orme-Johnson, & Travis, 1988). In addition the TM-Sidhi program further develops EEG coherence (Dillbeck, Orme-Johnson, & Wallace, 1981; Orme-Johnson, Clements, Haynes, & Badawi, 1977; Orme-Johnson & Haynes, 1981; Travis, 1988). Correlational studies in meditators have shown that EEG coherence among frontal and central areas is positively correlated with higher levels of neurological efficiency, intelligence, creativity, mathematics achievement, principled moral reasoning, as well as lower levels of neuroticism (Dillbeck, Orme-Johnson, & Wallace, 1981; Gaylord, Orme-Johnson, & Travis, 1989; Nidich, Ryncarz, Abrams, Orme-Johnson, & Wallace, 1983; Orme-Johnson, Clements, Haynes, & Badawi, 1977; Orme-Johnson & Haynes, 1981; Orme-Johnson, Wallace, Dillbeck, Alexander, & Ball, in press). Thus the longitudinal increases in these EEG parameters would suggest cognitive development.

The TM and TM-Sidhi programs also produce several other physiological changes that would suggest increased cognitive abilities. Argenine vasopressin has been associated with improved learning and memory, and argenine vasopressin is elevated during TM (Jevning, Wells, Wilson, & Guich, 1987). Shorter latencies and higher amplitudes of auditory evoked potentials have been associated with more efficient information processing in the brain, and TM and TM-Sidhi participants have been found to have shorter latency and larger amplitude evoked potentials than controls (Cranson, Goddard, Orme-Johnson, & Schuster, submitted for publication; Goddard, 1989; Kobal, Wandhofer, & Plattig, 1975; Wandhofer, Kobal, & Plattig, 1976). The TM-Sidhi program also increases paired H-reflex recovery rate, an indicator of adaptability of the nervous system and a correlate of academic achievement, EEG coherence, and concept learning (Dillbeck, Orme-Johnson, & Wallace, 1981; Wallace, Mills, Orme-Johnson, Dillbeck, & Jacobe, 1983; Wallace, Orme-Johnson, Mills, & Dillbeck, 1984).

In explaining performance on speeded tasks, several investigators (Eysenck, 1986; Gardner, 1983; Jensen, 1982a; Sternberg, 1985; Vernon, 1987) have described the information processing system as a system of limited-capacity processors or components. They have proposed that individual differences in choice reaction time and performance on IQ tests are associated with differences either in operation of neural substrates, or in capacity of components of the information processing system such as short-term and long-term memory. It may be that the psychophysiological development

fostered by experiences of more abstract states of the thinking process during TM includes expansion of the capacity of the information processing system, resulting in improved performance on such tasks.

As mentioned in the introduction, transcendental consciousness has been described as a state of unbounded awareness. Growth of higher states of consciousness are characterized by maintenance of this broad awareness along with the focused awareness of the waking state. Several studies indicate that long-term practitioners of the TM and TM-Sidhi programs appear to be capable of spontaneously maintaining broadened awareness while simultaneously focusing their attention on a task (Dillbeck, 1982; Dillbeck et al., 1986; Pelletier, 1974; Travis, 1988). This ability to maintain a broad, comprehensive style of awareness while simultaneously focusing on the parts of a problem may help account for observed improvements in performance on choice reaction time and tests of figural reasoning such as the one used in this study, since both tests emphasize the ability to perceive and analyze relations of parts with one another and with a larger whole, and to respond accordingly. For example, on the Hick's 8-light RT task, some subjects spontaneously volunteered that they were able to perceive the whole field of eight lights simultaneously and respond quickly and accurately when the target light came on, rather than serially scanning the lights and trying to anticipate the correct choice.

Figure 4 shows a decrease in intraindividual SD of Hick's 8-light RT, considered by some to be an index of "noise" in the information processing system, and the RT-related variable most strongly correlated with IQ measures (Eysenck, 1987; Jensen, 1985a). It is interesting that, although SD scores for the MIU group were initially lower by 150 msec., their scores improved significantly, decreasing by 58.29 msec., while scores increased insignificantly (37.5 msec.) for the control group.

This reduction of noise in the information processing system is explained by the theory associated with the TM and TM-Sidhi programs, mentioned in the introduction. According to the Vedic principles underlying TM, the technique directly reduces noise in the information processing system by allowing the individual to experience progressively quieter, more abstract states of thought until his or her awareness becomes silent or noise-free in the state of transcendental consciousness (Maharishi Mahesh Yogi, 1963, pp. 48-49; 1969, pp. 278, 282; 1972). Regular practice of the TM and TM-Sidhi programs is predicted to stimulate development of the nervous system such that it can maintain this noise-free state along with information processing in the waking state (Maharishi Mahesh Yogi, 1963, pp. 103, 114-116; 1969, pp. 135-137, 150-153; 1972). The present finding of reduced RT variability operationalizes and supports this prediction. In addition, the observed changes in IQ scores and reaction time measures can also be interpreted as reflecting an improved signal-to-noise ratio in the system.

The findings indicate that "g" or fluid intelligence can be developed, as measured by IQ tests and reaction time tests. The study does not refute the theory that "g" is largely genetically determined (Bouchard & McGue, 1981; Bouchard & Segal, 1985; Jensen, 1969, 1985b; McGue & Bouchard, 1988; McGue, Bouchard, Lykken, & Feuer, 1984; Plomin, 1988), but rather suggests that the experience provided by the TM and TM-Sidhi programs facilitates the expression of inherent potential.

In conclusion, the above findings, together with previous research brings to light an educational technology that results in increased experiences of higher states of consciousness, accompanied by improved cognitive abilities. These results indicate that growth of higher states of consciousness represents growth of more adaptive, optimal states of functioning than the ordinary states of waking, dreaming, and sleeping. The technology employed here is based on well established theoretical principles. Both the technology and the theoretical approach deserve serious investigation by researchers in the fields of education, adult development, intelligence, and personality.

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[i] EDITORS NOTE: The following is poster from the corollary sessions at the Lucidity Association's Conference on Higher States of Consciousness, in Chicago in July, 1990.

[ii] A fairly high attrition rate for the first two years of enrollment is characteristic of MIU and UNI, these two universities being typical of American universities in this regard. Hence, 97 subjects were pretested at MIU and 125 at UNI. As expected, by posttest these numbers had decreased to 45 at MIU and 55 at UNI. Analyses were performed to address the question of whether attrition could have been responsible for any observed differences at posttest, and these are reported at the end of the Results section.

[iii] Although the questionnaire on higher states of consciousness had items on experiences of lucid dreaming and witnessing dreaming, these items were not included in the analysis because the investigators found that subjects

confused the experience of lucid dreaming with the experience of witnessing dreaming and hence the data on these two types of experience was unreliable.