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Coherent Consciousness and Reduced Randomness: Correlations on September 11, 2001

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Abstract—The Global Consciousness Project (GCP) is an international collaboration of researchers studying interactions of consciousness with the environment. The GCP maintains a network of random event generators (REGs) located in over 40 host sites around the world. These devices generate random data continuously and send it for archiving to a dedicated server in Princeton, New Jersey. The data are analyzed to determine whether the fundamentally unpredictable array of values contains periods of detectable non-random structure that may be correlated with global events. In this paper we examine the data from September 11, 2001, for evidence of an anomalous interaction driving the REGs to non-random behavior. Two formal analyses were made, testing hypotheses based on standardized procedures for making predictions and performing a statistical evaluation. A number of *post hoc* and exploratory studies, including work by five independent analysts, provide additional perspective and examine the context of several days before and after the major events. The results show that a substantial increase in structure was correlated with the most intense and widely shared periods of emotional reactions to the events. Further analysis indicates that the non-random behavior cannot be attributed to ordinary sources such as electrical disturbances or high levels of mobile phone use. The evidence suggests that the anomalous structure is somehow related to the unusually coherent focus of human attention on these extraordinary events.

Keywords: consciousness—anomalous interactions—random events—random numbers—September 11, 2001—mind-matter interaction

Introduction

A glimpse of the extraordinary span of human consciousness may have come from the horrific events of September 11, 2001. As we all know, beginning at about 8:45 in the morning, a series of terrorist attacks destroyed the twin towers of the World Trade Center (WTC) and severely damaged the Pentagon. Commercial airliners were hijacked and flown directly into the three buildings. The first crashed into the North tower at 8:45 and about 18 minutes later the second airliner hit the South tower. At about 9:40, a third airliner crashed into the Pentagon. A fourth hijacked plane crashed in Pennsylvania, apparently due to the heroic self-sacrifice of the passengers. At about 9:58, the South WTC tower collapsed, followed by the North tower at 10:28.

Thanks to CNN, BBC and other media, human beings all over the planet were simultaneously feeling horror, shock, fear, dismay and fascination with the same images and sounds. We were forged by the events into a collective consciousness tuned to a single frequency. In apparent correspondence, over the course of this tragic day, a world-spanning network of electronic devices exhibited unmistakable patterns where there should have been none. Without question, these events and the powerful reactions around the world qualified as a "global event". As such, this was an appropriate case study for the Global Consciousness Project (GCP), an international collaboration involving researchers from several institutions and countries, set up to explore whether objective measurement might reveal correlations between inferred special states of consciousness on a global scale and the behavior of physical devices.

The project builds on experiments conducted over the past 35 years at a number of laboratories, demonstrating that human consciousness can interact with true random event generators (REGs), to somehow induce non-random patterns that are correlated with intentional, mental efforts (Radin and Nelson, 1989). For example, small changes in the proportion of 1s and 0s are associated with participants' attempts to change the distribution of numbers produced by a physical random event generator in controlled experiments. The results show a tiny but significant correlation with the participants' assigned intentions (Jahn *et al.,* 1997). The replicated demonstrations of anomalous mind/machine interactions clearly show that a broader examination of this phenomenon is warranted, and the research continues in a number of laboratories.

Variations on the theme include "FieldREG" studies that take the REG device into the field to see whether group interactions might affect the random data (Nelson *et al.,* 1996, 1998a). In related work, prior to the GCP, an array of REG devices in Europe and the U.S.A. showed non-random activity during widely shared experiences of deeply engaging events. For example, the funeral ceremonies for Princess Diana created shared emotions and a coherence of consciousness that appeared to be correlated with structure in the otherwise random data (Nelson *et al.,* 1998b). Instead of the expected, unpredictable sequence of random numbers, small changes in the mean value indicated that something had introduced a non-random element that structured the sequence, making it slightly more predictable. In graphical terms, instead of a random walk (a "drunkard's" walk), the data sequence showed a steady trend.

These experiments were prototypes for the GCP. In the fully developed project, a world-spanning network of more than 40 devices collects data continuously and sends it to a central server in Princeton, New Jersey, via the Internet. The system is designed to create a continuous record of nominally random data over months and years, gathered from a wide distribution of locations. Its purpose is to document and display any subtle effects of humanity's collective consciousness as we react simultaneously to global events. Our research hypothesis predicts the appearance of increasing coherence and structure, or non-random trends, in the globally distributed data collected during major events in the world. The events that comprise the sample of test cases share a common feature, namely, that they powerfully engage human attention all around the world, and draw us in large numbers into a common focus.

I take responsibility for the descriptions in this paper, but I will use collective pronouns to represent the collaborative nature of this work. I also want to acknowledge the fact that some of the terminology and images in these descriptions are convenient metaphors rather than scientific entities. I like the notion of a noosphere (Teilhard de Chardin, 1959), but it is clear that at this point the idea remains an aesthetic speculation. We do not have solid grounds to claim that the statistics and graphs demonstrate the existence of a global consciousness. On the other hand, we do have strong evidence of anomalous structure in what should be random data, and clear correspondence of these unexplained departures from expectation with well-defined events that are of special importance to people.

Method

Because this is an unusual and relatively complex experiment, the research methodology requires a brief introduction. The GCP Web site and prior publications present greater depth of description and discussion (Nelson, 1998c, 2001a). In a nutshell, the method is to collect continuous, concurrent streams of data from electronic devices designed to produce completely unpredictable and unstructured sequences of numbers. We identify events that powerfully stimulate shared human reactions, make *a priori* predictions that specify the analysis parameters, and then look at the temporally corresponding data to determine whether they show significant changes from the expected random quality. The following sections document the procedures in some detail.

