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ORIGINAL PAPERS

Effects of Healing Intention on Cultured Cells and Truly Random Events

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ABSTRACT

Objective: To explore effects of healing intention and intentional space conditioning on the growth of cultured human brain cells and the distribution of truly random events.

Design: The experiment took place inside an electromagnetically and acoustically shielded chamber over a period of 3 days. On each day randomly selected flasks of human astrocytes in culture were exposed to healing treatments; an equal number of unexposed flasks served as controls. Intentional healing and space-conditioning meditations were repeatedly held inside the chamber over the course of the experiment to see if this activity would cumulatively enhance the efficacy of healing treatments. To monitor the environment for negentropic effects possibly associated with healing intention, three truly random number generators were operated continuously throughout the duration of the experiment.

Outcome measures: For the cell cultures, the outcome measure was the difference in mean colonies formed under healing intention versus control conditions, and the change in these differences over the 3-day experiment. For the random number generators, the outcome measure was the variance in the distribution of random numbers generated, compared to chance expectation.

Results: There was no overall difference in growth between treated and control cells. A treatment by day interaction indicated that treated cells grew more than control cells as the experiment progressed ($p = 0.02$). The three random number generators deviated from chance expectation on the morning of the third day of the experiment (combined peak associated with $p = 0.00009$).

Conclusions: Results were consistent with the postulate that healing intention, applied repeatedly in a given location, may alter or condition that site so as to enhance the growth of treated cell cultures compared to untreated controls. Repeated intentions also appear to be associated with a general increase in negentropy or statistical order.

INTRODUCTION

Healing intention may be defined as the act of holding a benevolent desire for another human being to achieve or sustain a state of health, or more generally, a state in which life is enhanced (Schlitz et al., 2003). Healing intention therapies such as Therapeutic Touch, *Reiki*, *qigong*, and *Johrei* share the assumption that the healer's intention is a *sine qua non* in causing positive changes in a client's body. This paper describes a laboratory experiment investigating this basic assumption.

Effects of healing intention were studied simultaneously on a living and a nonliving system. The living system was cultures of the most abundant cell type in the brain, primary

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human astrocytes. The experimental question was whether astrocytes exposed to healing intention would proliferate more than unexposed control cells. The nonliving system consisted of truly random numbers generated by three different types of electronic random number generators (RNGs). The study examined whether the distribution of random numbers would deviate from chance expectation as a result of exposure to healing intention. Previous experiments suggest that the outputs of RNGs, which by design tend toward a state of maximum entropy, become unexpectedly ordered when exposed to coherent mental states, including healing intention and focused attention (Crawford et al., 2003; Nelson and Radin, 2003; Radin and Nelson, 1989, 2003).

Two fundamentally different targets of healing intention—cells and RNGs—were used in this study to explore whether effects observed in one system would be mirrored by effects in the other. Use of such coincidence detectors provide a way to distinguish between genuine influences and measurement artifacts, equipment failures, and other flaws. They are also useful in helping to discriminate among possible explanations for observed effects. For example, if healing intention directed at cell cultures affected only those cells and not unexposed control cultures or RNGs, then intention might be modeled as a local influence that can be attuned to specific targets, analogous to a limited range bioelectromagnetic resonance phenomenon. But if healing intention affected targeted cells, control cells, and RNG outputs, then a better explanation might be in terms of a field effect, or perhaps as a negentropic principle.

This study also explored the idea that healing intention practiced repeatedly at the same location causes those intentions to become "impressed" into the physical substrate of the site itself. With sufficient exposure, such a site is hypothesized to generate healing properties similar to those produced by a healer. This postulate is weakly supported by reports of spontaneous healing as well as geophysical anomalies associated with religiously numinous locations such as Lourdes and other so-called sacred sites (Ansaloni, 2002, 2003; Cohen, 2003; Devereux, 1999; Szabo, 2002). It is also supported by the concept of "place memories" (i.e., physical and psychologic sensations associated with precise locations in traditionally haunted sites [Roll and Persinger, 2001]). Of course, anecdotal reports about sacred and haunted locations are confounded by expectation effects, and geophysical anomalies at such sites may be the cause of behavioral and perceptual distortions.

Beyond anecdotes, a small body of experimental evidence supports the idea that consciousness may be able to influence locations in subtle ways. Intention-related "linger" effects have been described in laboratory healing experiments involving mice (Watkins and Watkins, 1971; Watkins et al., 1973; Wells and Watkins, 1975) and magnetic and electromagnetic fields (Joines, 1975; Watkins and Watkins, 1974). More recently, evidence suggests that it may be possible to imprint intention into electronic circuitry through sustained meditation (Kohane and Tiller, 2000; Tiller et al., 2001), but so far this effect has not been independently replicated (Mason and Patterson, 2003).

