

Consciousness and the Anomalous Organization of Random Events: The Role of Absorption

LONNIE A. NELSON AND GARY E. SCHWARTZ

Laboratory for Advances in Consciousness and Health, The University of Arizona

Abstract—Research has documented that intention can be associated with deviations in an electronic Random Event Generator (REG). The present set of five experiments examined correlates of changes in the REG with two aspects of absorption, perceived depth (depth) and distortions of time perception (time) in a single subject (the first author). In the initial exploratory experiment, the subject collected 59 experimental runs in which various meditative practices were performed, and 42 control runs. Ratings of depth and time were each significantly correlated with magnitude of deviation in the REG. These findings were replicated in a confirmatory experiment with 60 experimental runs that included deliberate "daydream" runs, and 43 control runs. The third experiment manipulated "absorbed/daydream" runs (A) and control (non-absorbed) runs (B) using 20 sets of ABAB runs. The main effect of A versus B was significant. The fourth experiment tested the possibility that the results were due to some electromagnetic effect produced by body movement and consisted of 20 hand motion runs and 20 "absorbed" runs. The results suggested that absorption, and not movement, was the main factor of importance. The fifth experiment was intended to confirm the findings suggested in experiment four. A total of 40 runs were collected at two distances from the REG, and ratings of absorption were taken for all runs. Significant results were found for absorption, not distance. The results are consistent with the hypothesis that states of absorption associated with changes in perception of time and experience of trance-like awareness are associated with replicable alterations in an electromagnetically shielded REG device.

Keywords: Consciousness—absorption—depth of trance—time perception—REG—mind-machine interaction

A substantial amount of research has been published over the past several decades documenting the interaction of human intention with the anomalous organization of events produced by a Random Event Generator (REG). Though numerous researchers across the world have been engaged in this area of research since the middle of the 20th century (Radin & Nelson, 1989), in recent years, much of this work has been conducted at the Princeton Engineering Anomalies Research (PEAR) Laboratory in the department of electrical engineering at Princeton University (Jahn & Dunne, 1987; Jahn et al., 1997). Over a 12 year period, the PEAR research program involved 91 individual subjects (termed "operators" by PEAR), who were all "normal" adults, claiming no special abilities in this, or any other area of psi. These operators

accumulated a total of 2,497,200 trials distributed over 522 experimental "tripolar" series.

The tripolar protocol is characterized by the designation of the runs into high, low and baseline conditions. In this format, the goal is for the subject/operator to attempt to influence the REG device with mental intention that produces directional deviation from chance expectation (i.e., anomalous organization of the random events). This deviation is to be in line with their pre-stated or directed intention (i.e., Higher mean than chance expectation, Lower mean than chance expectation or chance expected mean specifically). This research program has demonstrated that relatively small scale, but repeatable ($p < 6.99 \cdot 10^{-5}$ one-tailed) external mind-machine interactions can be produced under their laboratory circumstances (Jahn & Dunne, 1987; Jahn et al., 1997).

The PEAR Portable REG used in those experiments, as well as the current investigation, is a relatively simple electronic device that operates by passing an electrical current through a resistor, thus producing a wide band spectrum of quantum-level thermal noise (referred to as Johnson noise). The Johnson noise is then pre-amplified, filtered, amplified, compared with its mean-value reference level and ultimately converted to a binary digital signal for transmission to the computer that records the data. Prior to transmission, the digital sequence is compared with an alternating bit template to preclude any ground reference drift effects. The resulting random sequence of ones and zeroes is accumulated in "trials" consisting of a specified number of bits, and the sum of these bits is recorded as the fundamental data unit.

In our application, 200-bit trials, generated at about one per second, yield a binomial distribution with an expected mean of 100, and standard deviation of 7.071. The data may be displayed as a cumulative deviation (a random walk) relative to chance expectation. Each data point represents one trial, and the terminal value of the cumulative trace is identically equal to the mean of the distribution, and hence represents the statistical significance of the deviation (see Jahn & Dunne, 1987). The parabolic envelope shows the locus of the one-tailed 0.05 probability of so large a deviation. As mentioned above, scores of researchers over the past several decades, in addition to the PEAR group, have demonstrated that human "operators" can affect this deviation score with intention and mental action alone (e.g., Radin & Nelson, 1989). This occurs even though the distribution of numbers that the device produces during calibration runs on the whole are generally "random", conforming to the statistical predictions nearly exactly at a large number (Jahn & Dunne, 1987; Radin et al., 1996; Jahn et al., 1997).

Given that the PEAR group has approached this phenomenon mainly as an engineering problem (Jahn et al., 1997), much of their time has been spent exploring the many facets of the phenomenon related to the physical characteristics of the devices that the effect can be demonstrated with. As a result of this focus, the aspects of the subjective experience of the operators in these experiments have gone largely under explored. Some exceptions to this

approach are found in the work of Radin and colleagues, who examined various situations involving mass consciousness effects in such events as the Academy Awards related to "high attention" periods (the revealing of an award winner) versus "low attention" (commercial break) periods (Radin et al., 1996). The findings of these studies were that the "high attention" periods were characterized by larger deviations from chance expectation than the "low attention" periods. There have also been reports that during the 9/11/2001 terrorist attacks, a number of REG/RNG across the globe showed significant "anomalous organization effects". These findings are intriguing, and suggestive (in a psychological sense) of the parameters of the state of consciousness involved, but have left specific aspects of conscious experience undelineated and somewhat ambiguous.

The purpose of the present project was to discover these specific aspects of conscious experience by way of Tart's (1975) proposed methodology of *state specific science*. Tart specifically suggests that consciousness researchers intending to study a specific state of consciousness should, while in the state of interest, themselves evaluate, "the interaction of that state with the external physical reality . . ." (Tart, 1975; p. 217). In this project, the question is being approached from the opposite end, in that there is a case in which consciousness seems to interact with the external physical reality (the mind-machine interaction) and the aim of the research is to determine the state of consciousness that provides for that interaction. Therefore, in this case, the question to be answered is in regard to the nature of the specific state of individual consciousness that may be interacting with the occurrence of anomalous organization within the output of the REG device. One might note that the production of specific directional manipulations was not the intended object of this project, only the presence or absence of anomalous organization in an absolute sense, or stated another way, the magnitude of the cumulative deviation from theoretical (chance) expectation was the dependent measure in all cases reported here, without reference to which direction (positive or negative) that deviation tended.