Data Acquisition

We begin with a description of the physical data-acquisition system, and a definition of terms used for the specialized equipment. At each of a growing number (over 40 in early 2002) of host sites around the world, a well-qualified source of random bits (REG or RNG)[1] is attached to a computer running custom software to collect data continuously at the rate of one 200-bit trial per second. This local system is referred to as an "egg," and the whole network has been dubbed the "EGG," standing for "electrogaiagram," because its design is reminiscent of an EEG for the Earth. (Of course this is just an evocative name; we are recording statistical parameters, not electrical measures.) The egg software regularly sends time-stamped, checksum-qualified data packets (each containing five minutes of data) to a server in Princeton. We access official timeservers to synchronize the eggs to the second, to optimize the detection of inter-egg correlations. Even if the computer clocks (which are notoriously inaccurate) should have uncorrected drift, any mis-synchronization is expected to have a conservative influence in our standard analyses. The server runs a program called the "basket" to manage the archival storage of the data. Other programs on the server monitor the status of the network and do automatic analytical processing of the data. These programs and processing scripts are used to create up-to-date pages on the GCP Web site, providing public access to the complete history of the project's results. The raw data are also available for download by those interested in checking our analyses or conducting their own assessments of the data. Each day's data are stored in a single file with a header that provides complete identifying information, followed by the trial outcomes (sums of 200 bits) for each egg and each second. With 40 eggs running, there are well over three million trials generated each day.

Analysis

The database is a continuously growing matrix of trials, each of which has an expected mean (μ) of 100 and expected standard deviation (σ) of 7.071[2]. Deviations from the expected mean can be converted directly to approximately normally distributed Z-scores ($Z_i = (m_i - \mu)/\sigma$). For N eggs in the network, the Z-scores can be combined across eggs using the Stouffer method ($Z_s = \Sigma Z_i/\sqrt{N}$) to form a new Z-score representing the composite deviation of the mean at any given moment. This is an algebraic sum that becomes large when the eggs show correlated deviations. The Stouffer Z is the elementary unit in the standard analysis of data generated during the event of interest. If desired, the same procedures can be applied to blocked data created by taking the mean over a block of time for each egg. An alternative analysis addresses the variability among the eggs using either a direct calculation of the variance (s^2) across eggs or a sum of the Z_i^2, that is, the squared deviations. In contrast to the Stouffer Z, this quantity is substantially affected by small differences among the physical REG devices, so comparisons require the use of empirical error estimates and statistical expectations.

The hypothesis for REG experiments in general is that the mean value of the nominally random numbers will be shifted. In other words, the output of the REG device will not be random as expected but will show a bias that is correlated with the putative source of influence. In some experiments (in the laboratory), an intention is assigned to shift the mean high or low, but in field experiments, including the GCP, there is no specified intention. Therefore, a significant deviation of the mean in either direction away from what is expected qualifies as anomalous and interesting, especially if the deviations of the eggs are not only large, but inter-correlated. The standard analytical procedure looks at deviations of squared composite Z-scores (Stouffer Z's), which are χ^2 distributed with one degree of freedom (df), assuming a null hypothesis. The experimental hypothesis specifies a positive accumulation in the sum of these χ^2 values across the time of the event that has been identified. That is, we declare an expectation that the eggs' output will tend to show increased deviations from expectation during the pre-specified period of time and test this using a one-tailed χ^2 accumulation ($\Sigma Z_s{}^2 \gg$ df, where df is the number of seconds or Stouffer Z-scores). The formal hypothesis for each global event is defined in a prediction registry and specifies the period of time, the resolution (usually seconds, sometimes blocks of one minute or 15 minutes), a confidence level, and any special requirements, *e.g.*, signal averaging across time zones. The standard analysis described here is used unless another procedure is defined in advance for the registered prediction.

The important qualities of the standard analysis are: (a) All the procedures are well understood and widely used in statistics, (b) normalization is straightforward and based on a well-characterized mean and standard deviation, (c) χ^2 values are additive, so the results from separate eggs or minutes or occasions can readily be combined to give an overall picture, and (d) the analysis represents the basic idea that the eggs will exhibit a degree of correlated behavior if they somehow respond to events in the world.

Predictions

The tests for the overall GCP hypothesis depend on a Prediction Registry to establish the timing and analysis parameters for each event. This time-stamped registry is available for public inspection on the GCP Web site. Because we often cannot identify relevant events before their occurrence, we use categorical specifications to help select a reasonable sample of cases to represent the hypothesis. On the basis of prior experience, we postulate broadly engaging, emotionally salient events and situations as the conditions that we expect will be correlated with anomalous and significant deviations in the REG data-streams. We set the criteria for global events restrictively, to identify very few occasions with broad scope and impact for a large number of people around the world. Each prediction identifies the period of time during which a deviation is expected in the data, and it provides the information needed for analysis. It may be helpful to note that each formal prediction is in some sense a new "experiment," so that the full database may be thought of as a large number of replications of a simple experiment. There are three distinct categories for predictions. In some cases, they address known events, such as New Year's Eve celebrations and other widely observed holidays, and certain globally interesting scheduled events, such as World Cup Soccer and the Olympics. Also known ahead of time, but with no regular schedule or repetition, are widely publicized ceremonies such as the Princess Diana and Mother Teresa funerals. In this category we also may place unusual cosmic events, such as full solar eclipses. Finally, there is a large category of unpredictable events that gather worldwide attention, such as major earthquakes, the fall of the Berlin wall, the assassination of Israeli Prime Minister Rabin, the detonation of atomic weapons in India and Pakistan, or the terrorist attacks of September 11, 2001. The times we use for archiving the data, and hence for the predictions and analyses, are registered unambiguously in coordinated universal time (UTC or GMT).

A prime source of predictions is inevitably the international news services, such as CNN and BBC. The reports of a major story identify its scope and usually provide enough information to specify the timing. Relatively local events also may be considered for predictions if they involve powerful engagement of many people in some part of the world. Obviously, we cannot discover or assess all possible global events, so the selection is arbitrary and constitutes a fixed sample from an indefinitely large population. Some predictions may have two aspects, one referring to the moments of the actual event and one that looks at growing world consciousness of the event. The first might be envisioned as representing a ‘‘psychic’’ reaction that might occur if there were something like an independent global consciousness or, alternatively, an immediate effect from intense local reactions. The second type represents a more ordinary conscious engagement across large numbers of people because of media coverage.