METHOD

Participants

Four experienced *Johrei* practitioners took part in a 3-day experiment. *Johrei* is a spiritual healing practice founded in Japan by Mokichi Okada (1882–1955). As in many spiritual healing traditions, *Johrei* maintains that there is a universal energy or spiritual force that can be cultivated and directed by intention. When focused on the human body, *Johrei* is said to raise its spiritual vibrations, or to achieve spiritual purification; this in turn is said to improve health and to allow one's divine nature to unfold. *Johrei* practice assumes that for optimal healing to manifest, repeated treatments are required to help overcome the body's inertia to remain in its existing state. It is further assumed that intentional effects are not limited exclusively to the body, but may affect and alter the physical surroundings.

Cell culture materials and design

In preparation for each day of the 3-day experiment, the second author (R.T.) placed primary human astrocytes into 16 sealed rectangular flasks at a cell biology laboratory at California Pacific Medical Center (CPMC) in San Francisco, CA.[*] The author labeled each plate with a random 5-digit number and then placed the flasks into randomly assigned positions within a cell culture incubator.[†] The cultures were allowed to grow for 48 hours, then following a random selection schedule: 2 flasks were placed on the laboratory bench outside the incubator (as CPMC controls), 2 were left inside the incubator (as secondary CPMC controls), and 12 were placed inside a thermally insulated opaque plastic box and transported by R.T. to the Institute of Noetic Sciences (IONS), approximately a 45-minute automobile drive. At the IONS laboratory, R.T. placed the thermally insulated carrier inside a preparation room approximately 20 meters from the electromagnetically and acoustically shielded chamber where the healing trials were to take place.[‡]

[*]Astrocytes (Cambrex Corporation, East Rutherford, NJ) were seeded in T25 flasks (Sarstedt, Inc., Newton, NC) at a concentration of 2300 cells per flask, in modified cell-culture media (BioWhittaker's [Walkersville, MD] endothelial basal medium media with the addition of 10 mg/mL insulin, 50 mg/mL transferrin, 25 μg/mL progesterone, 10 μg/mL hEGF, and 50 μg/mL gentamicin.) and incubated at 37°C and 5% CO_2.

[†]The random assignments were made by a third party using the pseudorandom function in the Zbasic programming language (Zedcor Corp., Phoenix, AZ).

[‡]The shielded room was an ETS-Lindgren Series 81–type solid steel, double-walled, enclosure, 8 × 8 × 7.5 feet in size.

To begin each session, R.T. consulted a previously generated random schedule that identified 3 of the 12 flasks to use for the first of 4 half-hour sessions. He placed the 3 flasks into an opaque plastic box, took the box into the shielded chamber, then returned to the preparation room and waited for half an hour. After the plastic box was placed inside the chamber, the third author (G.Y.) consulted a randomly counterbalanced schedule that specified either to call a *Johrei* practitioner to enter the chamber and apply healing intention for 25 minutes, or to allow the cells to remain in the empty chamber for 30 minutes as a "no treatment" control.

During healing sessions, the *Johrei* practitioner sat in front of the treatment box, the palm of one hand directed toward the treatment box from approximately 20 cm away, alternating hands as the arm fatigued. For 25 minutes, the practitioner directed healing intention toward the plastic treatment box. G.Y. signaled the practitioner when the session was over, whereupon he or she left the shielded chamber and went to another part of the building. Then G.Y. called R.T. using an electronic (nonverbal) signal to retrieve the plastic box. G.Y. signaled R.T. at 30-minute intervals so R.T. would not accidentally encounter the practitioner and thus become aware whether the cell cultures had been in a treatment or control condition. R.T. placed the flasks back into the insulated box, retrieved 3 new flasks according to the random assignment schedule, brought them into the shielded room, and repeated this process four times per day for each of 3 days. Through this design, on each day 6 flasks were exposed to *Johrei* healing intention and 6 were controls in a randomized counterbalanced order. During all sessions a closed-circuit video camera located inside the shielded chamber allowed G.Y. to view the actions of the Johrei practitioners.[§]

Interspersed between the healing treatments, four *Johrei* practitioners met inside the shielded room and chanted and gave each other *Johrei* treatments for 75 minutes. These chanting/healing sessions were intended to help "condition the space" of the shielded room so as to support the efficacy of the healing treatments, and potentially to alter the shielded room itself to enhance cell growth.

After each day's healing sessions, R.T. returned the transport box back to the laboratory at CPMC and placed all of the flasks back into their randomly assigned positions inside the cell-culture incubator. Ten days after the first day's healing sessions, the cells in all flasks were fixed and stained,[‖] and two CPMC analysts not otherwise involved in the experiment independently examined each flask with a low-power stereoscope and counted colonies of more than 50 cells. This colony-formation efficiency assay is standard practice for measurement of cell response *in vitro* (Pomp et al., 1996). The average of the two analysts' colony counts was used as the primary data point per flask.