The current investigation hypothesized that the mental state known as "absorption", defined by Webster's unabridged dictionary (© 1996, 1998) as "Entire engrossment or occupation of the mind; as, absorption in some employment." This state is described further in Appendix A. While there has been some degree of investigation into "absorption" and its relation to psi performance, this has been primarily in examining the *personality trait* of "absorption" as put forth by Tellegen & Atkinson (1974) as a trait related to hypnotic susceptibility (e.g., Stanford & Angelini, 1984; Irwin, 1985; Reid et al., 1982; Sondow, 1986; etc.). It is worth noting that this personality variable has been correlated with increased psi performance in several reports. However, in the current investigations, *absorption* is discussed as a *state* of mental activity as opposed to a *trait* of an individual's personality (See appendix A for a subjective description of this state of awareness).

General Method

Subject

In line with Tart's (1975) proposed methodology, a single subject was studied systematically for a total of 53 sessions. The subject was a 23 year old male, an experienced meditator (7 years) and martial artist (13 years) who was a graduate student and first author of the current paper, as the experiments described herein served as his Master's thesis which was defended before committee and passed at the University of Arizona in the spring of 2000. Data collection spanned approximately 5 months across the last four experiments reported here following a period of approximately 1 month in which the subject interacted with the device informally for several hours per day in his home while determining an appropriate experimental protocol (and arrived at the protocol of exploratory experiment one).

Materials

A Random Event Generator (REG) device, built and designed by PEAR, was used in the Human Energy Systems Laboratory at the University of Arizona. It should be noted that this device was on loan to our laboratory from the PEAR facility. For the data collection in experiments one, two, four and five a 233 Mhz, IBM compatible laptop computer was used for data acquisition and storage. In study three, the data were acquired and stored with an IBM 486 tower desktop computer. The data for all studies reported herein were collected using the FieldReg software designed by PEAR labs. Upon collection and storage, the data were scored and entered into Microsoft Excel for Windows and the calculations were done using Statistica for Windows and SPSS for Windows.

Experiment One

Design and Procedure

In order to discover what mental action would affect the device, the subject utilized various meditative techniques during 59 exploratory, informal experimental runs. "Runs" and "Trials" are nomenclature used by PEAR. These runs were informal in the sense that they were not carried out with strict control of the protocol, as the protocol was being determined during this period. Each run contained *approximately* 60, one-second trials, each trial was composed of 200 bits. This experimental manipulation was chosen in order to determine which, if any, of a set of specific meditative practices performed correlated with significant deviations from chance expectation.

The data were collected using the FieldReg program, which was designed by the PEAR laboratory for studying mass consciousness effects; therefore, no

running output could be viewed by the subject/operator. This circumstance allowed the subject to rate his experience of the meditation practice on two dimensions that had appeared to be important during informal pilot runs prior to these for which little systematic data was collected. These ratings were made at the termination of each run, before the results were viewed. These dimensions were depth of absorption and distortion of subjective sense of time (the criteria for ratings are described in Appendix A).

Thus, an experimental run was conducted as follows: The subject/operator initiated the run at his own discretion. At this point, the subject would attempt to employ one of a number of meditative techniques for the next minute or so. This period length was used because it provided a reasonable run length (sample size), while also being near the general length for the subject at which a "break" in concentration would occur. Thus, the trial time was not set to 60 seconds, but rather, to the "break" in meditative focus that was estimated by the subject/operator to be nearest that point, providing a range of run lengths. At the end of the run, the subject/operator would stop the program manually and make his ratings. Following the ratings, the output would be viewed and the mean would be recorded in a Microsoft Excel© spreadsheet.

The experimental runs were compared with 42 interspersed "control" runs. During these control runs, the subject did not engage in a meditative practice, but rather performed other tasks and simply waited for the time to elapse. These runs were stopped at 60 seconds and no ratings were made. The data were collected over 16 sessions.

Results and Discussion: Experiment One

The results from the exploratory experiment yielded a correlation of 0.399 between the sum of the ratings of depth of trance and distortion of time with the REG deviation from expected mean output values for individual runs. The sum of the two ratings was used because the ratings were conceptualized as a "state scale", or an indicator of a temporary state, on which the ratings would be considered "items". Calculating an r-squared for this correlation yielded an adjusted $r^2 = 0.133$, $p < 0.001$. To assess the individual contributions of the scale "items" to the dependent measure, two one-way analyses of variance (ANOVAs) were calculated, one for the absolute value of the deviation from chance expectation by ratings of depth of trance, and one for distortion of subjective sense of time separately. As shown in Figures 1 and 2, respectively, the results of these analyses were significant $F(3,97) = 7.64$; $p < 0.0001$, $F(4,96) = 8.34$; $p < 0.0001$, respectively. Given that the trial length was not held constant throughout data collection and one could expect greater deviations from chance expectations for those trials with a lower number of trials, a partial correlation was calculated controlling for run length. This yielded a partial correlation between the sum of depth of trance ratings and distortion of time ratings (used as a "state absorption scale") and the absolute value of the deviation from randomness which was significant ($r = 0.458$; $p < 0.0001$). This

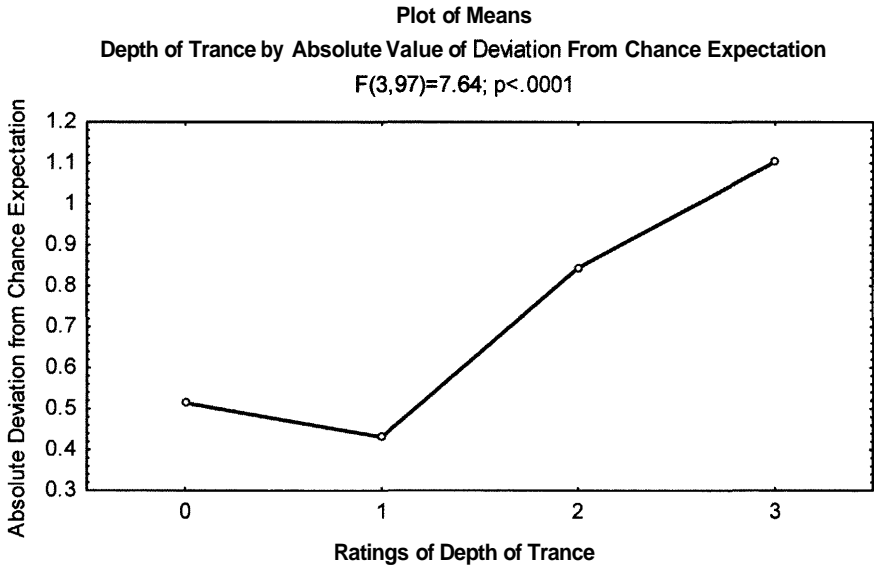


Fig. 1. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "depth of trance" for the exploratory study.

result indicated that the observed deviations were not due to systematic differences in run lengths.