Controls

Control data are needed to establish the viability of the statistical results. Because predictions for the GCP are situation dependent, we need specially designed procedures to ensure that the statistical characterizations of the complex array of data are valid. There are several components in the control procedures. We begin with quality-controlled equipment design, with special attention to the exclusion of electromagnetic and environmental influences. The data are further processed through a logical XOR stage that inverts exactly half of the sample bits. This eliminates any physically induced bias of the mean, at the cost of possible effects on higher moments of the distribution. The resulting data-stream will show normal, expected variation, but no trends attributable to spurious physical sources. The REGs are empirically tested by thorough device calibration based, typically, on one million 200-bit trials. In addition, resampling procedures are used to examine the distribution of parameters in control segments from the actual data. See Nelson *et al.* (1998a) for more detail and examples. Finally, we conduct another type of control analysis, based on a complete clone of the GCP database, with all trial values replaced by values created from a high-quality pseudo-random algorithm. Details are beyond the scope of this article, but the control analysis essentially duplicates the formal analysis using the pseudo-random database, which is expected to show only normal variations. The combined force of these efforts ensures that the GCP data meet rigorous standards and that the active subsets subjected to hypothesis testing are correctly evaluated against expectations established by theory and appropriate control and calibration data.

Results

The Introduction and the description of methodology should make it clear that the tragedies of September 11, 2001, are an obvious test case, a global event that should, according to the general hypothesis, affect the EGG network. Two formal predictions were made for the major events on September 11. There are some less-directly associated events later, but we will focus on these two examples, plus some contextual analyses that are helpful for interpretations. The standard analysis yields an inferential statistic for the formal cases, as described previously. The relative consistency of the anomalous effects leading to that statistic can be visualized in a graph showing the progressive departure of the data from expectation, which is a random walk centered on a horizontal path at zero deviation. The data from all the eggs are combined in a single score for each second (the Stouffer Z described earlier), these Z-scores are squared, and the cumulative deviation from chance expectation of the resulting sequence is plotted.

Composite Deviation of Means

The primary formal prediction for September 11 was modeled on that made for what seemed to be a similar event, namely, the terrorist bombings of U.S. embassies in Africa in August 1998. I had taken a cursory look at the global data coming in for September 11, but the specific prediction was based on the prior model, and was made without knowledge of the actual results. It specified a period beginning an arbitrary 10 minutes before the first crash and continuing to four hours after, thus including the actual attacks plus an aftermath period of a little more than two hours following the last of the major cataclysmic events. Figure 1 is the graph of data from this formal prediction, with the times of the major events indicated by boxes on the zero line. It shows a fluctuating deviation during the moments of the five major events, as increasing numbers of people around the world were watching and hearing the news in stunned disbelief. The apparently random fluctuation of the EGG data continues for almost half an hour after the fall of the second WTC tower. Then, a little before 11:00, the cumulative deviation takes on a trend that continues during the aftermath period and ultimately exceeds the significance criterion, with a final probability of 0.028 (χ^2 is 15332 on 15000 df, with 37 eggs reporting).

The formal test thus indicates a significant departure from expectation, but it is not especially persuasive by itself, given the enormity of the event. Moreover, the outcome appears to be dependent on a fortuitous specification of the timing in the formal hypothesis. It is therefore important to examine the larger context by looking at the behavior of the eggs over a longer period, before and after September 11. We find that while there is nothing unusual in the data from preceding days, the opposite is true following the attacks. During most of September 11, 12, and 13 there is a strong trend indicating correlated behavior among the eggs. Figure 2 uses the same cumulative deviation format as before to display the nine days from September 7 through 15, with the time of the attacks on September 11 marked by a black rectangle. It is apparent that shortly before the terrorist attack, the wandering line takes on a strong trend representing

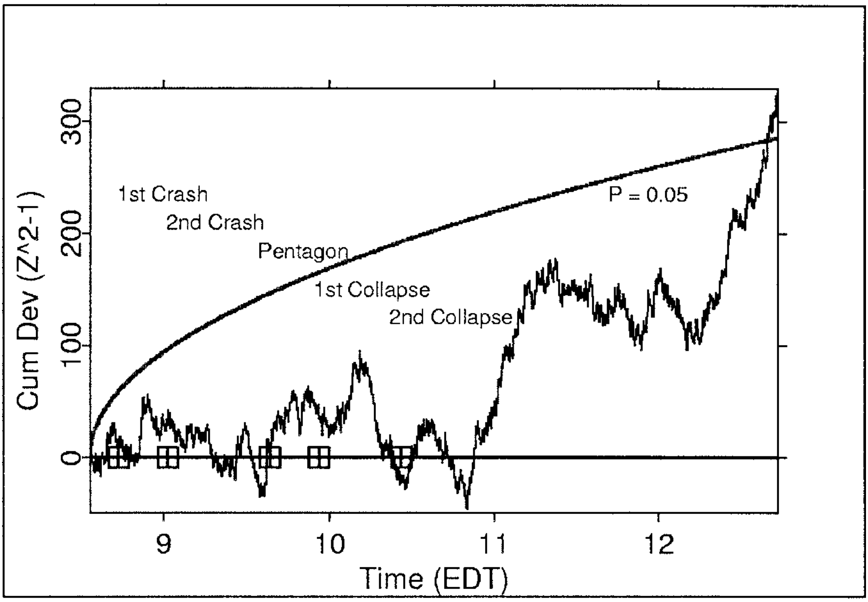

Fig. 1. Cumulative deviation of χ^2 based on Stouffer Z across eggs for each second, from 08:35 to 12:45 EDT, September 11, 2001. The separate events of the terrorist attacks are marked with rectangles on the line of zero deviation. A smooth parabolic curve shows the locus of a 5% probability against chance.

a persistent departure from what is expected of random data. A small probability envelope inserted at that point provides a comparison standard to indicate the scale of the deviation. The slope of the graph beginning just before the first WTC tower was hit and continuing for over two days, to noon on the 13th, is essentially linear and it is unusual. A permutation analysis using the 11 days of data suggests that it has a chance probability of approximately 0.012.

This multi-day perspective places the four-hour formal specification in a larger context, and we also can look at finer details. Calculation of the second-by-second tail probabilities for the squared Stouffer Z-scores (χ^2s) for September 11 reveals an extreme value that is equivalent to a Z-score of 4.81, occurring at 10:12:47, EDT, not long after the first WTC tower collapsed. A Z-score this large would appear by chance only once in about a million seconds (roughly two weeks). It is not terribly unusual to find such a spike in our three-year database, but it is thought provoking that one does occur within the brief time-span of the attacks, about an hour and 45 minutes. The ratio of this period to the mean time between spikes of this magnitude is 1/192, which arguably represents the probability that the spike is just a chance occurrence. A large cluster of relatively strong deviations occurs during the period from about 09:30 to 12:30, corresponding, roughly, to the most intense period of time on September 11.