Blinding procedures were used throughout the experiment so that no one handling the cell culture flasks, nor the analysts who counted the cell colonies, knew if a given flask had been exposed to *Johrei* treatment or was in the unexposed control condition. The random flask condition codes were not revealed to anyone until after copies of the colony-forming efficiency data had been sent to an independent code-keeper.

In summary, each day of the 3-day experiment involved four counterbalanced cell culture healing/control periods, each lasting a half hour, and between one and three space-conditioning chanting sessions, each lasting 75 minutes.

Analysis and predictions. The healing intention hypothesis predicts that astrocytes exposed to *Johrei* healing intention would proliferate more (i.e., produce more cell colonies than untreated controls). The space-conditioning hypothesis predicts that intentional healing effects would progressively increase over the 3 days of testing.

The first analysis examined the correlation between the two analysts' colony counts. A significant positive correlation would provide evidence that the independently assessed colony counts accurately reflected cell growth in each flask. Obtaining two independent colony formation efficiency assays is somewhat unusual for cell biology studies, but given the controversial nature of the hypotheses we felt that a double-check was prudent. It also provided a way to identify potentially unreliable data (i.e., those cases in which the two analysts substantially disagreed on their counts).

The second analysis investigated whether the act of transporting cell cultures to the IONS laboratory might have affected cell growth. This was performed by comparing cell growth in flasks left at CPMC with those transported to the IONS laboratory. The comparison was tested with a two-factor analysis of variance (ANOVA): one factor was condition (CPMC versus IONS controls), the other was day (measurements on each of the 3 days). If the main effects and the interaction were not significant, then all control data would be pooled for the subsequent analysis.

The third analysis examined the hypotheses of healing intention by examining overall differences between treated and control flasks, and space conditioning by examining changes in treated versus control differences over time. A two-factor ANOVA was used with the factors of condition (treated versus control) and day (overall cell growth per day). The prediction for healing intention was a significant main effect for condition, specifically more overall cell growth in treated versus control cells. The prediction for space conditioning was a condition × day interaction, specifically that the difference in treated versus control cells would increase as the experiment progressed. No prediction was made for the ef-

[§]The video signal was sent outside the chamber to a monitor via fiber optic cable. The third author later confirmed that the practitioners did not touch or interfere with the RNGs or the cell cultures in any way.

[‖]All cell flasks were fixed on the same day as a matter of convenience.

fect of day, as cell cultures were subjected to uncontrolled factors including inherent variations in growth rates of cell cultures (which were freshly prepared for each day's test), and daily fluctuations in temperature, humidity, and handling of the cells transported to IONS.

RNG equipment and design

Two of the RNGs used in the present test were noise-based electronic circuits, the Orion (Amsterdam, The Netherlands[¶]), and the MindSong[#]. Both of these devices output streams of truly random bits (i.e., 0s or 1s) at 9600 baud to a computer's serial port. A Packard Bell 100-MHz computer (Packard Bell/NEC Computers, Rancho Cordova, CA) collected data from the Orion RNG using a DOS-based Microsoft QuickBasic 4.5 program (Microsoft, Inc., Bellevue, WA) written by the first author. A Dell 1.5-GHz computer (Dell, Austin, TX) collected data from the MindSong RNG using a DOS-based program written by the Princeton Engineering Anomalies Research Laboratory (Princeton University, Princeton, NJ). Both of these RNG/computer systems were hidden behind a curtain inside the shielded room. The *Johrei* practitioners were aware that the RNGs were in the shielded room, and continuously running during the experiment, but they did not pay explicit attention to the devices, nor was any feedback provided about the outputs of the RNGs.

Data generated by these RNGs were collected in the form of samples consisting of the sum of 200 sequential random bits. Use of such summed samples, rather than individual random bits, diminishes potential mean-biasing effects because of short-term autocorrelations. In addition, the raw bit sequence is subjected to a logical exclusive-or (XOR) against a pattern of an equal number of 0 and 1 bits to guarantee that the mean output is unbiased. These RNG circuits are designed to operate robustly within a broad range of physical influences including variations in temperature, electromagnetic fields, vibration, and component aging. Prior calibration runs confirmed that these particular RNGs generated data conforming to the expected theoretical mean, variance, skew, and kurtosis for truly random binomial samples. Calibration tests by the manufacturers have shown that both the Orion and MindSong RNGs pass the Marsaglia DIEHARD randomness tests, one of the gold standards used to test the randomness of RNGs.[**] The 200-bit samples generated by these RNGs were collected and stored at a rate of 1 sample per second for the Orion and at a slightly faster rate for the MindSong. All samples were date and time stamped to allow later synchronization with external events, and the computers were synchronized to standard Internet time at the start of the experiment.