The results of exploratory experiment one suggest that there may be some relationship between the observed deviations from chance expectation in the output of the REG device and the subjective ratings of two dimensions of the mode of experience commonly known as absorption.

Experiment Two

Design and Procedure

The aim of experiment one was exploration. The purpose was to discover which meditative techniques yielded the highest absolute deviations from chance expectation in the output of the REG, such that these might be used in a subsequent confirmatory study as the sole techniques. It was discovered that the most successful runs shared the characteristic of being within the first few runs collected in which a new meditative technique was applied. Thus, a qualitative analysis showed that the 15 most successful runs actually included a high number of specific techniques, indicating that the *content* of the meditative practice was not the central variable of impact, but rather that the more important factor seemed to be the newness of the specific practice.

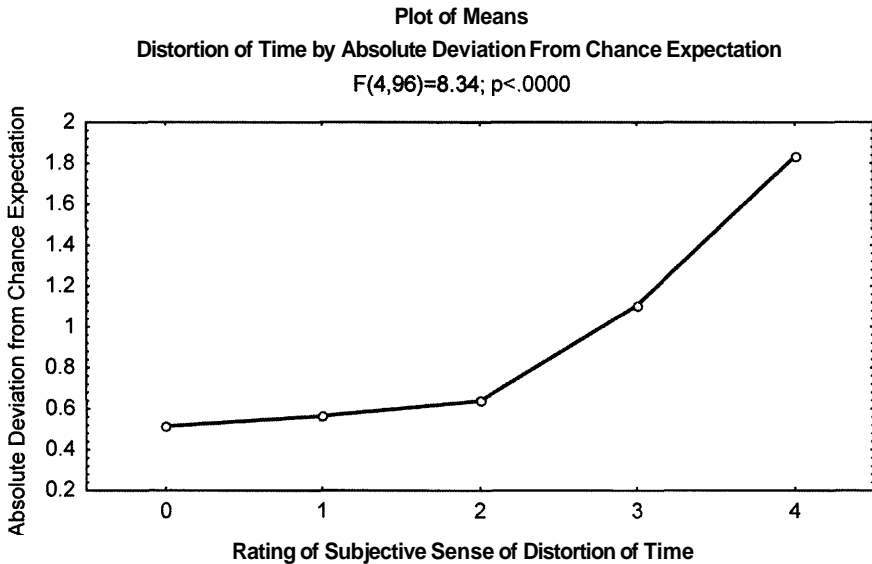


Fig. 2. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "sense of distortion of time" for the exploratory study.

Effects analogous to this have been reported in the literature on various psi tasks for a number of years now and are thought to be related to a number of perceptual and cognitive factors (e.g., Jahn et al., 1997). To the current authors, this characteristic of the data hinted at a "novelty effect". Seemingly, the first few attempts with a new technique showed higher ratings and greater deviations within the device's output than subsequent runs employing the same technique. Hence, when the technique was novel, it was easier to perform the practice more fully because of a natural interest on the part of the subject/operator. As the technique was employed repetitively, or the task was performed repetitively, the task naturally became less interesting. Thus, the subject became less engaged and invested in the process, and subsequently experienced a lower degree of absorption in the task.

The state of mental absorption is characterized by a distortion in one's subjective sense of time, and a "snapping back" or "awakening" feeling at the termination of the state, or return to ordinary awareness. During the state, one loses awareness of their surroundings and physical conditions, while their mind is unified with internal activity and often rather vivid internally generated sensory impressions (Quarrick, 1989; Tellegen & Atkinson, 1974).

Based on this observation, the data in experiment two were collected with the experimental periods spent attempting to become "absorbed" in thought, or to "daydream". Thus, no specific meditative techniques were employed. The process employed to accomplish this is given in Appendix B. The control periods were

spent attempting *not* to become absorbed, or daydream. This required the subject/operator to shift his attention rapidly about, and to not stay focused on any stimuli for any duration, while monitoring his thoughts such that they were terminated or changed at recognition. While one could be referred to as being absorbed in this process, the characteristics of being engaged in this involvement are incommensurate with those of the "absorption" described as a mental state above.

Sixty experimental and 43 control runs were collected in the manner described in experiment one over the course of 16 sessions. It should be noted that since the experimental protocol was well defined at this time, the procedures were adhered to more strictly than in the beginning stages of the exploratory experiment described above. The control runs were interspersed within the collection order; there was no intentional pattern to the timing or order of control versus experimental runs.

Results and Discussion: Experiment Two

The results from this confirmatory study yielded a correlation between the sum of the ratings of depth of absorption and distortion of subjective time and the mean of the output of the REG of $r = 0.51$, adjusted $r^2 = 0.246$, $p < 0.0001$. In addition to the correlation, two one-way ANOVAs were calculated for the absolute value of the deviation from chance expectation by both ratings of depth of trance and distortion of subjective sense of time separately, as shown in Figures 5 and 6, respectively, the results of these analyses were significant $F(4,98) = 8.70$; $p < 0.0001$ and $F(4,98) = 7.29$; $p < 0.0001$, respectively. Given that the trial length was not held constant throughout data collection and one could expect greater deviations from chance expectations for those trials with a lower number of trials, a partial correlation was calculated controlling for run length. This yielded a partial correlation between a variable that was a summation of depth of absorption ratings and distortion of time ratings (used as an "state absorption scale") and the absolute value of the deviation from randomness which was significant; $r = 0.474$, $p < 0.0001$ (see Figures 3 and 4).

The combined analysis of these data sets further illustrates the effect shown in the studies analyzed separately for "depth" by "absolute deviation" $F(4,199) = 14.18$ $p < 0.0001$ (see Figure 5), and for "distortion of sense of time" by "absolute deviation" $F(4,199) = 13.32$ $p < 0.0001$ (see Figure 6).

Experiment Three

Experiment three was carried out in order to determine whether the results from the confirmatory study reflected a genuine and actual interaction between mind and machine or a rather impressive string of "luckily guessing" when the REG would produce a deviated outcome. This alternative hypothesis likely would be predicted by both skeptics of psi as well as other critics of the "mental interaction" interpretation of the results. The process of this determination of mental interaction utilized an ABAB reversal paradigm.