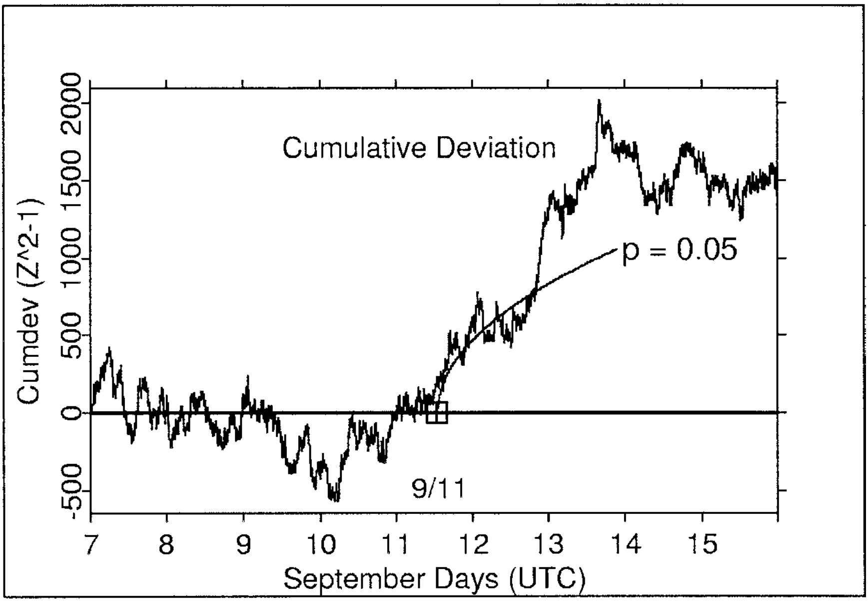

Fig. 2. Cumulative deviation of χ^2 based on Stouffer *Z* across eggs for each second, from September 7 through September 13, 2001. The time of terrorist attacks is marked with a rectangle on the line of zero deviation. A smooth parabolic curve beginning at the time of the attacks provides a 5% probability comparison standard.

Variance of the Data

The second formal prediction addressed the variability of scores (the sample variance, s^2) for each second among the 37 eggs over the course of the day of September 11. It was a test of Dean Radin's emailed hypothesis that this measure would show strong fluctuations: "I'd predict something like ripples of high and low variance, as the emotional shocks continue to reverberate for days and weeks." Although this was only a partial specification, it effectively predicted that the variance around the time of the disaster would deviate from expectation. I added the necessary specifications for a formal analysis, predicting increased variance among the individual eggs at the beginning followed by low variance after the intensely disturbing events. The intent was to specify a degree of variability in the data that might correspond to the reactions of people engaged by this uniquely powerful emotional imposition. As Figure 3 shows, compared with empirical expectation, the variance exhibits normal random fluctuation around the horizontal line of expectation until about three or four hours before the attack, and then takes on a steep and persistent rise, indicating a consistent excess of variance that persists until about 11:00. Shortly thereafter, a long period begins during which the data show an equally strong and persistent decrease of variance. In this figure, the X-axis shows Eastern

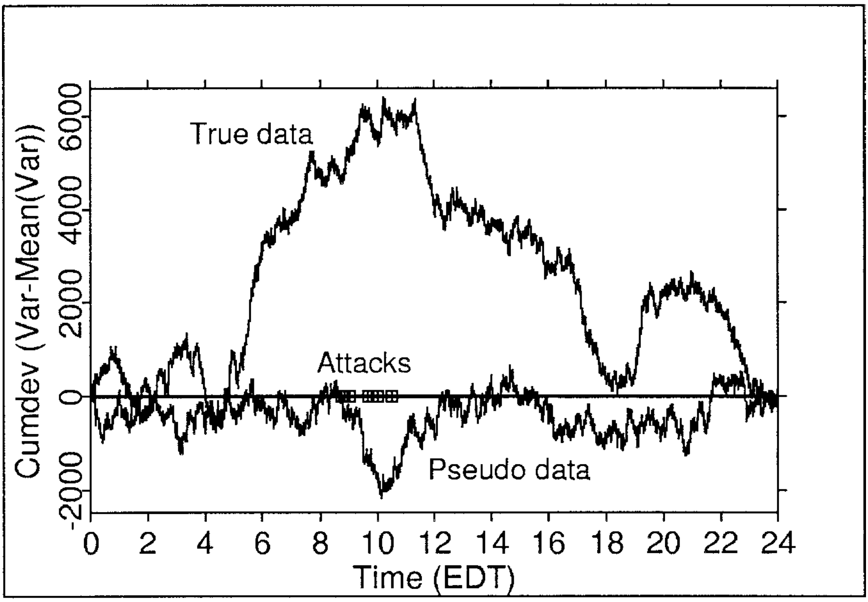

Fig. 3. Cumulative deviation of variance across eggs for each second on September 11, 2001. Times of the separate events in the terrorist attack are marked with rectangles on the zero line. The light gray curve labeled "Pseudo Data" shows a control calculation using a pseudo-random clone data set for the day.

Daylight Time (EDT), allowing a direct reading of the timing of the strong deviations. We note, incidentally, that the distinctive shape of the graph is suggestive of a classic "head and shoulders" graph seen in stock market analysis of leading indicators (Walker, 2001).

For a visual indication of the likelihood that the data show merely random fluctuation, a comparison can be made with the pseudo data generated for September 11, 2001, and plotted in the same format. In contrast to the real data, there are no long-sustained periods of strong deviation in the algorithmically generated data. While it is not a rigorous test, this comparison with the pseudo data indicates that the variance measure is unusual around the time of the attacks. It is difficult to make a direct calculation of probability for this analysis, but a conservative estimate is included in the formal database. It is based on assessing the rise and fall of the variance measure surrounding the period of the attacks. The estimate was made by extrapolating a 5% probability envelope to accommodate the full, extreme deviation, and comparing its length to the much shorter period that covers the actual time of the striking rise. The resulting estimate is $p = 0.096$. Independent analyses by Peter Bancel and Richard Shoup, described later, suggest much a smaller probability, as does a simple permutation analysis. The latter provides an estimate for the probability of the extreme excursion of $p = 0.0009$, based on 10,000 iterations. The corresponding permutation p-value for the clone data is 0.756.