The third RNG was a computer-monitored Geiger counter (model RM-60 from Aware Electronics, Wilmington, DE). This device monitored background ionizing radiation (i.e., naturally occurring alpha, beta, gamma and x-ray particles), and data were collected by a Dell 1.5-GHz PC with a Windows-based software package also from Aware Electronics. The program counted and stored the number of radioactive particles detected in successive 10-second periods.

Analysis and predictions. Each sample from each of the two electronic noise-based RNGs was transformed into a normalized score as $z = (x - 100)/\sqrt{50}$, where x was the per-second RNG sample. Then a 1-hour composite Stouffer z score, z_H, was created by combining the per-second z scores as $z_H = \sum_i z_i/\sqrt{N}$, where i ranged from 1 to 3600 and $N = 3600$ for the Orion RNG and i ranged from 1 to 3970 and $N = 3970$ for the MindSong RNG.[††] Data from the radiation monitor were normalized by finding the mean m and standard deviation s of all 10-second counts, forming $z_r = (x - m)/s$ for each sample x, and then creating a 1-hour composite Stouffer z score, z_H, as above, except with $n = 360$ (because x was based on 10-second rather than 1-second counts). This procedure created three arrays of z_H scores, each 263 data points in length, each point representing 1 clock hour of continuous data collection from each of the three RNGs (the RNGs were running continuously for a week before the 3-day experiment began). These hourly z's provided convenient temporal units to work with and were used as the basic statistics in the following analyses.

Two types of analyses have been commonly employed in similar RNG studies (e.g., Nelson, 2001; Nelson et al., 2002; Radin, 1997, 2002): a cumulative deviation statistic and a sliding window statistic. The former is useful for exploring slow-moving, systematic biases that may arise in RNG outputs; the latter is useful for detecting faster moving deviations. In both cases, the underlying statistic is the sum of z-squares, which is χ^2 distributed with degrees of freedom (*df*) equal to the number of summed values. In this study, both methods were explored.

For the cumulative deviation method, the hourly z_H^2 values were independently summed for each RNG from the beginning of data collection up to the start of the experimental period, and then for comparison cumulated again from the start of the experimental period to the end of data collection. For ease in estimating the probabilities of these chi-

[¶]See valley.interact.nl/av/com/orion/rng/home.html Accessed April 29, 2003.

[#]See noosphere.princeton.edu/eg.html: Accessed April 29, 2003; the Mindsong RNG is no longer manufactured.

[**]Marsaglia, G. DIEHARD software available at stat.fsu.edu/~geo/ as of May 25, 2003.

[††]MindSong RNG data were extracted for each day and the total number of samples divided by 24 to determine the number of samples used to form the hourly Stouffer z. Instead of 1 sample per second, the MindSong recorded approximately 1.1 samples per second, which is expected for this device.

squared values, each hourly z_H^2 value in each of the three cumulative arrays was normalized into a z score as $z_{ij} = \sqrt{\chi_{ij}^2 \times 2} - \sqrt{i \times 2 - 1}$ (Guilford and Fruchter, 1976), where $\chi_{ij}^2 = \sum_{ij} z_{Hij}^2$, $i = 1$ to 263 (hours), and $j = 1$ to 3 (RNGs). The resulting three arrays of cumulative z scores, one per RNG, were then combined into a single, composite Stouffer z score as $z_{cd(i)} = \sum_{ij} z_{ij}/\sqrt{3}$, where "cd" indicates cumulative deviation, $i = 1$ to 263, and $j = 1$ to 3.

For the sliding window method, the sum of squares of 12 adjacent z_H^2 values was taken for each RNG, representing the hours 1–12, 2–13, 3–14, et cetera. This created a vector of $263 - 12 = 252$ χ^2 values (each with 12 *df*) per RNG. Those three vectors were then combined by (1) determining the p value associated with a χ^2 statistic with 12 *df*, (2) converting this p value into a one-tailed z score using an inverse normal transform, and then (3) combining the resulting 3 z's into a single composite Stouffer z score as $z_{sw(f)} = \sum_{ij} z_{ij}/\sqrt{3}$, where the subscript "sw" indicates sliding window, i ranges from 1 to 252 and $j = 1$ to 3.‡‡ A 12-hour sliding window was selected based on the first author's experience in analyzing similar data. Later we discuss other sliding window sizes to see if this choice was especially fortuitous. The prediction was that nonchance deviations in the RNGs would be observed during the 3-day experiment, and because of the space-conditioning efforts the likelihood of observing these deviations were predicted to increase as the experiment progressed.

RESULTS

The experiment lasted 51 hours, from 5:00 PM on Friday, September 27, 2002 through 7:00 PM on Sunday, September 29, 2002. The first cell-culture healing session took place Friday evening from 5:00–7:00 PM. The first space-conditioning session took place that same evening from 8:00–9:15 PM. On the second day the space-conditioning sessions took place from 9:00–10:15 AM, 3:30–4:45 PM, and 8:00–9:15 PM, and the cell culture healing sessions were held from 5:00–7:00 PM. On the third day a space-conditioning session was held from 9–10:15 AM, and the last cell culture healing session took place that evening from 5–7 PM.