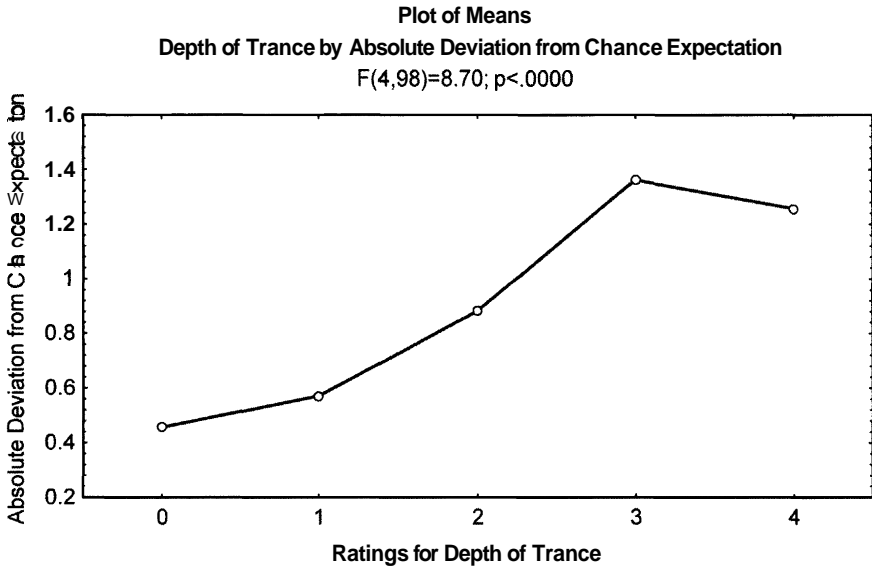


Fig. 3. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "depth of trance" for the confirmatory data alone.

The ABAB reversal paradigm has been used in clinical psychology for several decades. The aim of using this experimental paradigm is generally to demonstrate the effect that a specific treatment has on the frequency of a clinically relevant behavior. The nature of the reversal paradigm is such that one may infer causality based on significant differences in the frequency of an observed behavior between treatment conditions and control conditions as a manipulation is instantiated and removed across the passing of time. In the present instance, however, the ABAB paradigm has been employed to determine the role of mental processes on the behavior of a REG device. The aim of using this paradigm is that causality may be inferred and the anomalous organization of the random events produced may be attributed to the alteration in conscious state of and by the operator specifically. However, since the choice as to when to start the sessions was still left to the subject, one cannot *completely* rule out that there was some third variable that influenced both the subject's choice of time *and* the output of the REG. Hence, this is merely a demonstration of *proximal* or *apparent* causality.

Design and Procedure

The "A" periods in this study were designated to be the periods in which the subject/operator was to attempt to alter his mode of awareness into an absorbed state. Thus, testing the hypothesis provided by previous results (i.e., that this

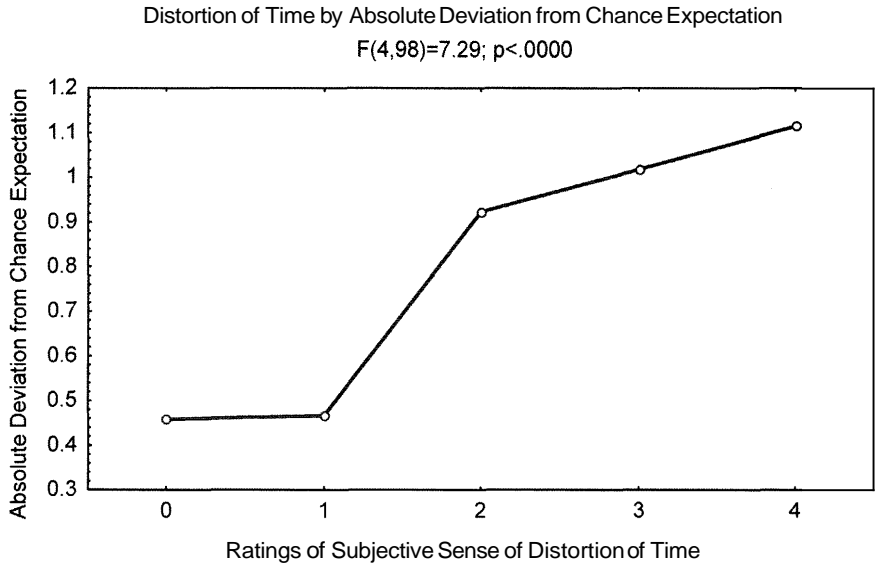


Fig. 4. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "distortion of sense of time" for the confirmatory data alone.

would correlate with a deviation from chance expectation in the output of the device). The process described in Appendix B was employed to achieve a state of absorption (i.e., fixing gaze on an object, etc.). Measurements of REG output were taken at the point designated by the placement of a "mark" in the file, signifying the end of the "A" period and the beginning of the "B" period.

The "B" periods were, therefore, the within-run control periods, during which the subject/operator was to remove himself from the absorbed state and to remain unabsorbed for a comparable period of time to the length of the "A" period. Again, the same process for achieving this different level of focus was employed as was described in experiment two, above (shifting attention rapidly about, etc.). As above, the measurement of REG output for the "B" period was taken at the point "marked" within the file, signifying the end of the "B" period and the beginning of the next "A" period, or the end of the file, whichever was appropriate.

In addition to the within-run control periods additional control runs were taken. After each experimental run, the subject/operator would simply start the data collection procedure, leave the room and come back in an unspecified amount of time greater than the total length of the experimental ABAB block recorded just previously. Matched time point measurements of the absolute value of the deviation of the experimentally observed mean from the theoretically (chance) predicted mean were taken of the control data corresponding to the measurement marker points of its respective experimental file. Thus, the

Absolute Deviation from Means by Ratings of Depth

Main Effect

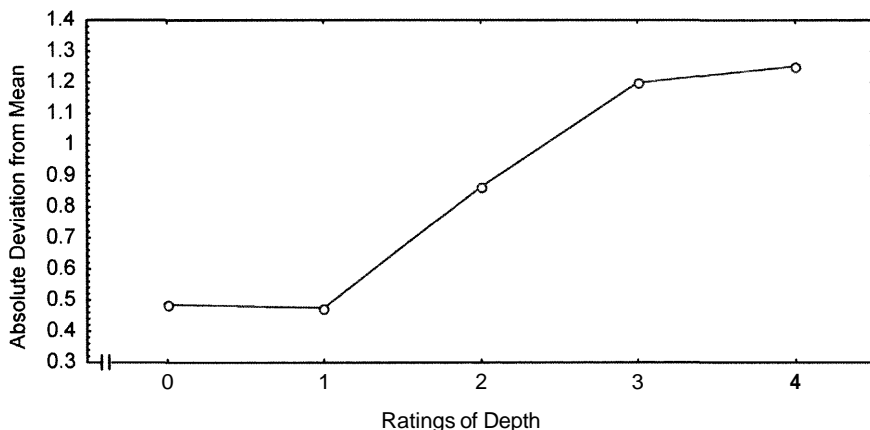
 $F(4,199)=14.18; p<.00001$ 

Fig. 5. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "depth of trance" for the exploratory study and the confirmatory study combined.

paradigm went as follows, ABAB run, control run, ABAB run, control run, etc. A total of 20 of each of these were taken in this counterbalanced order, the data were scored and entered into a spreadsheet in Microsoft Excel© and the statistics were then calculated in Statistica© for Windows. The data were collected over 15 sessions.