Other formal predictions were made for events related to September 11. These include the Silent Prayer during the memorial events in Europe and the U.S.A. on September 14, the Musicians and Actors benefit concert on September 22, the Maharishi Effect meditations during September 23 to 27, the beginning of bombing in Afghanistan, October 7, the Childrens' Pledge of Allegiance, October 12, and an Internet-promoted, magical Binding Spell on Bin Laden, October 15. The Silent Prayer event showed a marginally significant deviation opposite to the prediction, while the others all showed modest positive deviations, with probabilities ranging from 0.29 to 0.04. Details may be found on the GCP Web site.

Exploratory Work by Independent Analysts

The formal hypothesis testing is augmented by exploratory analyses that add breadth and depth to the picture. Interpreted carefully, they help understand the data, and they can be a primary source for future analytical questions. Five people have contributed independent assessments.

Dean Radin produced a variety of analyses of the September 11 events. One sample is presented here, and more can be found on the GCP Web site and in papers addressing the effect of location and correlations with news events (Radin, 2001, 2002). Radin's treatment of the low-level data is different from the GCP's standard approach. Instead of a composite (Stouffer) Z across eggs, he calculates the t-score per egg, squares the equivalent Z-scores, and sums these and their degrees of freedom across eggs. This χ^2 distributed quantity is converted to a Z-score (symbolized here as Z_v), to serve as a basic unit in further analyses. This measure is essentially equivalent to the inter-egg variance discussed earlier, and responds to excess absolute deviations of the individual egg scores, while the standard analysis responds to signed, correlated deviation of the eggs. Radin uses sliding window smoothing or moving averages of the data across time. This can make interpretation difficult because the results depend very heavily on the choice of parameters, such as the window width and centering. Because he generally tries several sets of parameters in exploring the data, the probabilities associated with his findings should be adjusted for multiple testing, probably by a factor of 5 to 10. Radin feels that while exploratory data analysis is not an appropriate tool for formal hypothesis testing, it is a necessary next step in attempting to understand statistical anomalies, and it often proves to be valuable in developing future hypotheses. In any case, he reports that nearly every analysis he tried with respect to September 11, from one-second resolution to nearly a year's worth of surrounding data, revealed unexpected statistical structure on that day.

Figure 4 shows the one-tailed odds against chance associated with moving average Z_v-scores calculated with a six-hour sliding window for the data from

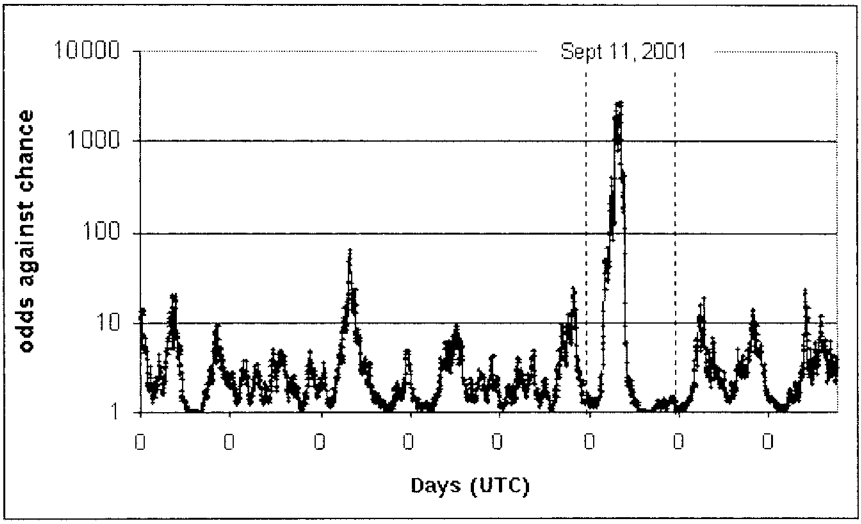

Fig. 4. Odds against chance for the moving average of Z_v across eggs using a six-hour smoothing window, from September 6 through September 13, 2001. The Y-axis is a log scale; "0"on the X-axis marks the beginning of each day. Adapted from figure by Dean Radin.

September 6–13. The Z_v variations show a particularly large excursion on the day of the attacks, corresponding to a peak of $Z = 3.4$, a value which then drops to $Z_v = -3.1$ over the next seven hours. A permutation analysis shows that the likelihood of finding a 6.5-sigma drop in Z_v-scores (based on a six-hour sliding window) in one day and within eight hours or less is $p = 0.002$. Radin identifies the major spike in this graph as occurring at about 09:30 on September 11. However, the algorithm that he used for the sliding window averages the data for the six hours *preceding* the plotted point. Thus, in terms of the original, unsmoothed data, the spike incorporates some large deviations early in the morning, and the peak weight of the moving average actually centers at 06:30, somewhat more than two hours prior to the first WTC hit. To help assure that there was no mistake in the processing, the same calculations were made using the clone database of algorithmically generated pseudo-random data. These "control" data show only expected random variation; none of the pseudo-random excursions approaches the magnitude of the spike on September 11.

Peter Bancel has taken another perspective, focusing on the correlation of the eggs' output over time (Bancel, 2001). He computes the autocorrelation function of the second-by-second inter-egg variance using Fourier techniques. This assesses the degree of predictability within the composite data sequence over a range of lags. The resulting coefficients are normalized as t-scores and plotted in Figure 5 as the cumulative deviation from expectation for all lags up to four hours, calculated over the 24-hour UTC window for September 11. For