Cell cultures

Figure 1 shows the relationship between the cell colony counts for the two analysts for the treated and control flasks used at IONS. Recall that the analysts were blind to the conditions of the flasks, and each analyst conducted the measurements independently. The expected positive relationship was observed ($r = 0.68$, $p = 3 \times 10^{-6}$).

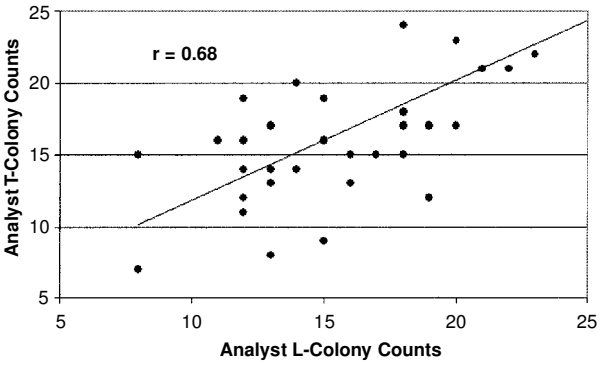

FIG. 1. Cross-analyst reliability, $r = 0.68$, $p = 2.5 \times 10^{-6}$.

However, in some cases the analysts' colony counts differed to a surprisingly large degree. To identify unreliable counts, the absolute differences between all 48 pairs of colony counts were determined (36 IONS flasks and 12 CPMC flasks). These differences ranged from 0–8, with a median of 2, average of 2.9, and standard deviation of 2.4. We defined as "unreliable" those absolute differences greater than 1.65 standard deviations from the average. There were five such cases, with absolute differences of 7 and 8, two of which occurred in the IONS treatment counts, two in the IONS controls, and one in the CPMC controls. We then examined the following ANOVAs with and without these five unreliable data points to see what effect they had on the results. If these outliers were randomly distributed, then the ANOVA results should be roughly the same with or without the unreliable cases.

TABLE 1. ANOVA OF COLONY COUNTS

ANOVA	*SS*	df	*MS*	F	p
All data					
Day	76.26	2	38.13	2.83	0.08
Site	4.51	1	4.51	0.34	0.57
Day × site	12.36	2	6.18	0.46	0.64
Error	322.98	24	13.46		
Outliers removed					
Day	44.58	2	22.29	1.70	0.21
Site	1.27	1	1.27	0.097	0.76
Day × site	14.19	2	7.09	0.54	0.59
Error	274.69	21	13.08		

Colony counts for controls at California Pacific Medical Center (CPMC) (12 flasks) and Institute of Noetic Sciences (IONS) (18 flasks), and with 3 unreliable counts excluded.

ANOVA, analysis of variance.

‡‡This method differs from that used for the cumulative analysis because the z score approximation to the χ^2 is not accurate with less than 30 degrees of freedom (*df*).

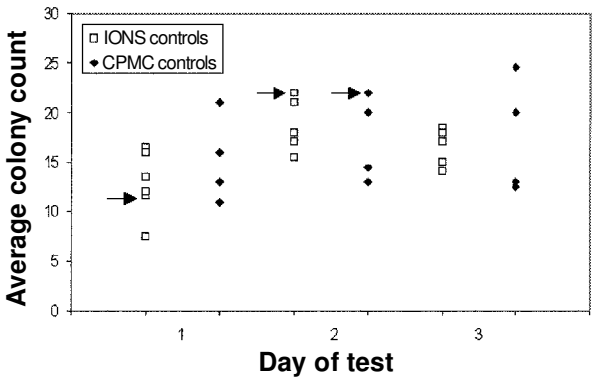

FIG. 2. Colony counts for controls at California Pacific Medical Center (CPMC), San Francisco, CA. (12 flasks) and Institute of Noetic Sciences (IONS), Petalunga, CA. (18 flasks). The arrows point to two IONS control counts and one CPMC control count identified as unreliable.

Cell-culture controls. Table 1 shows the result of the ANOVA comparing the control flasks at CPMC versus those transported to the IONS laboratory. The colony counts and outliers are shown graphically in Figure 2. None of the main effects or interactions were significant, thus all control data were pooled for the subsequent analysis.

Treated versus control cell cultures. In Table 2 and Figure 3, we see that the healing intention hypothesis, predicting an overall main effect for condition, was not supported with all data ($p = 0.45$) or with outliers removed ($p = 0.20$). By contrast, the space-conditioning hypothesis was supported with a significant day × condition interaction ($p = 0.02$). A Spearman R indicated a positive trend in the treated cells ($R = 0.63$, $p = 0.005$; excluding outliers $R = 0.75$, $p = 0.0009$), and a marginally positive trend in control cells (Spearman $R = 0.48$, $p = 0.04$; excluding outliers $R = 0.47$, $p = 0.07$).