Results and Discussion: Experiment Three

A repeated measures ANOVA was calculated for the experimental (ABAB) runs vs. control runs yielding a statistically significant two-way interaction between experimental and control runs at the matched "A" (influence) and "B" (non-influence) time points; $F(1,38) = 5.79; p < 0.021$. So, in the experimental runs, the periods of influence were significantly more deviated from chance expectation than were the corresponding periods in the control runs, as well as being significantly more deviated than the "non-influence" periods within the experimental run itself (Figure 7).

The following histograms show the frequency distributions for difference scores (deviation for A period minus deviation for B period) for the experimental runs and the matched control runs (Figure 8).

Experiment Four

The purpose of conducting experiment four was to test the alternative hypothesis that some sort of electromagnetic effect due to postural shifts or body

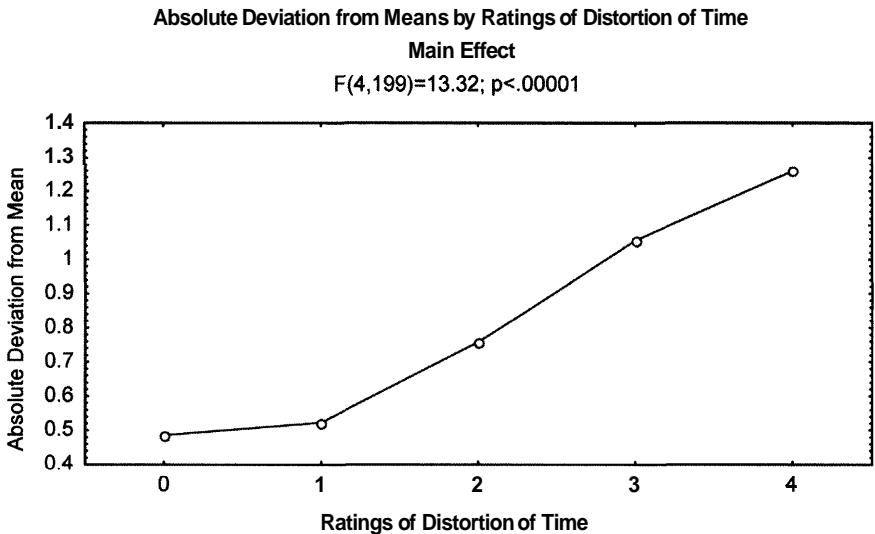


Fig. 6. Average absolute value of the deviation from the theoretically (chance) expected mean for each level of rating "distortion of sense of time" for the exploratory study and the confirmatory study combined.

movement may be responsible for the observed deviations in the output of the REG. While the PEAR device is electromagnetically shielded, to our knowledge, an actual experimental test of whether or not the sorts of electrical signals generated by human body movement (e.g., Schwartz et al., 1997) could

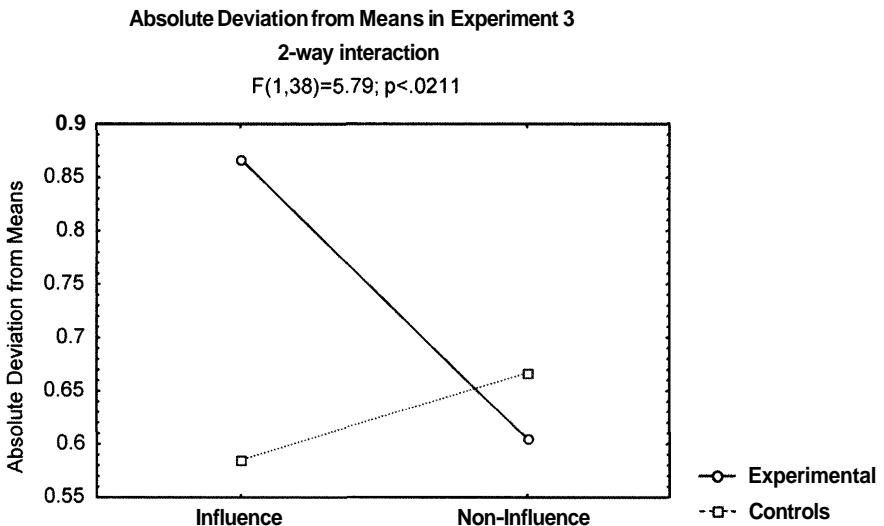


Fig. 7. Interaction effect between the "A" (influence) and "B" (non-influence) measurement points in control (dashed line) and experimental (solid line) runs.

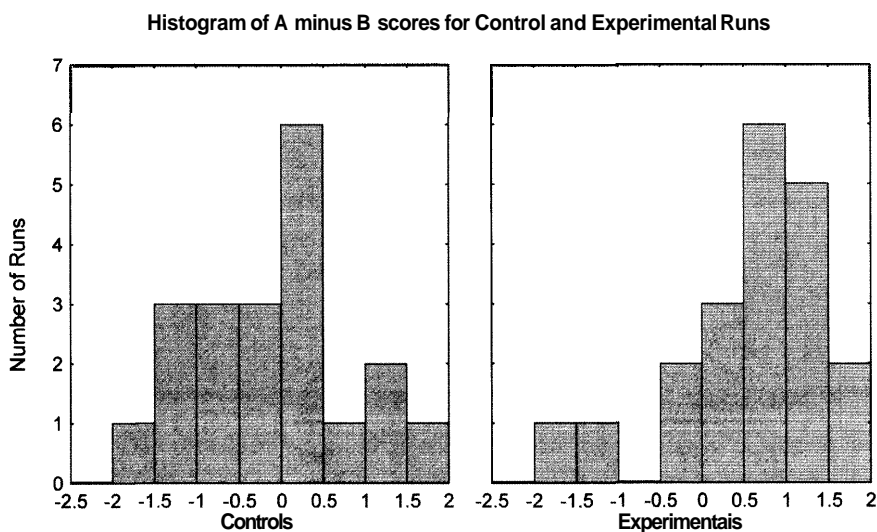


Fig. 8. Frequency distributions of the difference scores (A deviation measurement minus B deviation measurement) for experimental ABAB trials versus control trials.

affect the output of the device had never been carried out by the PEAR laboratory, or had at least never been reported in the literature.