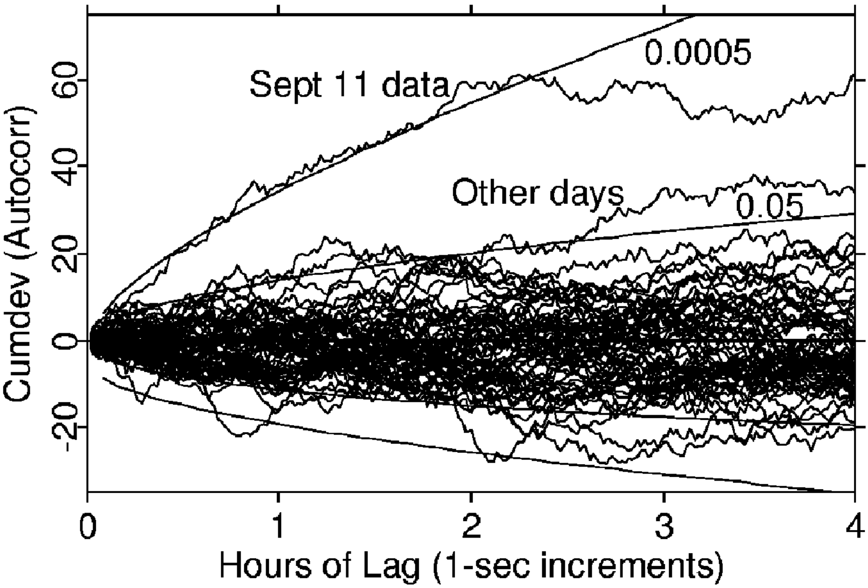

Fig. 5. Cumulative sum of normalized autocorrelation coefficients for the second-by-second inter-egg variance measure, calculated for all lags up to four hours. The time period is the 24-hour UTC day of September 11. The smooth curves show a 0.0005 threshold and the ±5% probability envelope. Adapted from figure by Peter Bancel.

comparison, the same calculation is shown for 10 days surrounding September 11, from the 5th to the 15th. The significant rise in the curve over the first two hours of lags indicates that the data were strongly autocorrelated during a substantial portion of the day. That is, a common external source was partially defining the output of the REG devices on September 11. Detailed examination shows that this result was driven by several clusters of aberrant data, and notably by a strong, persistent deviation in the average *Z*-score across eggs during the period from 9:50 to 11:50.

Richard Shoup also has examined correlations over time, as well as other aspects of the GCP data. He uses the same treatment of the raw data as Radin, and hence is also looking at a measure of variability among the eggs. The analyses are particularly concerned with determining whether the September 11 data really are uniquely deviant in the context of long time-spans, and he concludes that they are, based on assessing four months of data (July through October, 2001). One aspect of this effort addresses the question of whether there is similar behavior across the eggs, instead of the expected random relationship, during the time of interest. Figure 6 is a sample from an extensive array of analyses (Shoup, 2001a). It shows the cumulative deviation of the moving average of χ^2s calculated by summing the squared *Z*-scores per egg for each

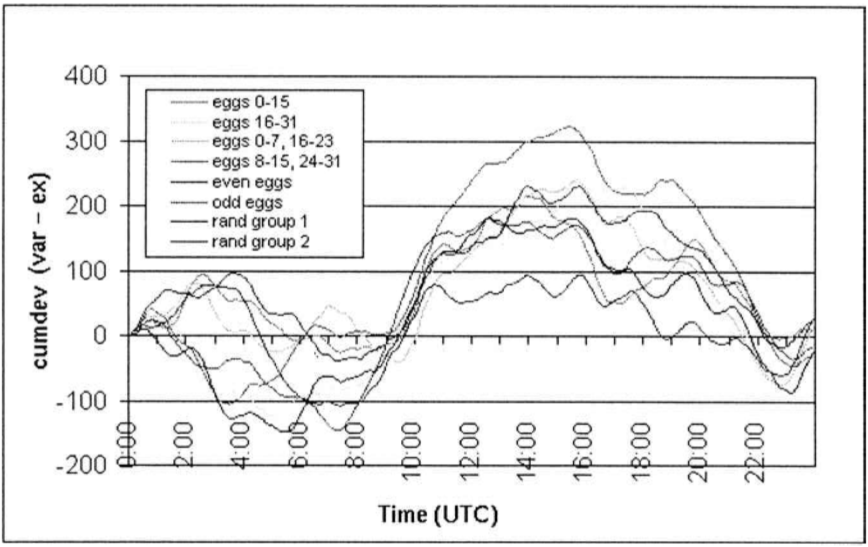

Fig. 6. Cumulative deviation of the moving average of χ^2s calculated by summing the squared *Z*-scores per egg for each second, using a smoothing window of one hour. Separate curves show several pair-wise comparisons of subgroups of the eggs to give a visual impression of their correlated anomalous deviation. Adapted from figure by Richard Shoup.

second for 32 eggs with complete data. The smoothing window in this case is one hour, and it uses data from the past relative to the plotted point. The X-axis shows time in UTC, which was four hours later than New York time on September 11. This analysis assesses the generality of the large correlated increase in variance beginning around 8:00 UTC, by dividing the eggs into two groups in several different ways and plotting a separate curve for each group. The curves all show much the same pattern, indicating strong correlation beginning at about 4:00 or 5:00 EDT and continuing for the entire day. Shoup establishes that no such correlations are seen in arbitrarily selected ''control'' days.

Ed May and James Spottiswoode took a severely critical look at the September 11 results (May & Spottiswoode, 2001). They began with a thorough examination of the nature of the data and concluded that the GCP network of REGs does exactly what it is designed to do: it produces a continuing swath of random data, indistinguishable from theoretical expectations. They then selected certain of the formal and exploratory analyses to see whether they could find any way to discount them. They determined that their analysis of the primary formal hypothesis test confirmed the GCP analysis, but went on to say that its hypothesis formulation was unclear, that the specified time was fortuitous, and that the result was not very impressive, given the magnitude of the global event. For the exploratory analysis, they focused on Dean Radin's sliding window approach and demonstrated that, as noted earlier, the result is dependent on the size of the window. They showed that apparently strong spikes can be made to disappear, or to appear, by judicious selection of the parameters.

Comprehensive Results

Although this paper is most concerned with the events of September 11, the formal predictions and analyses related to the terrorist attacks and the aftermath are only a small part of the GCP database. It is not practical to provide details of the other analyses here, yet the September 11 results should be viewed within that context. In a sense, each individual prediction is another replication of the basic experiment, and the full database is a concatenation of the evidence for the general hypothesis. In other words, the proper test of the hypothesis that there will be structure in the EGG data correlated with noteworthy events in the world is an accumulation of evidence from a growing database of specified global events.

At the end of January 2002, 98 formal predictions had been made over a three-year period. The individual results can be cumulated over time to provide a summary of the GCP experiment as a whole. Figure 7 shows the accumulating excess of the χ^2s over their corresponding degrees of freedom for the 98 analyses. It culminates in a composite probability for the whole array of events that is 8.3×10^{-8}. The dotted lines show probability envelopes for the cumulative deviation from chance expectation, which is plotted as the horizontal black line at zero deviation.