RNG results

RNG data were collected for 1 week prior to the 3-day experimental period, and for 1 day after to provide a long-term baseline with which to confirm proper device operation. The IONS laboratory was not used for other purposes during the experiment. Data collection ended the morning of Tuesday, October 1, 2002. Approximately 1 million 1-second samples had been collected from each of the two electronic RNGs over this time, and 100,000 10-second samples from the radiation monitor.

Figure 4 shows the composite result for the three RNGs in the IONS laboratory, based on the 12-hour sliding window method. The observed peak deviation occurred between 1:00 and 2:00 AM of the third day, and is associated with $z = 4.8$. To assess the probability of this z score, given that the hypothesis did not specify when the peak would occur, a bootstrap statistical method was used as follows. The order of the observed z_H values were randomly shuffled, a new 12-hour sliding window curve was created out of the shuffled order, and the peak value within the 51 hours of the experimental period was determined. This procedure was then repeated 100,000 times to build up a distribution of possible peak values. This analysis showed that among the maximum shuffled z_H values only 9 exceeded the observed $z = 4.8$, thus the probability of the observed peak deviation is $p = 0.00009$.

Figure 5 shows the sliding window analysis individually for each RNG. Note that the peak effects for all three RNGs occurred within the 51 hour experimental period.

Figure 6 shows the results of the cumulative deviation analysis for data combined across the three RNGs. This showed a nonsignificant deviation throughout the baseline period up to the start of the experiment. Then, when cumulating the data again from the start of the experimental period, the three RNGs peaked at 3.3 standard deviations above chance expectation at 8:00 AM on the morning of the third

TABLE 2. ANOVA FOR TREATED AND CONTROL FLASKS

a	*SS*	df	*MS*	F	p
All data					
Day	244.53	2	122.27	9.93	0.0003
Condition	7.10	1	7.10	0.58	0.45
Day × condition	110.14	2	55.07	4.47	0.02
Error	517.06	42	12.31		
Minus 2 outliers					
Day	276.93	2	138.46	12.37	0.00008
Condition	18.91	1	18.91	1.68	0.20
Day × condition	120.78	2	60.39	5.39	0.009
Error	414.09	37	11.19		

Treated flasks = 18; control flasks = 18. The day main effect indicates an overall rise in cell growth as the experiment progressed; the day by condition interaction indicates that the differences between the treatment and control conditions increased as the experiment progressed.

ANOVA, analysis of variance.

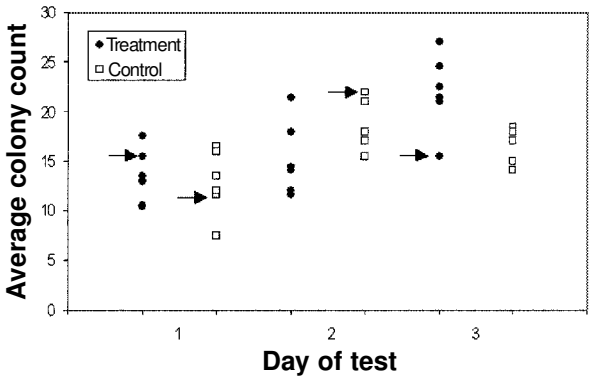

FIG. 3. Average cell-culture counts for treated and control flasks by day of test. The arrows indicate two treatment and two control counts identified as unreliable.

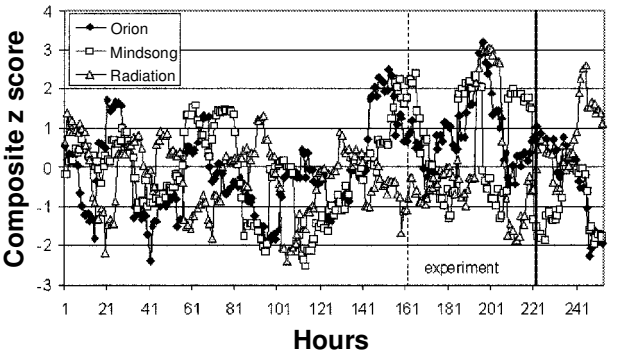

FIG. 5. Twelve (12)–hour sliding window analysis for each random number generator expressed as z scores.

day, an hour before the last space-conditioning session was about to begin, and remained above 3 standard deviations for the duration of that session.

DISCUSSION

Cell cultures

Table 3 shows the probabilities associated with a *post hoc* Newman-Keuls test contrasting cell growth per day in treatment and control conditions. This indicates that the significant day × condition interaction was the result of increased growth of treated cells on day 3. Values in parentheses in Table 3 show that these contrasts increased after removing four colony counts identified as unreliable.