Design and Procedure

The present experiment was intended to test the above stated hypothesis. This was accomplished by employing a hand movement condition, in which the experimenter moved his hand up and down over the outside of the REG device approximately once per second, each movement covering one and a half feet of vertical distance. This condition was considered to be of a low potential for producing the mental state of absorption. An additional attempt to minimize absorption was made by the experimenter counting the hand movements aloud. As the comparison condition, the task chosen was playing the computer game "freecell" which comes with both Windows 95 & 98. This comparison condition was chosen because it is a task involving very little body movement with a presumably higher potential for producing the mental state of absorption.

The experiment was carried out in counterbalanced order of a trial of approximately one hand movement per second, followed by a trial of freecell play, followed by a trial of hand movements, etc. Twenty trials of each condition were carried out, so that the number of trials included in experiment three was matched, guided by the observation that this number of trials was sufficient to observe a significant effect should one exist. The data were collected over 10 sessions.

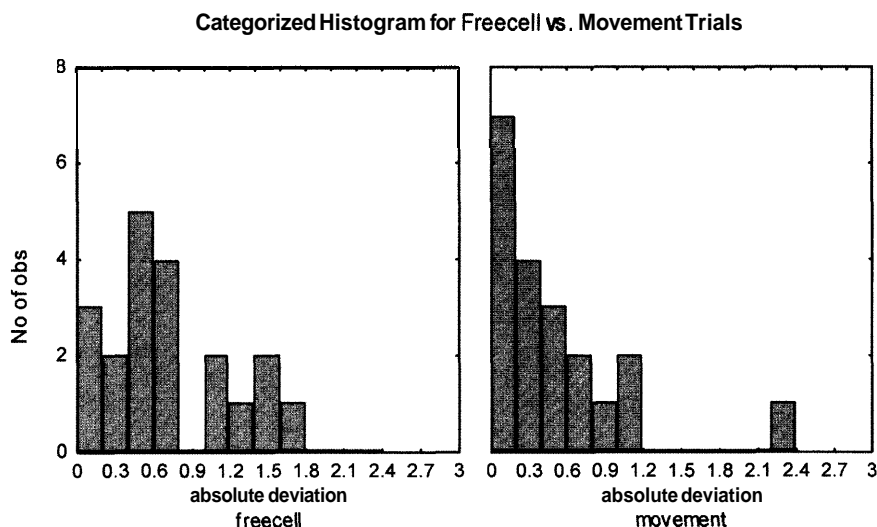


Fig. 9. Histogram of frequencies of various absolute values of deviations in REG output during freecell and hand movement trials.

Results and Discussion: Experiment Four

A one-way ANOVA was calculated comparing the absolute value of the deviation from chance expectancy for Movement vs. Freecell conditions. The analysis revealed a non-significant difference ($p < 0.238$) for these trials. However, upon examination of the distributions (see Figure 9), it was found that the non-significance of the difference was due to one abnormal case in the movement condition. One would not expect this to be the case if the movements per se were responsible for all of the observed deviations. In addition to this, the experimenter (anecdotally) recalled being absorbed during this particular trial but included it because it was scheduled to be counted as a control trial. When this single trial was replaced with an identically performed movement trial (minus absorbed state), the analysis became significant ($p < 0.0314$, see Figure 10).

Experiment Five

Given the inconclusive nature of experiment four, the need was seen to repeat a hand movement study while simultaneously taking ratings of absorption and distortion of the sense of the passing of time. The electromagnetic effects produced by the movement of the human body are known to decrease with an increase in distance from the measuring instrument, in this case the REG device (Schwartz et al., 1997). Therefore, in this experiment movements were made at two distances from the device and ratings of depth of absorption and distortion of the sense of the passing of time were taken in the same manner described in experiments one and two. This was carried out to more clearly determine

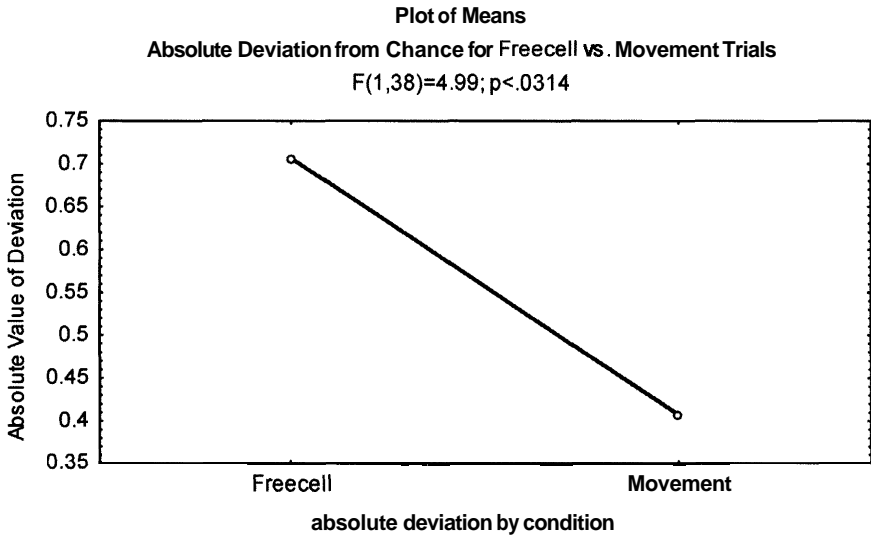


Fig. 10. Plot of mean deviation from chance expectation in freecell trials versus hand movement trials with single outlying trial replaced.

whether the observed deviations in the output of the REG device were due to an electromagnetic movement effect or to the mode of experience commonly known as absorption.

Design and Procedure

Hand movements of the same size and frequency as those performed in experiment four were performed at two distances: one directly over the box, and one at a distance of four feet from the REG device. The experimenter counted aloud the number of hand movements performed in order to try to minimize absorption. After each trial, before viewing the output of the REG device, ratings were taken of the degree of absorption experienced by the experimenter as well as a rating of any sense of distortion of time. The attempt was made to keep absorption to a minimum on all trials; however, some variability was present in the ratings. Trials were collected in counterbalanced order. Twenty trials in each condition were collected, to be congruent with the previous experiments. The data were collected over two sessions.