As is the case with any experiment using statistical measures, there is intrinsic variation in the results, but about two-thirds of the cases have a positive deviation, and 21% are independently significant at or beyond the 5% level. The composite probability that chance fluctuation can account for the total deviation from expectation is less than one in a million. Tables and graphical displays on the GCP Web site give up-to-date summaries of the formal results (Nelson, 1998c). Most of the table entries contain a link to a complete description of the detailed analysis for the event, and in many cases, further explorations and investigations that provide illuminating context for the formal prediction.

Discussion

The accumulating evidence for an anomalous effect on the GCP's network of REG devices placed around the world is strong. Multiple, independent analyses show unmistakable structure in data that should be genuinely random. There is a small but highly significant statistical deviation from theoretical expectation for the REG outputs, integrated across all the active devices, and it is correlated with global events identified by experimenters without knowledge of the data or results. We do not have a theoretical understanding of the sort that must underlie

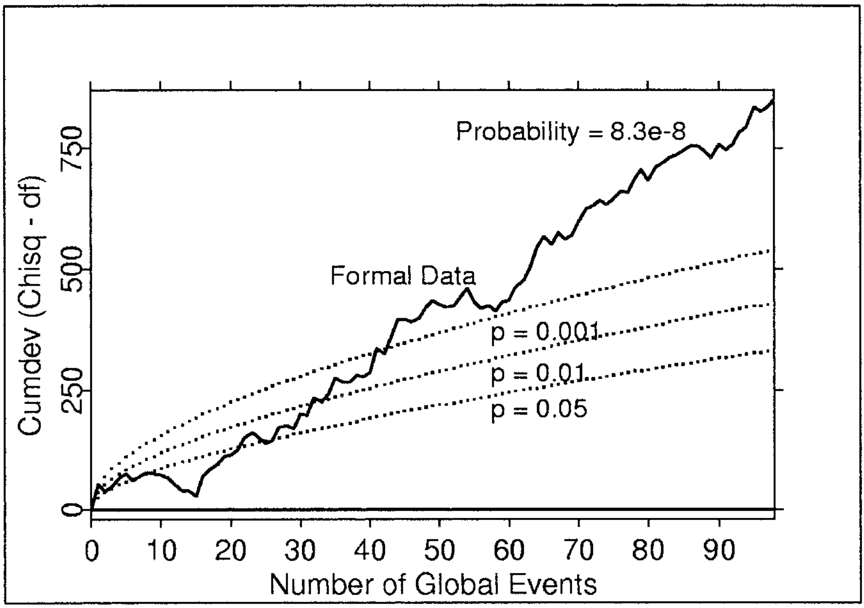

Fig. 7. Overall results for 98 formal experiments over the past three years. The data curve shows the cumulative deviation from chance expectation of the individual "bottom line" χ^2s for the separate events. Expectation is shown as the horizontal line at zero. Dotted curves show the 5%, 1%, and 0.1% probability envelopes.

robust interpretations, but several potential explanations for the results may be considered.

Perhaps the first proposals that come to mind are spurious physical effects that arise directly out of the extreme conditions of a day like September 11. For example, since the eggs are electronic devices, perhaps some combination of extraordinary stresses on the power grid, or unusual electromagnetic fields, or huge increases in mobile phone usage might have altered the REG outputs. Such influences would center on New York and Washington, of course, while the eggs are distributed around the world. Their average distance from New York is more than 4000 miles (~6400 km), and the anomalous effects are broadly distributed across the network. Moreover, the design of the research-grade instruments includes both physical shielding (minimal in the Orion devices) and a logic stage that literally excludes first-order biasing from electromagnetic or other physical causes. Finally, empirical studies show no diurnal variation of inter-egg correlation to correspond with the strong diurnal fluctuations of natural and manmade electromagnetic fields (Radin, 2002). Thus, we are forced to look elsewhere for the source of the induced structure.

The patterning is statistical in nature (a small, correlated mean shift, alteration of variance across the eggs, autocorrelation over long lag times) and is similar in scale to what is seen in laboratory research and in field applications of the REG technology. Indeed, this similarity raises the question of why the effects are not stronger, given the large number of REG devices and the very large numbers of people who may be regarded as sources. In fact, there is no substantial evidence to support the assumption that multiple REGs will necessarily yield a compounded effect, or that multiple ostensible sources will increase effect sizes. For example, when larger effect sizes for pairs of participants have been reported, the attribution is not to the number of people but to the quality of the relationship (Dunne, 1993), and in the FieldREG studies there is no correlation of group size and effect size. The same general principles may apply to the data reported here. The effects appear to be dependent on the nature of the situation, including obviously subjective aspects, and not on simple physical parameters, such as the location of detectors relative to the focus of a correlated event, the number of detectors, or the number of people involved. On the other hand, a preliminary analysis of the September 11 data suggests there may be an effect of geographic location (Radin, 2001). The potential for serious, objective assessment of questions like these is enormous, given the continuous and growing database, the wide distribution of the REG network, and the unending variety of potentially instructive events.

A particularly thought-provoking aspect of the anomalous changes in the data is that they appear to begin before the major events. Because our measures are statistical and necessarily have an error distribution around the trends and point estimates, these indications must be regarded with caution. They are present, however, in multiple analytical perspectives, and we should consider some provisional interpretations. The major trends began to appear on the order of two to four hours prior to the first crash. Certainly no ordinary physical source such as electromagnetic disturbances would seem to be a candidate. If ordinary waking consciousness were the source, it would seem it could only be attributable to a small number of people: the terrorists who knew what was coming. Alternatively, the hypothesized “global consciousness” that later would be intensely aware might have had a premonitory cognition or feeling at an unconscious level that was registered in the data from the EGG network. There are a number of laboratory studies that document an analogous “precursor” response in humans about to be presented with a shocking stimulus (Bierman & Radin, 2000).

In any case, the formal data from the EGG network definitely show anomalous deviations that are consonant with our general hypothesis. Many of the individual events have results that, in addition to their statistical contribution, also exhibit temporal patterns that are subjectively striking, perhaps even meaningful. Indeed, when we look for further insight from subjective or aesthetic perspectives to complement the hard-edged, scientific analyses, there are a plethora of indicators that seem meaningful. Discussion of these is beyond the scope of this article, but many examples from contextual and exploratory studies are discussed in a special section of the GCP Web site

(Nelson, 2001b). Of course, we try hard to understand what the data say, and, having looked long and carefully at the subtle patterns, we can attempt explanations in a rudimentary form. It is obviously important to identify the attempts as speculative and provisional, but having said that, I would like to describe a picture that appeals to me aesthetically. More general discussion of alternatives and cautions can be found on the GCP Web site.