The nonsignificant main effect of condition provided no support for the healing intention hypothesis. But it also indicated that proximity of the healer's body to the cell cultures in the treatment condition was probably not responsible for the increased cell growth on day 3. Thus, in light of evidence that something unusual occurred on the third day of this experiment, the nonsignificant condition effect may be reinterpreted as suggesting that individual healing intention effects are weak, but cumulative. That is, repeated applications of healing intention in a given location may have measurable consequences, but a "single shot" may not be detectable.

One limitation of this experiment was the lack of cell-culture measurements in the shielded chamber before the healers arrived and after they departed. Such longitudinal data would have allowed a more detailed examination of the space-conditioning hypothesis, including questions about intentional "dose," and how long cell growth enhancements in a "conditioned space" may persist.

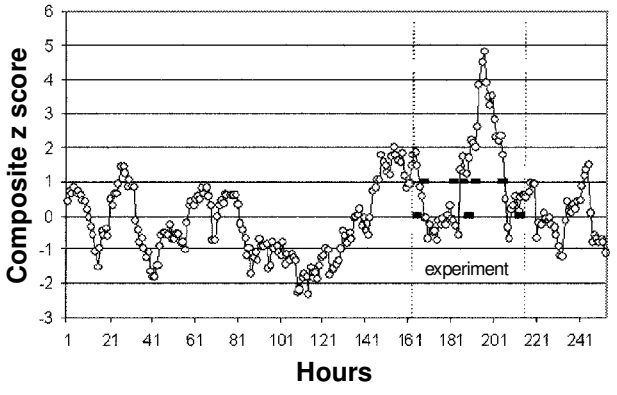

FIG. 4. Combined results of the three random number generators (RNGs) for the sliding window analysis in terms of z scores (i.e., standard normal deviates). The black bars within the experimental period indicate periods of healing intention (bars at $z = 0$) and space conditioning (bars at $z = 1$). The peak z score occurred on the third day of the experiments, between 1:00 and 2:00 AM.

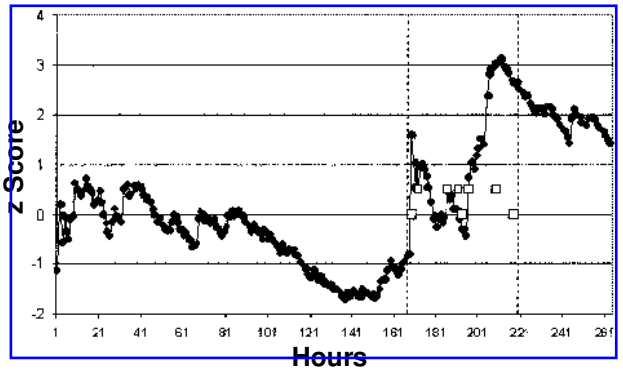

FIG. 6. Cumulative deviation results for the three randon number generators combined, in terms of z scores, cumulated over a 1-week baseline prior to the experiment, and cumulated again at the start of the experiment. The white boxes at (shown at $z = 0$ and 0.5) indicate when the intentional healing and space conditioning periods occurred, respectively. The vertical lines indicate the beginning and end of the experimental period.

TABLE 3. RESULTS OF *POST HOC* NEWMAN-KEULS TEST

Condition	*T Day 1*	*C Day 1*	*T Day 2*	*C Day 2*	*T Day 3*	*C Day 3*
T day 1		0.57	0.43	0.09	0.0008 (0.0002)	0.24
C day 1			0.37	0.04	0.0003 (0.0002)	0.14
T day 2				0.24	0.004 (0.0007)	0.40
C day 2					0.04 (0.003)	0.43
T day 3						0.02 (0.003)
C day 3						

Results show the probability of six contrasts (i.e. 3 days × 2 conditions) for cell growth at Institute of Noetic Sciences (IONS). T is treatment, C is control condition. Values in parentheses show the effect of removing four colony counts identified as unreliable.

Random number generators

Both the sliding window and a cumulative analysis of the RNG outputs showed significant deviations from chance expectation during the experiment, and no unexpected deviations for one week prior or one day after the experiment. In addition, the peak deviations of all three RNGs occurred during the experiment at about the same time. These deviations appeared in the morning of the third day sometime between 1:00 AM (sliding window analysis) and 8:00 AM (cumulative analysis), when no healing or space-conditioning efforts were actively taking place. It is not clear why the RNG deviations appeared when they did in this study, but similar effects, apparently linked to group attention and intention, have been reported by a growing number of independent groups (e.g., Bierman, 1996; Blasband, 2000; Crawford et al., 2003; Nelson et al., 1996, 1998; Radin, 2002; Radin et al., 1996; Rowe, 1998; Schwartz et al., 1997).