Results and Discussion: Experiment Five

A two by two ANOVA was calculated for the factors of distance (close vs. far) and absorption (low vs. moderate). There were no trials in which the degree of absorption was "high" (a rating of "4"). The dependent variable was the absolute value of the deviation from the theoretical mean, or chance expectation.

The main effect for absorption was significant, $F(1,36) = 7.178$, $p < 0.011$. The main effect for distance of movement was not significant, $F(1,36) = 0.138$, $p < 0.712$. The interaction for absorption by distance was not significant, $F(1,36) = 0.348$, $p < 0.559$.

A two by two ANOVA was also calculated for the factors of distance (close vs. far) and two levels of distortion of subjective sense of time (low vs. moderate). There was an insufficient number of trials in which the distortion of subjective time was "high" to include that level of this factor in the analyses ($N = 2$). The dependent variable was the absolute value of the deviation from the theoretical mean, or chance expectation. The main effect for distortion of subjective sense of time was significant, $F(1,34) = 5.353$, $p < 0.029$. The main effect for distance of movement was not significant, $F(1,34) = 0.303$, $p < 0.586$. The interaction for distortion of subjective time by distance was not significant, $F(1,34) = 0.341$, $p < 0.563$.

Discussion and Conclusion

The results of the five experiments are consistent with the PEAR lab findings that mind and matter/energy do appear to interact. While the actual magnitude of the RNG deviations is in alignment with previously reported results (i.e., quite small in magnitude), the high significance in some of these studies thus refers not to deviations in RNG outputs but rather to correlations between psychological conditions and RNG deviations. Significant correlations were found in both the initial exploratory and confirmatory studies (experiments one and two) between ratings of certain dimensions of conscious experience indicative of the degree of absorption experienced by the subject/operator and the absolute value of the deviation from chance expectation of the distribution of values produced by a REG. The magnitude of the deviation from chance expectation can be thought of as a measure of anomalous organization within the random events because a deviation from "randomness" implies "order" rather than "disorder", and order is considered to be a result of organization. The presence of the correlations and differentiations presented here is anomalous to the currently dominant theory of the nature of the mind because they indicate that the mind is able to have effects on energetic (physical) systems through currently unknown mechanisms (Radin et al., 1996).

The rated dimensions of subjective experience ("Depth of absorption" and "Distortion of time") were intended to be indicators of "state absorption". The reason that there was no pre-designed questionnaire used to assess "state absorption" is self-evident; the administration of such an instrument would undoubtedly alter the state being measured unless it was given after the fact, which is in effect what was done here with a simple two item rating system using a four point likert scale. We recognize that a larger number of indicator items (post-state, specific ratings) may yield a clearer and more accurate measure of the specific dimensional nature of this state of consciousness. While it was not

employed in this study, future research would do well to show interest in the scale created by Tellegen, for the measurement of the personality dimension "Openness to absorbing and self altering experiences (Absorption), as a trait related to hypnotic susceptibility" (Tellegen & Atkinson, 1974). This scale could be a useful tool for predicting which specific individuals might be able to easily go into and out of this state with the most minimal training. If the observations made in this paper are accurate, and the authors' understanding of the purpose of Tellegen's scale is accurate, the possibility exists that this tool could be used as a predictor of performance in mind-machine interactions. This is a hypothesis for future research since this phenomenon appears to be mediated by the operator's subjective experience of the mental state of absorption.

Hypnosis has been explored as a possible avenue for heightening psi performance by several investigators, with variable reports of success. However, the mind-machine interaction presented in this paper was not one of the tasks studied in those explorations, as the tasks referred to were primarily limited to telepathy and precognition tasks (for a review see Alvorado, 1998). If the hypnotic trance is actually characterized by high absorption and dissociation, as is hypothesized by some investigators (Irwin, 1997), the present observed interaction could be turned into an objective instrument for use in the measurement of the depth of hypnosis. Related to this application of the findings, the possibility exists that hypnosis may be one method of facilitating the necessary absorption in a subject population such that these results may be replicated on a more generalizable scale.

The connection between the absorbed mind and "non-randomness" also has several potentially important implications for the role of consciousness and intention in healing and energy medicine. Cooperstein (1998) proposes a multidimensional continuum along which to place "transpersonal healers". Many of the methods used by such healers involve a trance state in which dissociation from "ordinary self" and "ordinary reality" is regularly employed. Based on these findings, it might be interesting to investigate possible correlations between the degree of trance that these healers report and the degree of anomalous organization observed within the output of the REG device during a healing session. This would in essence be a replication and extension of the research conducted by Radin et al., as they recorded REG data while a group healing session was occurring (1996). Perhaps this correlation could serve as a predictor of the degree to which the healing session is effective in achieving its goals.

The nature of the observed anomalous connection between mind and the functioning of a nearby electronic information-energy system is yet to be discovered; the results do, however encourage further investigation into mind-machine interaction. An interesting facet of these results is that the REG device is electromagnetically shielded. Though this effectively rules out a large spectrum of energetic mechanisms that could otherwise be hypothesized to be responsible for the observed interactions, experiments four and five of the

present report explicitly tested this possible explanation with clear results. Absorption, not movement or distance, per se, is associated with observed deviations in the REG.

Given these findings, the most plausible attempt at an explanation of this effect would probably be in line with the "active information" hypothesized by Bohm to be related to the phenomenon of consciousness (Bohm & Hiley, 1997). This concept is hypothesized to be the information that organizes quantum effects into the forms that they take. It is not currently a controversial position to hypothesize the involvement of various types of organization and information with consciousness. In light of this, the observed interaction between mind and machine may simply be interpreted as suggestive of the possibility that the type of information involved with consciousness can impose order onto random processes. This would not be surprising given that we observe the mind performing that very operation any time we choose to act, either mentally or physically. The controversial component of the findings reported here really only lies in the fact that there is no obvious physical connection for this information to be transmitted.

However, as one of the reviewers for this paper commented, "I would request that they add a clear and specific caveat on the necessity of independent replication by other researchers with the same attitude and training, under similar conditions. I should add that the findings in this paper are *prima facie* very important, and deserve attention by professional researchers—if they are correct! The work constitutes a major contribution to the perennial search for replicable methodologies in psi research. Therefore it is essential that the results be confirmed in further work by independent investigators." We could not agree with this sentiment more. It is absolutely vital that research such as this be replicated under as similar conditions as possible, by individuals with similar training and a similar approach to the project.