One way to think of these unexpected correlations is to consider the possibility that the instruments actually have captured the reaction of an inchoate global consciousness. The network was built to do just that: to see whether we could gather evidence for effects of a communal, shared mind in which we are participants even if we don't know it. Groups of people, including the group that is the whole world, have a place in consciousness space, and under special circumstances they—or we—become a stronger presence. Based on experimental evidence that both individuals and groups manifest something suggestive of a consciousness field, the GCP grew out of the hypothesis that there could be a global consciousness capable of the same thing. Pursuing this speculation, we could envision an integrated global mind that pays consistent attention to events that inspire strong coherence of attention and feeling among its constituents. Perhaps a useful image is an infant just beginning to develop an integrated awareness, but already manifesting recognizable emotions in response to the enveloping comfort of cuddling or the intense discomfort of pain.

The hypothesis we set out to test is that the REG devices we use may respond to the concerted effect of large numbers of people turning their attention in one direction, becoming deeply absorbed in one focus. There are alternatives to such an explanation of the deviations as an effect of communal consciousness, including that the experimenters themselves might be the source of anomalous effects. This is a viable hypothesis according to professional parapsychologists (White, 1976), and we can accept the possibility that such an "experimenter effect" may contribute to the overall result. The characteristics of the individual events and their correlated outcomes, however, suggest that a broader and more comprehensive source is a major contributor. In the full database of formal and exploratory analyses, there are several instructive parallel cases. For example, my expectation, and that of my colleagues, for the Omagh bombing event in Northern Ireland was exactly the same as for the embassy bombings in Africa. They both were egregious travesties, and they both were the most prominent international news items when they occurred. Yet the results for these two analyses are completely different; one showed a huge effect, the other none at all. The tragedy in Nicaragua in October 1998 from flooding and the collapse of the Casitas volcano showed no response, contrary to our expectations. The bombing in Iraq produced no response, while that in Yugoslavia yielded a highly significant deviation. New Year's Eve, which clearly meets the criteria for global interest as well as the experimenters' expectations, appears to produce quite different results each year, but in the three New Years we have assessed, the data around midnight are nonetheless unmistakably structured, not random.

Either of these models—communal consciousness or experimenter effect—begs for an interaction mechanism. One suggestion is to co-opt the essential qualities of field theory for a "consciousness field" that carries information (Nelson, 1999). This is not completely out of touch with models in physics, and might be formalized in terms of David Bohm's concept of "active information" (Bohm, 1980). Other efforts to describe a mechanism that could produce the anomalous results in these experiments draw on the "observer" requirements of quantum theory. The idea is that future observation collapses a superposition of possibilities into a state that may represent reality (Schmidt, 1982; Walker, 2000). A recent formalization of this approach argues that no major changes to physical theory are required to address anomalous effects of consciousness (Shoup, 2001b).

The terrible events of September 11 were a powerful magnet for our shared attention. More than any event in recent memory, they evoked extraordinary emotions of horror, fear, commiseration and dismay. The EGG network reacted in a powerful and evocative way. While there are viable alternative explanations, the anomalous correlation is not a mistake or a misreading. It can be interpreted as a clear, if indirect, confirmation of the hypothesis that the eggs' behavior is affected by global events and our reactions to them. This is startling in scientific terms because we do not have widely accepted models that accommodate such an interpretation of the data. More important than the scientific interpretation, however, may be the question of meaning. What shall we learn, and what should we do in the face of evidence that we may be part of a global consciousness? Of course, this is not a new idea or a novel question. The results from this scientific study are an apparent manifestation of the ancient idea that we are all interconnected, and that what we think and feel has effects everywhere in the world. The discovery of patterns in the GCP data that appear to reflect our shock and dismay implies that these insensate but labile electronic random generators can "see" the effect of massive, shared emotion and attention. The challenges posed by this unexplained effect are great, but it may be an unexpected source of incisive questions about the span of human consciousness.

Conclusion

The GCP is an extension of laboratory REG experiments and non-intentional FieldREG experiments to a much larger domain, using a network of REG sampling nodes distributed around the world. The data from multiple, independent devices running in parallel, continuously over months and years, can be a rich resource for a variety of purposes, including correlation with special moments in time, as described in this article. It also may be instructive to attempt correlations with other variables, such as the geophysical and cosmological data that have shown some promise in psychophysiological and parapsychological research. Thus far, the main focus of the project has been on the question of whether any evidence of a communal global consciousness can be seen. A definitive answer will require patient, continuing data collection combined with creative assessment techniques, but already it appears that by our simple measures there is robust evidence for part of the picture. Anomalous departures of the data from expectation are demonstrably correlated with global events that are important to human beings.

Excellent technology, sound experimental design, rigorous analysis, and sophisticated controls exclude ordinary physical and environmental variations as spurious sources. Although the effects on the GCP data may be modulated by experimenter expectations or other subjective influences, the most consistent correlate, and hence the most likely source of the apparent effects, is the relatively high coherence of widespread attention during events with a strong global focus. This report on the data from September 11 is the best description we can give of empirical measurements and effects that are essentially mysterious. We do not know how the correlations that arise between electronic random event generators and human concerns come to be, and yet the results of our analyses are unequivocal. The network responded as if the coherence and intensity of our common reaction created a sustained pulse of order in the random flow of numbers from our instruments. These patterns where there should be none look like reflections of our concentrated focus of attention, as the riveting events drew us from our individual concerns and melded us into an extraordinary shared state. Maybe we became, briefly, a coherent global consciousness.

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Notes

[1] Three sources are in use: The PEAR portable REG, the Orion RNG, and the Mindsong MicroREG. All three use quantum-indeterminate or thermal electronic noise. They are designed for research applications and are widely used in laboratory experiments. They are subjected to calibration procedures based on large samples, typically a million or more trials, each the sum of 200 bits.

[2] Data are collected continuously at all host sites over months and years. There naturally are some missing data from individual eggs due to hardware malfunctions, loss of electrical supply, and similar causes. Summary statistics are made from all valid data; no replacement values are needed.

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