A working speculation, based on the outcomes of a half-century of experiments examining mind–matter interactions (Radin and Ferrari, 1991; Radin and Nelson, 1989, 2003), is that mind and matter may be complementary aspects of a deeper, underlying reality. When mind becomes ordered, either through specific forms of concentration as in an intentional healing practice, or through focused attention as stimulated by a highly engaging event, matter appears to reflects this ordering not because it is "pushed" to do so, but because it is metaphorically the other side of the same mind-matter coin.

The important point for the present study is that both the treated cell cultures and the RNGs showed significant deviations from chance expectation within hours of each other, and those deviations were in alignment with the hypothesis of space conditioning. The coincidence of such deviations arising in both a living and a nonliving system supports the likelihood of a genuine physical phenomenon associated with intention. It also suggests that the underlying effect is not limited to the nominal target of intention, but is more akin to a field effect with possible negentropic properties.

Alternative explanations

What alternative conventional explanations might there be for the observed effects? Mundane explanations include (1) chance fluctuations, (2) systematic biases or other artifacts in the RNG hardware or software, (3) natural environmental fluctuations, especially in the case of the RNG based on radioactive decay, (4) differences in how treatment and control cell culture flasks were handled, (5) how cell cultures were counted, (6) proximity of a human body near the treated cells, (7) use of inappropriate statistical analyses, (8) selective reporting of data, and (9) selective reporting of multiple analyses.

For the present experiment, most of these explanations were rendered implausible by design, the others by observed outcomes. For example, the RNG peak result was determined by a nonparametric bootstrap technique to be equivalent to 3.75 standard normal deviates (z scores) from chance, and the cell culture day × condition result was equivalent to $z = 2.12$ to 2.37, depending on whether unreliable cell counts are excluded. Thus, the combined statistical evidence for an apparent space-conditioning effect ranges from $z = 4.15$ to 4.32, equivalent to $p = 0.00002$ to 0.000008. This joint outcome, in light of no significant deviations in the RNGs before or after the experiment, or between the CPMC and IONS control cell cultures, suggests that chance is not a plausible explanation.

Examination of geophysical and geocosmic variables obtained from the National Oceanic and Atmospheric Associ-

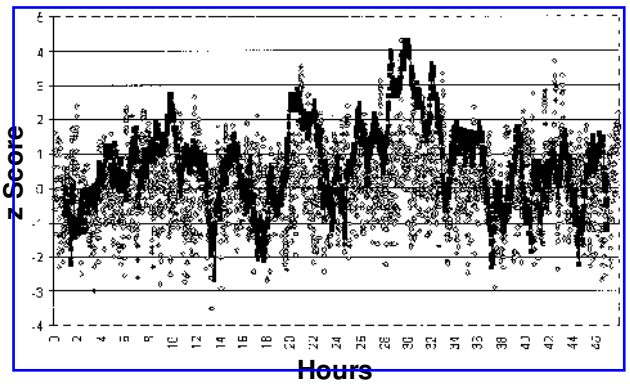

FIG. 7. Analysis of the three random number generators combined, with data consolidated into 10-minute segments (white diamonds) and 2-hour segments (black squares). The peak deviations observed at $z > 4$ occur at nearly the same time.

ation Web site[§§] for days before, during, and after the experiment, including geomagnetic field flux, sunspots, solar flares, and solar wind, indicated that these environmental factors were unremarkable. In particular, there were no solar storms or other natural reasons for increased radiation that might have influenced the Geiger-counter based RNG. Everyone who handled the cell cultures was blind to the conditions they were exposed to, and the analysts independently counted the colonies. If proximity of a human body near the treated cells was responsible for higher growth rates, then this should have been evident on each day of the experiment, not just the third day. The statistics used were based on nonparametric methods for the RNGs, and a conventional two-factor ANOVA for the cell cultures. All data collected were reported, and all analyses applied to the data are also reported.

Finally, given the fact that there are an infinite number of ways to analyze data, could the reported results be the result of fortuitous guesses about which analyses to use? For the cell-culture data this is not a major concern because the ANOVAs and pair-wise contrasts were merely formal ways of confirming what the raw colony count data reveal in Figures 2 and 3. But could the use of a 12-hour sliding window be the one window size that just happened to result in a statistically significant peak in the RNG data? To explore this possibility, RNG data combined over the three devices were analyzed for the 51-hour experimental period using time scales of 10 minutes and 2 hours. Results, shown in Figure 7, indicate that both methods peaked at $z > 4$ approximately 30 hours into the experiment, the same time as the peak observed with the 12-hour sliding window. Thus, the 12-hour sliding window size originally selected for examining the RNG data does not appear to have been fortuitous—similar deviations also occurred at faster and slower time scales.

CONCLUSION

This experiment suggests that a single application of healing intention may be insufficient to affect human brain cell colony formation or random number generators to a significant degree. But repeated application of healing intentions and space-conditioning meditations appear to have measurable consequences in both systems. Future studies exploring healing intention and associated environmental and negentropic side-effects appear to be warranted.

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[§§] See www.noaa.gov

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