A Note on the Use of a Single-Subject Design

Reviewers of this paper expressed concern over an obvious limitation in the current report and highlighted that the effects reported in the current investigation are too large for a study using this number of trials, especially with a single subject, who also is the first author of the paper and was involved in the statistical analysis. This is clearly a valid set of concerns, especially given the controversial nature of the findings reported here, and the obvious need for considerations of integrity in the scientific endeavor as a whole and in this area of research in particular. A natural and perhaps automatic hypothesis to entertain is that of the role of error or bias in the processing of data or recording of the observations upon which the findings are based.

However, aside from hypotheses related to experimenter error or biasing, which are not, of course, ever completely ruled out, even with the assurances of the author that every possible precaution was taken to prevent the effects of these possible factors, there are other factors involved in the specifics of the

design and methods of these experiments that may have served to amplify the effects observed. It was hoped that in choosing a single-subject design, that we may have been able to take advantage of the specific benefits that such a design might offer to reduce the problems of the typically low signal to noise ratio that is characteristic of research in this area.

The first set of these factors is related to the subject and setting. The most important, methodologically speaking, of this set of factors were 1) the use of a single subject, who 2) prior to and throughout the course of the first two experiments, 2a) had been given unlimited access to the device and 3) could exercise complete freedom over when runs were conducted. The possible implications of each of these points will be explained in turn before moving on to the next set of methodological factors that may account for differences between this report and the existing literature.

In using a single subject, one reduces variability due to individual differences. Thus, methodologically speaking, the within-group variance is dramatically reduced, and statistically speaking, requires the use of the repeated measures form of ANOVA which takes into account the correlation between the repeated observations (which with a single subject would be expected to be fairly high). These observations would be expected to be highly correlated not only in terms of talent for entering the state of consciousness in question (in this case, absorption), but also in terms of the ability to recognize the state of consciousness that one has just been in, and to reliably rate the dimensions of that state of consciousness (and in this case, appropriately and reliably designate certain runs as "non-absorbed" or control trials, or providing another rating of the extent to which a particular dimension was present, thus enhancing "between-groups" variance in comparisons between rated trials). This then, enhances the statistical resolution with which effects can be detected since within-groups variance is methodologically minimized, and statistically taken into account, and between-groups variance is simultaneously methodologically enhanced through the same mechanism.

The second methodological "subject and setting" factor that may have influenced the magnitude of the findings reported here is that the subject had access to the device for approximately one week prior to the beginning of data collection in any formal sense. During this period of time, the device was simply left running, and the subject checked, informally, to see what effects various activities in the environment seemed to have on its output. It is *very* likely that this "free formed introduction" provided the subject with some insight into the interaction of the device with its environment. Related to this point, over the course of the first two experiments, the subject was free to explore, within certain constraints, the effects of various exercises and techniques upon the overall output of the device, in a manner not unlike that employed in biofeedback paradigms. This period of learning was absolutely essential to identifying "absorption" as the specific state of consciousness that had an effect on the device's output (it "clicked" during a supposed "control" run in which the

subject found himself daydreaming, only to observe the largest deviations from randomness up to that point).

The third "subject and setting" factor that may have powerfully influenced the size of the effects that are reported in these experiments was that of the subject having absolute freedom in choosing when the runs would be conducted. This feature may only approximately be replicated in web-based experiments where the task is always available to the participants. This is a very rare characteristic in parapsychological investigations. Because of this, the subject was able to choose to conduct runs during times that he knew that his capacity for absorption would be maximal (e.g., immediately following a hot bath, or other such activities that facilitate optimal relaxation or absorption).

In addition to the "subject and setting" factors outlined above, there was one primary difference in data processing that has not typically been used in the literature on single-operator effects because of the "tripolar" paradigm that the PEAR group has historically favored. The current effects were expressed in terms of "absolute value of the cumulative deviation from chance expectation". This measure removes the "up" and "down" components of the tripolar paradigm and collapses any deviation from randomness into a single measure. While this approach has been widely used in field consciousness studies, it is less common in single-operator studies. Similarly, there were no trials anywhere in the reported experiments in which the subject attempted to "cause" the device's output to deviate in the "positive" or "negative" direction. The only outcome measured was *magnitude*. This probably effectively magnified the effects reported here (in comparison to the existing literature) by removing a constraining factor on the criterion being measured. Since there were no attempts to control the *direction* of the deviation from randomness, the probability of a "significant deviation" was at least doubled *in comparison* to the tripolar protocol that directed subjects to move the deviation either positively, negatively or not at all.

Taken together, the factors presenting the primary differences between the methods employed in the current report and those extant in the literature as the status quo for conducting anomalous organization research are considerable. It is at least plausible that these considerable methodological differences could lead to sizable differences in terms of the consistency of the effects observed. This is another important consideration in interpreting the results reported in these experiments—the deviations from theoretical expectancy are not larger than those typically observed in other literature, but rather are consistently correlated with the relevant ratings. One reviewer commented that there may have been statistical issues related to using the presumably highly correlated time and depth ratings as separate measures. A closer examination of these ratings yielded an $r^2 = 0.15$, indicating that while there was a significant degree of shared variance, each rating also reflected a large degree of unique variance.

In the experiments reported here, the primary precautions employed to protect against bias or experimenter/subject error were those such as only viewing the

output of the device after making ratings of time distortion and subjective depth of absorption in the experiments that involved such ratings, and specifically noting in the methods or results sections any instances in which there was a deviation from the set experimental protocol such as the caveats regarding the exploratory nature of experiment one.

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Appendix A: Ratings Criteria

The ratings of *depth of trance* were made on a scale from 1 to 4 where a rating of 1 reflected "light-sporadic trance" and a rating of 4 reflected an "extremely deep trance". This "depth" rating was actually dependent upon the strength or intensity of the subject's sense of "awakening", upon returning to "normal" consciousness and the degree to which body awareness was lost or altered. Thus

the rating was dependent upon the subjective sense of the difference that the subject/operator experienced in his return to "normal waking consciousness".

The ratings of *distortion of time* were made on the same 1 through 4 scale. The individual values were simply dependent on how much subjective "surprise" the subject experienced upon finding out the actual run length (which was displayed as a running count on the monitor screen) at the termination point of the run.

Appendix B: Specific Method of Attaining an Absorbed State

The absorbed state utilized in this experiment was induced as follows. The subject/operator would fix his eyes on an uninteresting object, usually a paperclip or pen, allow the muscles in his face to relax, open his eyes slightly more than normal and purposely surrender to whatever thought would arise. Subjective observations of the most inductive types of thoughts were those of conversations and interactions, either future or past. The interactive nature of the thought seemed to be the most important point, as it allowed for sustained interest and the effortless wandering along semantic association networks with a high degree of dynamism in information content and interactivity with the information contained in those networks.